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Vicarious Learning and Reduction of Fear in Children via Adult and Child Models

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Abstract

Children can learn to fear stimuli vicariously, by observing adults' or peers' responses to them. Given that much of school-aged children's time is typically spent with their peers, it is important to establish whether fear learning from peers is as effective or robust as learning from adults, and also whether peers can be successful positive models for reducing fear. During a vicarious fear learning procedure, children (6 to 10 years; $N = 60$) were shown images of novel animals together with images of adult or peer faces expressing fear. Later they saw their fear-paired animal again together with positive emotional adult or peer faces. Children's fear beliefs and avoidance for the animals increased following vicarious fear learning and decreased following positive vicarious counterconditioning. There was little evidence of differences in learning from adults and peers, demonstrating that for this age group peer models are effective models for both fear acquisition and reduction.

Keywords: Fear, Vicarious learning, Observational learning, Modeling, Peer learning

Vicarious Learning and Reduction of Fear in Children via Adult and Child Models

Research has consistently shown that vicarious learning is one means by which both social (Askew, Hagel, & Morgan, 2015; de Rosnay, Cooper, Tsigaras, & Murray, 2006) and specific fears can be learned in childhood (e.g., Askew & Field, 2007, 2008). Experimental evidence with 6- to 11-year olds has indicated that vicarious learning can increase fear beliefs and avoidance preferences (e.g., Askew, Dunne, Özdil, Reynolds, & Field, 2013; Askew, Cakir, Poldsam, & Reynolds, 2014; Askew & Field, 2007; Reynolds, Field, & Askew, 2014, 2015; Askew, Kessock-Philip, & Field, 2008; Askew, Reynolds, Fielding-Smith, & Field, 2016), avoidance behavior (Askew & Field, 2007; Reynolds, Field, & Askew, 2014, 2017, in press), heart rate responses (Reynolds et al., 2014, in press) and attentional bias for animals (Reynolds et al., 2014, 2015, in press). Vicariously learned fear and avoidance of animals has also been observed in infants as young as 12–20 months (Egliston & Rapee, 2007; Dubi, Rapee, Emerton, & Schniering, 2008; Gerull & Rapee, 2002). Comparisons in adults suggests that vicarious fear learning can be as effective as direct (classical) fear conditioning (Olsson and Phelps, 2004). However, the type of model can be important, with evidence showing that adults learn fear more successfully from in-group models than out-group models (Golkar, Castro, & Olsson, 2015).

In childhood, fear-related responses to stimuli are likely to be learned from a variety of sources including other family members. However, evidence shows that while mothers are effective fear models, they are no more influential than adult strangers. Dunne and Askew (2013) presented children aged 6 to 10 years with pictures of novel animals, alone (control) or together with pictures of either their mother or a stranger expressing fear. Fear beliefs and avoidance preferences increased for fear-modeled animals, but there were no differences between children who saw their mother and those that saw a fearful stranger model. Similar results were found when children were subsequently given a positive vicarious learning

(counterconditioning) procedure that involved seeing their previously fear-modeled animal again but this time together with a picture of either their mother or a stranger expressing happiness. Fear responses returned to baseline levels regardless of whether the positive model was their mother or a stranger, and whether original vicarious fear learning had been from their mother or a stranger.

Research to date has mainly focused on adult models. However, it is possible that peers might be equally, or more, influential than adults for vicarious fear learning in children. Same-age peers maturing and developing together tend to have similar skill-sets and interests; they view peers as desirable companions and persons to play with and as they mature often prefer them over family members (Ladd, 2008). In school, children spend more time interacting with their peers than with adults and they become the daily companions of children in the activities and experiences that comprise their formative years (Ladd, 2008). It follows then that children may have more opportunities to learn from peers than from adults. Therefore, given also specific fears and phobias typically develop during childhood (Öst, 1987), it is important to understand the degree to which this process can be influenced by the behavior of peers.

