ARTICLE IN PRESS

Acta Psychologica xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

# Instructed fear stimuli bias visual attention☆

Berre Deltomme[a,*], Gaetan Mertens[b], Helen Tibboel[c], Senne Braem[a,b,**]

[a] Department of Experimental Psychology, Ghent University, Belgium
[b] Department of Experimental Clinical and Health Psychology, Ghent University, Belgium
[c] Department of Clinical Psychology, Erasmus University, The Netherlands

ARTICLE INFO

*Keywords:*
Fear conditioning
Instructed fear
Learning via instructions
Attention
Dot-probe

ABSTRACT

We investigated whether stimuli merely instructed to be fear-relevant can bias visual attention, even when the fear relation was never experienced before. Participants performed a dot-probe task with pictures of naturally fear-relevant (snake or spider) or -irrelevant (bird or butterfly) stimuli. Instructions indicated that two pictures (one naturally fear-relevant and one fear-irrelevant) could be followed by an electrical stimulation (i.e., instructed fear). In reality, no stimulation was administered. During the task, two pictures were presented on each side of the screen, after which participants had to determine as fast as possible on which side a black dot appeared. After a first phase, fear was reinstated by instructing participants that the device was not connected but now was (reinstatement phase). Participants were faster when the dot appeared on a location where an instructed fear picture was presented. This effect seemed independent of whether picture content was naturally fear-relevant, but was only found in the first half of each phase, suggesting rapid extinction due to the absence of stimulation, and rapid re-evaluation after reinstatement. A second experiment similarly showed that instructed fear biases attention, even when participants were explicitly instructed that no stimulation would be given during the dot-probe task. Together, these findings demonstrate that attention can be biased towards instructed fear stimuli, even when these fear relations were never experienced. Future studies should test whether this is specific to fear, or can be observed for all instructions that change the relevance of a given stimulus.

## 1. Introduction

For long, psychologists and psychotherapists exclusively relied on classical conditioning to explain the acquisition of (pathological) fear, with a few notable exceptions (e.g., Cook & Harris, 1937; Grings, 1973). In classical or Pavlovian fear conditioning, animals learn through experience to fear a neutral stimulus (conditioned stimulus, $CS^+$) after it has been paired with an aversive stimulus (unconditioned stimulus, US) – usually on more than one occasion. However, in his seminal paper entitled *The conditioning theory of fear-acquisition: a critical examination*, Rachman (1977) described several phenomena that could not be explained by classical conditioning alone. Rachman argued that there are three ways in which fear can be learned: by classical conditioning, by observation, and by instruction. Rachman further suggested that of all three pathways to fear, the instructional pathway has the weakest fear inducing effects, despite being the most common way of fear-learning for children. In fact, according to Rachman, this pathway is of crucial importance and probably the cause of most fears we experience in our adult life. Still, despite its vital importance, most fear conditioning research to date has focused on experience-based fear conditioning (i.e., via classical conditioning), rather than fear learning via instructions.

In contrast to Rachman's (1977) initial assumption, some studies have shown that the instructional pathway to fear can also show strong effects (for a review, see Koban, Jepma, Geuter, & Wager, 2017). For example, Olsson and Phelps (2004) compared fear learning via classical conditioning, observation, or instruction. In the classical conditioning condition, the $CS^+$ (picture of a face) was paired together with a US (aversive electrical stimulation). In the observation condition, a video was shown in which a person received the same US. In the instruction condition, the participants were just told that the $CS^+$ predicted the US. Interestingly, Olsson and Phelps (2004) found a similar degree of learning for all three conditions, as measured with the galvanic skin response. The learning of fear via instructions has also been shown to have more long term effects. Field, Lawson, and Banerjee (2008)

☆ **Acknowledgements:** S.B. is supported by FWO - Research Foundation Flanders (12K6316N). The research reported in this paper was funded by the Interuniversity Attraction Poles Programme initiated by the Belgian Science Policy Office (IUAPVII/33), the Research Foundation Flanders (G.0231.13N), and Ghent University (BOF09/01M00209). We would like to thank Yoav Bar-Anan and an anonymous reviewer, for their helpful comments on earlier versions of this manuscript.

* Correspondence to: B. Deltomme, Department of Experimental Psychology, Henri Dunantlaan 2, B – 9000 Ghent, Belgium.
** Correspondence to: S. Braem, Department of Experimental Psychology, Ghent University, Belgium
*E-mail addresses:* Berre.Deltomme@ugent.be (B. Deltomme), senne.braem@ugent.be (S. Braem).

http://dx.doi.org/10.1016/j.actpsy.2017.08.010
Received 26 June 2017; Received in revised form 21 August 2017; Accepted 24 August 2017
0001-6918/ 

investigated these long term effects in children between six and thirteen years old. They provided children with negative, positive or no information on images of (unknown) animals. Thereafter, they measured participants implicit attitudes towards these images on different times after the instructions (one week, one month, three months, and six months). This showed that the relations could not only be observed immediately after instructions, but also stayed relatively stable for negative information, even until six months after the information was provided. Together, these studies show that the acquisition of fear by instruction can be a robust and stable cause of fear.

In the present study, we wanted to extend the investigation of instructed fear into the domain of visual attention. More specifically, we aimed to investigate the impact of instructed fear relations on attentional biases in the dot-probe task (Macleod, Mathews, & Tata, 1986). The dot-probe paradigm measures attentional selection and was first developed by Macleod et al. (1986), based on the works of Posner, Snyder, and Davidson (1980). In this task, participants are presented with a fixation cross after which two images are displayed simultaneously on both sides of the screen for 500 ms. Immediately after the images have disappeared, a dot replaces one of the two images and the task is to react as fast as possible to the location of the dot. Macleod et al. (1986) first used this task to investigate whether high-anxious persons show an attentional bias for fearful stimuli, which was indeed what they observed: Participants were faster when the dot appeared on the location of a fearful stimulus, suggesting that attention was oriented towards this stimulus.

