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The impact of a context switch and context instructions on the return of verbally conditioned fear



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ABSTRACT

Background and objectives: Repeated exposure to a conditioned stimulus can lead to a reduction of conditioned fear responses towards this stimulus (i.e., extinction). However, this reduction is often fragile and sensitive to contextual changes. In the current study, we investigated whether extinction of fear responses established through verbal threat instructions is also sensitive to contextual changes. We additionally examined whether verbal instructions can strengthen the effects of a context change.

Methods: Fifty-two participants were informed that one colored rectangle would be predictive of an electrocutaneous stimulus, while another colored rectangle was instructed to be safe. Half of these participants were additionally informed that this contingency would only hold when the background of the computer screen had a particular color but not when it had another color. After these instructions, the participants went through an unannounced extinction phase that was followed by a context switch. **Results:** Results indicate that extinguished verbally conditioned fear responses can return after a context switch, although only as indexed by self-reported expectancy ratings. This effect was stronger when participants were told that CS–US contingency would depend on the background color, in which case a return of fear was also observed on physiological measures of fear.

Limitations: Extinction was not very pronounced in this study, possibly limiting the extent to which return of fear could be observed on physiological measures.

Conclusions: Contextual cues can impact the return of fear established via verbal instructions. Verbal instructions can further strengthen the contextual control of fear.

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1. Introduction

Fear conditioning and extinction are considered to provide laboratory analogs for the acquisition of fear and phobias and the subsequent reduction of fear via exposure-based therapy (Field, 2006; Mineka & Zinbarg, 2006). Whereas fear conditioning refers to the acquisition of fear for a Conditioned Stimulus (CS) due to the pairing of the CS with an aversive Unconditioned Stimulus (US), extinction refers to the reduction of conditioned fear through the repeated unreinforced presentation of a CS after the CS–US pairings. Both phenomena have attracted widespread research interest

because they allow to investigate complex phenomena such as anxiety disorders and therapeutic interventions in a safe and well controlled laboratory environment.

Despite being an extremely useful framework for understanding the pathogenesis of anxiety disorders and the development of therapeutic interventions, fear conditioning as a model of the development of anxiety disorders has attracted strong criticism as well (e.g., Beckers, Krypotos, Boddez, Eftting, & Kindt, 2013; Field, 2006; Rachman, 1977). One important point of criticism is that fear conditioning in the lab nearly always relies on directly pairing a CS with an aversive US. In contrast to this standard practice in lab studies, retrospective studies with patients have found that it is often not possible to identify direct experience with a traumatic event as the etiology of anxiety disorders (for example, most people in Western countries will in

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general not have any experience with snakes, but may nevertheless develop phobias for them; e.g., Fredrikson, Annas, Fischer, & Wik, 1996; Oosterink, de Jongh, & Hoogstraten, 2009). Rachman (1977) and Field (2006) argue that, besides directly experiencing a traumatic event, acquisition of (maladaptive) fear can also be based on verbal instructions and social observation. This suggestion is supported by both laboratory research in which fear and avoidance responses have been established on the basis of verbal instructions and observation (Cameron, Roche, Schlund, & Dymond, 2016; Lovibond, 2003; Muris & Field, 2010; Olsson & Phelps, 2007) and retrospective reports of anxiety patients who identified verbal threats and social observation as the starting point of their psychopathology (e.g., King, Eleonora, & Ollendick, 1998; Merckelbach, de Jong, Muris, & van den Hout, 1996). However, fear acquisition via verbal instructions and via observation remain relatively understudied phenomena compared to the large amount of research available on fear conditioning through direct CS–US pairings. Arguably, such a lack of research concerning two of the major pathways of fear acquisition hampers a full understanding of the development and treatment of fear and phobias. Therefore, the primary goal of our research was to further investigate the properties of fear acquired through verbal instructions.

Specifically, we wanted to investigate whether extinction of fear established through verbal instructions is similarly sensitive to contextual cues as fear established through direct experience of CS–US pairings. That is, research on extinction of fear (established through direct experience) has shown that extinction often results in a fragile reduction of the conditioned fearful reactions that can easily be overturned by a change in contextual cues. Based on laboratory research it has been suggested that extinction does not lead to unlearning of previously learned contingencies, but rather results in context-dependent inhibitory learning that suppresses the expression of previously learned contingencies within a certain context (Bouton, 2004). This context specificity of extinction is an important phenomenon to understand why relapse can occur after successful therapy (Bouton, 2002). That is, because extinction memory is more context specific than the original acquisition memory, confrontation with a fear-eliciting stimulus in a new context tends to preferentially activate the original acquisition memory rather than the extinction memory, resulting in a return of fear. So far, however, no study has investigated whether extinction of fear established through verbal information is similarly context-specific. Given that verbal instructions can be regarded as a major pathway to the development of maladaptive fears and phobias, it is important to investigate whether return of verbally acquired fear can occur under similar circumstances as for fear acquired through direct experience.

