



Stimulus fear relevance and the speed, magnitude, and robustness of vicariously learned fear



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ABSTRACT

Superior learning for fear-relevant stimuli is typically indicated in the laboratory by faster acquisition of fear responses, greater learned fear, and enhanced resistance to extinction. Three experiments investigated the speed, magnitude, and robustness of UK children's (6–10 years; $N = 290$; 122 boys, 168 girls) vicariously learned fear responses for three types of stimuli. In two experiments, children were presented with pictures of novel animals (Australian marsupials) and flowers (fear-irrelevant stimuli) alone (control) or together with faces expressing fear or happiness. To determine learning speed the number of stimulus-face pairings seen by children was varied (1, 10, or 30 trials). Robustness of learning was examined via repeated extinction procedures over 3 weeks. A third experiment compared the magnitude and robustness of vicarious fear learning for snakes and marsupials. Significant increases in fear responses were found for snakes, marsupials and flowers. There was no indication that vicarious learning for marsupials was faster than for flowers. Moreover, vicariously learned fear was neither greater nor more robust for snakes compared to marsupials, or for marsupials compared to flowers. These findings suggest that for this age group stimulus fear relevance may have little influence on vicarious fear learning.

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Seligman (1971) explained the non-random distribution of fear, in which some types of fear are more common than others, in terms of evolutionary-based biological 'preparedness' and typically a distinction is now made between 'fear-relevant' ('prepared') and 'fear-irrelevant' (unprepared) stimuli. Phylogenetic fear-relevant stimuli such as snakes and spiders are said to be stimuli that presented a threat to human ancestors and avoiding these stimuli may have aided survival. Therefore, individuals that learned to fear them quickly and easily would have been more likely to survive and pass on their genes than those who did not. Fear-irrelevant stimuli on the other hand, are stimuli such as flowers that did not pose such a threat to our ancestors. Seligman argued that stimulus preparedness enhances learning of fear-related associations during a traumatic learning event with phylogenetic fear-relevant stimuli. Associations between a fear-relevant stimulus (conditioned stimulus; CS) and a negative outcome (unconditioned stimulus; US) are

believed to be less cognitive or rational than is the case for fear-irrelevant stimuli, and are argued to occur more readily and be more robust (Mineka & Öhman, 2002; Seligman, 1971; Öhman & Mineka, 2001). Typically, laboratory evidence for these 'selective associations' is said to occur when learning for a stimulus shows one or more of several features, including: a) a larger conditioned fear response; b) faster acquisition (learning in fewer trials); and c) is more persistent, showing enhanced resistance to extinction (see e.g., Mineka & Öhman, 2002; Öhman & Mineka, 2001).

One way that children can learn to fear a stimulus is vicariously, through observation of another person's (a model) response to the stimulus (Rachman, 1977). It has been argued that vicarious learning is a form of CS-US associative learning (Askew & Field, 2007, 2008; Bandura, 1969; Mineka & Cook, 1986, 1993; Reynolds, Field, & Askew, 2015) in which the model's response acts as the US and becomes associated with the animal or object CS. Vicarious fear-learning has been convincingly demonstrated in experiments with adults (e.g., Berger, 1962; Golkar & Olsson, 2016; Olsson & Phelps, 2004; Olsson et al., 2016; Vaughan & Lanzetta, 1980) and monkeys (e.g., Cook & Mineka, 1990; Cook, Mineka, Wolkenstein, & Laitisch, 1985; Mineka & Cook, 1993; Mineka, Davidson, Cook, &

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Keir, 1984). Given that specific fears and phobias often begin during childhood (Öst & Treffers, 2001; Öst, 1987), this is likely to be a particularly informative period in which to research their onset. Evidence with children has shown that vicarious learning can lead to changes in all three of Lang's (1968) fear response systems: verbal-cognitive, behavioral avoidance, and physiological responses (e.g., Askew & Field, 2007; Askew, Kessock-Philip, & Field, 2008; Askew, Reynolds, Fielding-Smith, & Field, 2016; Askew, Çakir, Pöldsam, & Reynolds, 2014; Dubi, Rapee, Emerton, & Schmiering, 2008; Dunne & Askew, 2013, in press; Gerull & Rapee, 2002; Reynolds, Field, & Askew, 2017); as well as attentional bias (Reynolds, Field, & Askew, 2014; Reynolds, Field, & Askew, in press) for animals.

In a series of seminal studies, Mineka, Cook, and colleagues demonstrated that laboratory-reared rhesus monkeys that were not initially afraid of snakes rapidly learned fear of snakes from observing snake-fearful monkeys (e.g., Cook et al., 1985; Mineka & Cook, 1993; Mineka et al., 1984). This vicarious fear learning effect was found for fear-relevant stimuli such as toy snakes but not for fear-irrelevant stimuli such as flowers (Cook & Mineka, 1989; 1990). Similar evidence of superior conditioning for fear-relevant stimuli also comes from a range of classical conditioning procedures with adults (see Öhman & Mineka, 2001 for an overview). The evidence, however, for selective associations in human vicarious learning is less clear. Using a paradigm in which toddlers saw their parents responding negatively to stimuli, Dubi et al. (2008) found no difference in learned fear and avoidance for fear-relevant (rubber snake or spider) and fear-irrelevant (rubber flower or mushroom) stimuli. Similarly, Askew, Dunne, Özdil, Reynolds, and Field (2013) found that the magnitude of vicariously learned fear responses was not affected by stimulus fear relevance. Askew and colleagues presented 6- to 11-year-olds with images of fearful adult faces alongside images of stimuli with low to high levels of fear relevance: flowers, worms, marsupials, caterpillars, and snakes. Vicariously learned increases in fear-related responses were no different for flowers, marsupials, caterpillars, and snakes; only worms showed lower levels of learning on some, but not all, measures. Together, these findings appear to suggest that fear relevance may be bypassed when children observationally learn fear-related information about stimuli from adults.