In the absence of clues to suggest the source is unreliable, the default response across developmental groups is to trust new information (Mills, 2013). Indeed, young children in particular are often presented as highly credulous and gullible, leading to the argument that children have been shaped by evolution to assimilate the cultural beliefs of their environment, accepting almost any suggestion without question (Dawkins, 1993). However, evidence suggests that, all else being equal, children consider information from adults more trustworthy than from other children (Mills, 2013). In addition, even very young children are selective about the information that they trust when there are clues to the trustworthiness of the information source (Mills, 2013). For example, young infants (13-16 months) are more

likely to imitate a model that has proven reliable in the past than one who provided unreliable information (Poulin-Dubois, Brooker, & Polonia, 2011). Similarly, 3-year-olds are less likely to learn the label for a new object from someone who appears uncertain, or someone that makes other naming errors and appears distracted (Jaswal & Malone, 2007). Children around this age and older (3 to 6 years) also recognize that some people have the required knowledge to be reliable informants while others do not, and are more likely to believe those who are better informed than themselves compared to those that are less well-informed (e.g., Robinson, Champion, & Mitchell, 1999). This may partly explain a general increased trust of adults. However, pre-schoolers (3 to 4 years) will nonetheless consider the reliability of informants more important than their age, trusting a reliable peer more than an unreliable adult (Jaswal & Neely, 2006). Therefore, even in the early years, children can make relatively sophisticated decisions about the information they choose to trust.

Bandura (1977) argued that children learn attitudes, values, and behaviors through social interaction with their peers. In relation to fear development, Field, Argyris, and Knowles (2001) found that threat-related information led to increases in fear beliefs for a novel stimulus only when the information was provided by an adult, not by a peer. But while peer-delivered threat information does not appear to influence children's fear responses, peer fear-modeling is effective. Broeren, Lester, Muris, and Field (2011) found that peer-modeled vicarious learning led to increases in 8- to 10-year-olds' fear-related beliefs towards animals. Similarly, positive modeling by (filmed) peers has also been shown to be effective for reducing fear in children with fear of dogs (Bandura & Menlove, 1968; Hill, Liebert, & Mott, 1968). Following positive peer modeling in these studies, children demonstrated significant increases in approach behaviors towards dogs compared to no-modeling controls. What remains unclear is whether peer models are as effective as adult models in relation to increasing and decreasing children's fear responses. This is important because while similar-

age peers might have some effect on child fear development, this could be relatively minor in comparison with learning experiences involving adults. As well as fear learning, research has also yet to compare the effects of the two types of model on vicarious fear reduction. One possibility is, for example, that although children can acquire fears from observing other children or adults, these may be subsequently ‘unlearned’ by adults displaying positive emotions towards the stimulus; in contrast, learned fear might be resistant to subsequent positive modeling by peers.

Dunne and Askew (2013) used an experimental procedure that allowed comparison between a) vicariously learned fear responses for mother models followed by vicarious counterconditioning by positive mother or stranger models; with b) fear responses vicariously learned from stranger models followed by vicarious counterconditioning from positive mother or stranger models. The current experiment adapted Dunne and Askew’s experimental methodology to compare vicarious learning and fear reduction for same age peer and adult stranger models. The basic methodology was identical to Dunne and Askew (2013) except that models were either adult strangers or children of a similar age to participants. In-line with previous research, it was expected that children would show increased fear-related beliefs and avoidance preferences for animals presented with images of fearful adults, and later a reduction when images of adults expressing happiness were seen with the animals (Dunne & Askew, 2013; Reynold et al., in press). Given previous peer vicarious learning research, it was expected that same age peers would also be effective fear models; however, no specific predictions could be made about whether they would be equally or less effective than adults. It was also unclear beforehand whether counterconditioning delivered by peers would be as successful as counterconditioning delivered by adults.