Further research has shown that most individuals show this general attentional bias for negative, threatening stimuli (but the effects remain much stronger for high-anxious people, Mogg & Bradley, 1998; Lipp & Derakshan, 2005; for reviews, see Puliafico & Kendall, 2006; Cisler & Koster, 2010), and it has been argued that this effect reflects the workings of an evolutionary adaptive system that allows us to efficiently detect dangerous and threatening stimuli in the environment (Oatley & Johnson-Laird's, 1987; Ôhman & Mineka, 2001). Most research on attentional bias towards threat has focused on the use of natural threatening stimuli (e.g., angry faces; Fox, Russo, & Dutton, 2002) or on conditioned stimuli (e.g., abstract shapes that were paired with shocks; e.g., Schmidt, Belopolsky, & Theeuwes, 2015; Van Damme, Crombez, Hermans, Koster, & Eccleston, 2006).

However, one question that remains is whether instructions regarding threat can bias attention as well. Finding such biases on the basis of instructions alone would go against fear conditioning theories as those of Ôhman and Mineka (2001), which state that the neural pathways that drive these automatic attentional biases, are impenetrable to conscious cognitive control. So far, one study by Field (2006) demonstrated that instructed fear for novel unseen animals can induce an attentional bias in children (see also, Reynolds, Field, & Askew, 2014). However, it is important to note that attentional processing in children differs from attentional processing in adults (Rueda et al., 2004) and the effects of instructed fear on visual attention in adults remains to be demonstrated. Furthermore, one can raise questions whether it was actually ‘instructed’ fear that drove the attention of the children in Field's study. The instructions about three unknown animals was given in a story-way fashion by an experimenter. Therefore, participants could have seen the emotional reactions expressed by the experimenter while (s)he was reading. Therefore, the fear learning in Field (2006) could have been a combination of instruction and observation.

A secondary goal of this study was to determine whether – if instructed fear can induce an attentional bias – this attentional bias would be greater for fear-relevant stimuli than fear-irrelevant stimuli. That is, in general, it has been shown that fear-relevant stimuli (e.g., pictures of snakes, spiders) show stronger and protracted effects of fear conditioning via classical conditioning than fear-irrelevant stimuli (e.g., pictures of birds, butterflies; Seligman, 1971). This phenomenon is often referred to as the effect of ‘preparedness’ in classical conditioning and relates to the idea that humans are biologically or evolutionary programmed to learn fear relations faster for certain stimuli. These prepared associations have been found to be less sensitive to extinction (McNally, 1987; Öhman, Eriksson, & Olofsson, 1975) and are more likely to lead to phobias (Mineka & Öhman, 2002; Ôhman & Mineka, 2001).

Therefore, we also studied whether the fear-relevant nature of certain stimuli also impacts the degree of fear learning via instructions. In a recent study, Mertens, Kuhn, et al. (2016) conducted two experiments in which they systematically compared whether fear learning via instruction is modulated by the fear relevance of these pictures. Their two experiments obtained mixed results. Specifically, Mertens, Kuhn, et al. (2016) did observe a differential effect on fear and US expectancy ratings for fear-relevant versus -irrelevant instructed fear in one experiment, but not in the other. Here, we hope to further inform this investigation by employing a different measure of fear learning, namely the hypothesized attentional bias towards instructed fear stimuli.

Finally, we also wanted to examine the effects of extinction and reinstatement on attentional processing of instructed fear. To this end, the experiment was interrupted after 240 trials with the pretext that the shocker was not working (see also, Raes, De Houwer, Verschuere, & De Raedt, 2011). The experimenter pretended to resolve the issue and gave another aversive stimulation (without being reminded of the specific instructed fear contingencies). After this procedure, the experiment continued. To detect extinction, the 240 trials of each phase (pre-reinstatement and reinstatement) were divided in two halves and analyzed separately. Previous research (Van Damme et al., 2006) has shown that conditioned stimuli bias attention, but that this attentional bias fades during extinction. However, after reinstatement, the attentional bias recurred. Here, we wanted to investigate whether this can also be observed for instructed fear conditioning.

## 2. Experiment 1

### 2.1. Method

#### 2.1.1. Participants

Twenty Dutch-speaking undergraduate students from Ghent University (17 female, between 18 and 20 years old) participated in return for student credit. Each participant filled in an informed consent and was debriefed after the experiment about the goals of the experiment.

#### 2.1.2. Material

*2.1.2.1. Apparatus.* The task was performed on a DELL laptop computer and programmed in E-Prime. The electric stimulus was generated by a constant current stimulator (DS7A, Digitimer, Hertfordshire, UK) and delivered through an electrode attached to the left ankle of the participant. The intensity of the electric stimulus was determined for each participant separately by the use of a stepwise work-up procedure until an aversive but tolerable intensity was reached (for a detailed description of this procedure see: Mertens & De Houwer, 2016).

*2.1.2.2. Stimuli.* The four images depicted a snake, a spider, a bird, and a butterfly, as used by Mertens, Kuhn, et al. (2016, Experiment 1; see also Olsson, Ebert, Banaji, & Phelps, 2005). The four stimuli were always presented in one of the twelve possible pairs: each possible combination of images, excluding pairs of identical images, was presented an equal amount of times. Each possible condition was presented 20 times per phase. In addition, the location of the picture that was followed by the dot could either be on the left or the right side. Therefore, there was actually a total of 24 different trial types. These 24 trials were displayed in a random order for ten cycles (= 240 trials). After the reinstatement instructions, another 10 cycles were administered.