The context-specificity of extinction is most convincingly demonstrated by the renewal effect. In a typical renewal experiment, conditioned fear is established by pairing a CS with an aversive US during an acquisition phase in a certain context A. This phase is then followed by an extinction phase in a new context B, in which the CS is repeatedly presented without reinforcement. The renewal effect refers to a rapid return of the previously extinguished fear response that occurs when subjects are exposed to the CS in the original acquisition context A (ABA renewal) or in a new context C (ABC renewal), compared to a control condition where the context is not changed (ABB). This basic effect has been obtained both in animal studies (for a review see: Bouton, 2002) and more recently in human studies as well (e.g., Alvarez, Johnson, & Grillon, 2007; Milad, Orr, Pitman, & Rauch, 2005; Vansteenwegen et al., 2005).

In the current study we investigated whether renewal effects can be obtained for verbally conditioned fear (see Dieussaert,

Vansteenwegen, & Van Assche, 2005, 2006, for related studies in the context of human contingency learning). We therefore told participants that a certain CS (CS+) would be predictive of an electrocutaneous stimulus (the US) while another CS was said to be safe (CS–). Subsequently, these participants underwent an unannounced extinction phase that was followed by a context switch by changing the background color of the computer screen (e.g., Dibbets, Havermans, & Arntz, 2008; Haesen & Vervliet, 2014).¹ We expected that the context switch would lead to a return of conditioned fear reactions similar to what has been observed in fear conditioning studies with direct CS–US pairings, even though the CS–US contingency was never directly experienced but merely instructed. We assessed conditioned fear reactions by collecting US expectancy ratings, fear potentiated startle reactions and skin conductance responses on every trial.

A second aim of our study was to investigate whether verbal instructions could modulate the renewal effect. Several models of human associative learning argue that the acquisition and expression of fear is a function of cognitive expectancies about the occurrence of harmful events (Lovibond, 2004; Mitchell, De Houwer, & Lovibond, 2009; Reiss, 1980). These expectancies can be strongly influenced by verbal instructions (e.g., Lovibond, 2003; McNally, 1981). Furthermore, verbal instructions not only allow to communicate whether two stimuli are related, but also allow to specify how they are related and under which conditions the relationship is valid (De Houwer, 2014). Hence, based on these models and studies, we expect that verbal instructions about the relevance of the context for the CS–US relationship could strongly impact the contextual expectancies of encountering an aversive event and hence strongly influence the magnitude of the renewal effect. So far, only one study has addressed the impact of verbal instructions on the renewal effect. In four studies, Neumann (2007) found that verbal instructions that informed the participant that the context was irrelevant for the CS–US contingency was ineffective in attenuating the renewal effect. However, while instructing participants that the context is irrelevant for the CS–US contingency seems to be ineffective in influencing the renewal effect, it cannot be excluded that making the context explicitly relevant for the CS–US contingency via verbal instructions could potentially strengthen the renewal effect. To test for this possibility, we included a second group of participants (context instructions, CI, group) who were informed that the previously instructed CS–US contingency would be instantiated only when the background of the computer screen had a particular color but not when the background of the computer screen had another color. We expected that the effect of the context switch would be particularly pronounced for this group compared to the group that did not receive these context instructions (no context instructions, NCI, group).

Finally, we measured startle reactions during noise alone trials to determine whether the obtained renewal effects could be explained by context conditioning (Alvarez et al., 2007). Specifically, while the renewal effect is usually explained by the context gated expression of a learned inhibitory CS–noUS relationship (Bouton, 2004), an alternative explanation is that participants learn that the context itself is a cue for the presence or absence of the US

¹ To control for time related changes which may explain the renewal effect (i.e., spontaneous recovery) usually a second group is included in which the extinction context is not changed (ABB group). However, in the current study the extinction phase was immediately followed by the context switch which reduces the likelihood that time related changes cause context switch effects. Previous studies with a short delay between the extinction and the renewal phase did not find evidence for time related changes that could explain the renewal effect (Alvarez et al., 2007; Vansteenwegen et al., 2005).

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