Method

Participants

Participants were 60 children (24 boys, 36 girls) aged between 6.83 and 10.91 years ($M = 8.86$ years, $SD = 0.98$ years). This age group was chosen because developmental fears often focus on animals around this age (Muris & Field, 2011). The required sample size was based on similar previous studies (e.g., Dunne & Askew, 2013; $N = 60$). Children were recruited via two schools in South-west London, U.K. Parents were not asked to provide socioeconomic information but school records showed that the number of socioeconomically disadvantaged children attending both schools was below the national average. Informed consent was obtained from parents and all children gave verbal assent prior taking part in the study.

Materials

Animals. Novel animals were nine color images (400×400 pixels) of three Australian marsupials, the quoll, quokka, and cuscus; three pictures of each animal were used. The Australian marsupials have been used successfully in previous similar research (e.g., Askew & Field, 2007; Reynolds, Field & Askew, 2015) and were selected because UK children are generally unaware of them (e.g., Dunne & Askew, 2013). No children reported prior experience or knowledge of the animals.

Faces. Images of the faces of one adult female, one adult male, one 9-year-old girl, and one 10-year-old boy were created for this experiment. For each model three fearful and three happy color portrait images (300×400 pixels) were created, making a total of 24 images. None of the models were known to children participating in the experiment. Models were taught to present emotional facial expressions using the guidelines and descriptions of Izard (1971) and Ekman and Friesen (1975). For example, models raised the corners of their mouth and cheeks for happy images, keeping their eyes open and forehead smooth. Eyes

were wide open with the eyebrows raised but drawn together for fear facial expressions. The forehead was wrinkled and mouths open slightly, with the corners pulled straight back and lips stretched horizontally without baring teeth (see Dunne & Askew, 2013).

Fear Beliefs Questionnaire (FBQ). The 21-item FBQ (Field & Lawson, 2003) was used to measure children's fear-related beliefs for animals. Children were asked seven questions (four reverse-scored) about each of the three animals (e.g., "Would you be scared if you saw a cuscus?") and children responded on a 5-point Likert scale: 0 (*No, not at all*); 1 (*No, not really*); 2 (*Don't know/Neither*); 3 (*Yes, probably*); and 4 (*Yes, definitely*). An average fear beliefs score was calculated for each animal, with 4 being the highest possible level of fear beliefs and 0 the lowest. Internal consistencies before vicarious learning were good and similar to previous studies (e.g., Dunne & Askew, 2013): Cronbach's $\alpha = .71$ (Cuscus subscale), .81 (Quokka subscale), .73 (Quoll subscale). All values remained above Kline's (1999) recommended .70 threshold following vicarious learning: .80 (Cuscus subscale), .81 (Quokka subscale), .84 (Quoll subscale), and after vicarious extinction: .82 (Cuscus subscale), .86 (Quokka subscale), .82 (Quoll subscale).

Nature Reserve Task (NRT). Past studies have successfully used the NRT to measure children's avoidance preferences for animals (e.g., Askew et al., 2013, 2014; Dunne & Askew, 2013; Field & Storksen-Coulson, 2007; Reynolds et al., 2015). Children were shown a green rectangular board (45 cm x 60 cm), with a photo of one of the three animals placed at one end of the board by the experimenter. Children were asked to imagine they were visiting a nature reserve where the three animals lived and place a model figure (a boy for boys or girl for girls) on the board where they would most like to be. Distances were measured from the animal to the child's figure to ascertain children's approach or avoidance preferences for the animal, and this was repeated for each animal.