Evidence from vicarious learning in children then, has found no evidence of larger learned responses for stimuli of greater fear relevance. However, it remains possible that vicariously learned fear for these stimuli is more rapid or robust, either of which would also be indicative of selective associations. For example, direct conditioning studies with adults have sometimes shown similar magnitudes of fear acquisition for fear-relevant (e.g. snakes, spiders, angry faces) and fear-irrelevant (e.g. flowers, mushrooms, happy faces) stimuli, but found superior resistance to extinction for fear-relevant stimuli (Öhman & Dimberg, 1978; Öhman, Fredrikson, Hugdahl, & Rimmo, 1976). Similarly, Hygge and Öhman (1978) found that although adults' vicariously learned fear responses were initially similar, they immediately extinguished for fear-irrelevant stimuli (mushrooms, berries, and flowers) but not for fear-relevant stimuli (snakes, spiders, and rats). Other evidence shows direct conditioning of fear in adults in a single CS-US pairing trial for fear-relevant but not fear-irrelevant stimuli (e.g., Öhman, Eriksson, & Olofsson, 1975). Thus, as well as the magnitude of fear learning, the speed and robustness of vicarious fear learning for stimuli of differing fear relevance should also be investigated in children. The three experiments described here examined all three laboratory characteristics of selective associations. Experiment 1 compared the magnitude and speed of vicarious fear-learning in children for two types of stimuli likely to be of differing fear relevance: novel (unknown to the child) animals (marsupials: a quoll,

quokka, and cuscus) and flowers (a red avens, willow gentian, and dotted loosestrife). It also examined whether learning is more lasting for marsupials compared to flowers. Experiment 2 investigated robustness of learning for the marsupial and flower stimuli in more detail, comparing robustness of learning in children following three extinction procedures over a 3 week period. Finally, given that marsupials are not established fear-relevant stimuli, Experiment 3 compared magnitude of learning and resistance to extinction and counterconditioning following vicarious fear learning for marsupials and well-established fear-relevant stimuli: snakes (keelback, pattoni, and boomslang).

1. Experiment 1

In an adaptation of Askew and Field's (2007) vicarious learning paradigm, two groups of children saw either three marsupial (higher fear relevance) or three flower (lower fear relevance) CSs together with emotional face USs in a series of marsupial-face (CS-US) 'pairings': one marsupial or flower CS with fearful faces (fear-paired), one CS with happy faces (happy-paired), and one alone with no faces (unpaired control). In addition, in order to investigate speed of learning, children were divided into three further groups that saw different numbers of CS-US trials: 1, 10, or 30 trials, to compare speed of learning. Measures of children's fear beliefs for the CSs were taken before and after learning and avoidance preferences were measured after learning. Follow-up measures were also taken 1 week later to investigate whether learning was more persistent for the animals than the flowers.

The marsupials and flowers were chosen because they are unfamiliar to U.K. children, so children were unlikely to have an existing learning history for them and therefore no prior threat-related beliefs or expectations for them. This is important because prior expectancies that a learning event involving a CS will have a negative outcome (US) are known to enhance fear learning, increasing the speed of learning between the CS and an aversive US, and producing associations that are more resistant to extinction (see Davey, 1992; 1997). US expectancy biases have not only been found for phylogenetic (snakes and spiders) but also ontogenetic (gun and electricity outlet) fear-relevant stimuli (Honeybourne, Matchett, & Davey, 1993), showing that expectancies can be learned via cultural transmission. Threat-related verbal information, for example, has been shown to increase children's expectancies in relation to novel marsupials (Field, Lawson, & Banerjee, 2008). Thus one limitation of typical conditioning paradigms with fear-relevant and fear-irrelevant stimuli is that participants are likely to have prior expectancies for the stimuli used. Learning for stimuli that are unknown to participants may produce different results to studies that use more obvious fear-relevant stimuli such as snakes or spiders, for which children in this age group are already likely to have existing fear-related beliefs and learning histories. It was considered important for the current study that children would have limited familiarity with the stimuli used but would also be old enough to be at an age when fears of this kind typically begin.

Based on Dubi et al.'s (2008) and Askew et al.'s (2013) findings, it was predicted that there would be similar increases in children's fear-related responses for fear-paired marsupials and flowers. However, based on evidence from human classical conditioning paradigms (see Öhman & Mineka, 2001), it seemed likely that learning might occur more rapidly (in fewer trials) for marsupial stimuli because of their higher fear relevance compared to flowers. It also seemed likely that learning for marsupials would persist longer than for flowers because classical conditioning procedures show greater robustness for fear-relevant stimuli compared with fear-irrelevant stimuli (see Öhman & Mineka, 2001). A final effect of

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