Procedure

The experiment was presented using a RM 4300 laptop computer with a 15" screen. The entire procedure except for the NRT was computerized (Field, 2010) in Visual Basic.net with ExacTicks 1.1 (Ryle Design, 1997). Children were randomly allocated to one of four model groups: Adult-Adult (AA), Adult-Peer (AP), Peer-Peer (PP), or Peer-Adult (PA). For example, children in the AP group experienced vicarious learning with an adult (A) model, then vicarious counterconditioning with a peer (P) model. At the start of the procedure children were asked to complete the first FBQ and NRT. Next, during vicarious learning, children saw 30 trials in which animals were presented together with emotional faces: one animal was seen together with scared faces in 10 'fear-paired' trials, one animal with happy faces in 10 'happy-paired' trials, and one animal was seen alone in 10 'unpaired' trials. The type of animal seen with each type of emotional face was counterbalanced across children. Emotional faces were modeled either by adults or peers depending on the group children were in: children in the AA and AP groups saw adult faces, whereas children in the PP and PA groups saw children's faces. An animal-face trial consisted of the animal being presented on the screen for 1 s alone and then for 1 s together with a face on the opposite side of the screen. In unpaired trials the animal was presented alone for 2 s. Trials were presented in a random order and each lasted for 2 s in total, followed by a randomly determined inter-trial interval of 2 to 4 s.

Next, children completed post-learning FBQ and NRT measures. This was immediately followed by the vicarious counterconditioning phase, which was identical to vicarious learning except that animals seen in vicarious fear learning trials were now seen with happy faces and animals seen in happy face trials were now seen with scared faces. Unpaired control animals were again seen alone. The type of model children saw depended on the group they were in: children in the AA and PP groups saw the same type of model (i.e., adult and peer respectively) as they had during vicarious learning; children in the AP

and PA groups saw the other type of model (i.e. peer and adult respectively) to that which they saw during vicarious learning. Finally, children completed the post counterconditioning FBQ and NRT, and were fully debriefed using games and puzzles and correct information about the animals.

Results

Fear beliefs

Mean fear belief scores pre-vicarious learning, post-vicarious learning, and post counter-conditioning are shown in Figure 1. Data analysis was split into two steps. The aim of the first step was to establish whether both adult and peer vicarious fear learning was successful. The aim of the second step was to ascertain whether learned fear beliefs were significantly reduced by positive adult and peer models.

Acquisition. A three-way 2(time: baseline vs. post-learning) \times 3(pairing type: scared, happy and none) \times 2(model type: adult vs. peer) mixed ANOVA with repeated measures on the first two variables was performed on fear belief scores. There was significant main effect of pairing type, $F(2, 116) = 10.33, p < .001, \eta^2p = .15$ (95% CIs [0.044, 0.26]), but the main effect of time was non-significant, $F(1, 58) = 0.25, p = .62, \eta^2p = .004$ (95% CIs [0, 0.09]). The time \times pairing type interaction, critical for showing changes in fear beliefs due to learning, was significant, $F(2, 116) = 14.43, p < .001, \eta^2p = .20$ (95% CIs [0.077, 0.313]), showing that vicarious learning led to changes in children's fear beliefs for animals that were different depending on the type of face (happy or scared) they saw them with. Planned comparisons comparing fear beliefs before and after vicarious learning showed a significant increase after fear-pairing, $F(1, 58) = 18.44, p < .001, \eta^2p = .24$ (95% CIs [0.73, 0.40]), but no decrease after happy-pairing, $F(1, 58) = 2.08, p = .16, \eta^2p = .035$ (95% CIs [0, 0.16]). Thus, vicarious fear learning was established. All other main effects and interactions were non-significant, including the pairing type \times time interaction \times model type, $F(2, 116) = 1.45,$

$p = .24$, $\eta^2p = .024$ (95% CIs [0, 0.092]). Therefore, there was no evidence that changes in fear beliefs due to vicarious learning were different for adults and peers. The effect size was trivial, indicating that a power explanation for the finding was unlikely.

A nonsignificant p -value does not in itself indicate support for the null hypothesis that there was no difference between adult and peer vicarious learning. Therefore, a Bayes factor was estimated for this effect. Bayes factors go further than merely stating whether an effect is significant, and allow researchers to estimate the relative strength of two competing theories. A Bayes factor (B) greater than 1 indicate that the alternative hypothesis is more probable than the null hypothesis and a B value of less than 1 indicates that the null hypothesis is more probably. Bayes factors of greater than 3 are typically considered substantial evidence for the alternative hypotheses and values of $1/3$ are considered substantial evidence for the null hypothesis. Values of B between $1/3$ and 3 represent only weak evidence either way, suggesting the data may not be sensitive enough to distinguish between the two options (Dienes, 2014). One advantage of Bayes factors is that they are not influenced by power.

In estimating Bayes factors, changes in fear beliefs scores over time were calculated (fear beliefs after learning minus fear beliefs before learning). There was a mean increase in fear beliefs for adult fear-paired animals of 0.37 ($SD = 0.75$) and for unpaired control animals of 0.06 ($SD = 0.91$), which is a difference of 0.31. This difference was used to represent the effect of vicarious fear learning. In the case of peer fear-pairing the mean increase was 0.57 ($SD = 86$) and for unpaired control animals fear beliefs decreased by -0.21 ($SD = 0.79$) which is a mean difference of 0.78, a larger effect than for adults. Adapting Dienes' (2014) recommendations, a Bayes factor was estimated for the comparison between the effects of fear vicarious learning for adult and peer models (i.e., differences in changes in fear beliefs over time for fear-pairing compared to no-pairing. The size of the difference in changes in

fear beliefs over time for fear-paired animals compared to unpaired animals has been reasonably consistent across previous studies with adults, typically varying between 0.86 to 1.40 on the fear belief scale (Askew & Field, 2007; Dunne & Askew, 2013; Dunne, Reynolds & Askew, 2017; Reynolds et al., 2017) with an average of around 1. Therefore, prior beliefs were that effects would range from -1 to 1 because the effect could theoretically be of a similar size in either direction. A Bayes Factor of 1.79 was calculated, which suggests that the data are 1.79 times as likely under the alternative hypothesis than the null. This is relatively close to 1 and therefore represents only weak inconclusive support for the alternative hypothesis. It was not possible to distinguish clearly between the two hypotheses. This is weak support for peer vicarious fear learning being greater than adult vicarious learning. Figure 1 suggests this may, in part, be the result of decreases in fear beliefs for the unpaired animal in the Peer-Peer group, which did not occur in other groups and makes any increases in fear beliefs compared to this control larger in relative terms.

Although this is only weak support for differences between adults and peers, it is important to confirm that vicarious learning effects were present within each modeling group. Further analysis showed that there were significant pairing-type \times time interactions in both the adult modeling, $F(2.36, 47.37) = 5.82, p = .009, \eta^2p = .17$ (95% CIs [0.03, 0.38]), and peer modeling groups, $F(2, 58) = 10.15, p < .001, \eta^2p = .26$ (95% CIs [0.07, 0.41]), even allowing for Bonferroni-adjusted alphas for multiple tests. This confirms that there were significant vicarious learning effects for both adult and peer models. In-line with the direction of the Bayes factor, the effect size was larger for peers.

Reduction. Children were starting at different baselines in the counterconditioning phase because not all children showed fear belief acquisition following vicarious fear learning. Therefore, only counterconditioning data from children that had shown increased fear beliefs for fear-paired animals compared to unpaired control animals were included in

the analysis (adult model group: $N = 16$; peer model group: $N = 18$). A three-way 2(time: post-learning vs. post-counterconditioning) \times 3(pairing type: scared, happy and none) \times 2(model type: adult vs. peer) mixed ANOVA with repeated measures on the first two variables was performed on post-learning and counterconditioning FBQ scores. Previous vicarious counterconditioning studies with adults have found reductions in fear beliefs for fear-paired animals compared to unpaired animals of between 0.77 (Dunne et al., 2017) and 1.23 (Dunne & Askew, 2003) on the FBQ scale, which is an average of 1. Consequently, as effects could be in either direction, priors of -1 to 1 were used again to calculate Bayes factors for the three-way interaction.

The critical pairing-type \times time interaction was significant, $F(1.19, 38.22) = 22.71, p < .001, \eta^2p = .42$ (95% CIs [0.17, 0.58]), indicating a significant change in fear beliefs due to counterconditioning. Planned comparisons confirmed that, compared to the unpaired animal, fear beliefs for positively modeled animals led to significant reductions in children's fear beliefs, $F(1, 32) = 67.20, p < .001, \eta^2p = .68$ (95% CIs [0.46, 0.78]). Thus, previously learned fear beliefs were significantly reduced by positive counterconditioning. No similar significant change in fear beliefs was found for negative counterconditioning. The pairing-type \times time \times model type interaction was nonsignificant, $F(1.19, 38.22) = 0.29, p = .63, \eta^2p = .009$ (95% CIs [0, 0.13]), $B = 0.64$. This indicated no evidence that counterconditioning was different when delivered via adult or peer models. The effect size was extremely small, suggesting this is unlikely to be a power issue. The Bayes factor was close to 1 indicating that the data did not clearly favor either the null hypothesis that vicarious learning was the same in both groups or the alternative hypothesis that there was a difference. Similar to fear acquisition, but in the opposite direction, the value showed that the null hypothesis was 1.56 times more likely than the alternative, suggesting some weak but inconclusive evidence in favor of there being no difference between adult and peer modeling.

In summary, vicarious fear learning of fear beliefs was successful for both adult and peer models with some, fairly weak, evidence that fear learning was greater for peer models. Counterconditioning was successful for both adult and peer models with no evidence that one type of model was more effective than the other. There was some, again weak and inconclusive, evidence from Bayesian analysis supporting no difference between the two types of model.

Avoidance preferences

Acquisition. Figure 2 shows mean distances (cm) from animals to the children's figures in the NRT. A three-way 2(time: pre-learning vs post-learning) \times 3(pairing type: scared, happy and none) \times 2(model type: adult vs peer) mixed ANOVA was performed on NRT distances. Priors of -20 and 20 were used to calculate Bayes factors based on an approximate average of vicariously learned NRT effects (18.39 and 21.51) from previous studies (Dunne et al., 2017; Reynolds et al., 2017). The significant pairing type \times time interaction showed that avoidance preferences changed over time depending on the type of face children saw animals with, $F(2, 116) = 7.40, p = .001, \eta^2p = .11$ (95% CIs [0.021, 0.22]). Planned comparisons comparing avoidance preferences at baseline with post-vicarious learning showed a significant increase in avoidance preferences for fear-paired animals compared to unpaired animals, $F(1, 58) = 4.72, p = .034, \eta^2p = .075$ (95% CIs [0, 0.22]), but no significant decrease in avoidance preferences for happy-paired animals compared to unpaired animals ($p = .11$). The pairing type \times time \times model type interaction was nonsignificant, $F(2, 116) = 0.37, p = .69, \eta^2p = .006$ (95% CIs [0, 0.48]), $B = 0.49$, showing no indication that vicarious learning of avoidance preferences was different for children exposed to adult or peer models. The effect size was very small, suggesting that power was not an issue here. The Bayes factor indicated that the data were twice as probable under the

null hypothesis than the alternative, which is some (tentative) support that there was no difference between adult and peer vicarious learning.

Reduction. Only children that showed acquisition of avoidance preferences during vicarious fear learning were included in the analysis (adult model group: $N = 14$; peer model group: $N = 18$). A three-way 2(time: post-learning vs post-counterconditioning) \times 3(pairing type: scared, happy and none) \times 2(model type: adult vs. peer) mixed ANOVA was performed on NRT distances. For Bayes factor estimation, NRT counterconditioning effects were calculated as change in distance over time for fear-paired animals minus change in distance over time for unpaired control animals, and Priors of -29 to 29 were chosen based on an average of effects (39 and 18) found in similar counterconditioning studies with adults (Dunne & Askew, 2003; Dunne et al., 2017).

There was a significant pairing type \times time interaction, $F(1.72, 51.51) = 12.19, p < .001, \eta^2p = .29$ (95% CIs [0.088, 0.45]) with follow-up tests indicating that avoidance preferences decreased significantly for animals seen with positive models, $F(1, 30) = 14.04, p = .001, \eta^2p = .32$ (95% CIs [0.070, 0.52]). Thus, previous acquired avoidance preferences were significantly reduced again. Increases for negatively modeled animals also approached significance, $F(1, 30) = 3.84, p = .059, \eta^2p = .11$ (95% CIs [0, 0.33]). However, the pairing type \times time \times model type interaction was not significant, $F(1.72, 51.51) = 0.16, p = .82, \eta^2p = .005$ (95% CIs [0, 0.073]), $B = 0.33$. showing that model type did not influence vicarious learning. The Bayes factor indicated that the data were three times more probable under the null hypothesis than the alternative, which is substantial evidence in support of the null hypothesis that vicarious counterconditioning was no different for adult or peer models.

To summarize, vicarious learning by both adults and peers increased children's avoidance preferences. There was no evidence of difference in learning from the two model types and some tentative support for the null hypothesis that there was no difference.

Similarly, vicarious counterconditioning significantly reduced vicariously acquired fear beliefs, with substantial evidence that there no difference between the effectiveness of adult and peer models.

Discussion

The experiment compared the effects of peer and adult modeled vicarious fear learning on children's fear-related responses for stimuli, as well as the effect of subsequent positive modeling (counterconditioning) by peers and adults on reversing learned fear. The findings showed that (a) children's self-reported fear beliefs and avoidance preferences for stimuli increased after initial vicarious fear learning; (b) vicariously learned increases in fear beliefs were significantly reduced by vicarious counterconditioning (positive vicarious learning); (c) there was little evidence that peer and adult vicarious learning were different, except for some fairly weak evidence that learning of fear beliefs was more successful via peer models; and (d) there was no evidence that fear reduction was different for adult and peer models, and in the case of avoidance preferences, there was convincing evidence that peer and adult modeling were identical.

Results confirmed previous findings (e.g., Askew & Field, 2007; Reynolds et al., 2014) that vicarious learning affects children's self-reported fear-related responses for novel animals: Fear-pairing increased fear beliefs and avoidance preferences and happy-pairing decreased fear beliefs. This was found for both adults and peers, providing further evidence for the effectiveness of same-age child peer models in negative fear-modeling as demonstrated by Broeren et al. (2011). Uniquely, the study found no evidence that peers are less effective fear models than adults for 6- to 10-year-olds. The negative effects of observing fearful peers appear to be potentially similar to seeing a scared adult, which is important in terms of understanding fear development because school children in this age group are likely to spend much of their time with same-age peers. In addition, results

supported previous findings that vicarious counterconditioning can reduce vicariously learned fear beliefs (Dunne & Askew, 2013) or other vicariously learned fear-related responses (Reynolds et al., in press). No evidence of differences between effects for adult and peer models was found; indeed, there was good evidence that reduction of avoidance preferences was the same for both model types. This suggests that same-aged peer models can be equally as effective as adults at reducing vicariously learned fears in this age group, which suggests peers could play an important role for reducing fear development. Moreover, Dunne and Askew (2013) have previously shown that adult strangers are as potent models as children's mothers; consequently positive and negative emotional responses to stimuli shown by peers may be as important as those shown by mothers for this age group, in terms of both the development and reduction of fear.

The results appear to contradict the wider literature on children's learning from adults and peers. Evidence suggests that children discriminate between sources of information and are typically willing to trust information from adults more than from their peers (Mills, 2013) unless there is evidence that the adult is less reliable (Jaswal & Neely, 2006). However, research in this area has often focused on information about the labelling or locating of objects. In the case of threatening information, quickly believing advice about danger may offer additional evolutionary advantage by increasing children's survival chances. Therefore, just as the age of a source has less influence on credibility if his or her reliability is in question, information about threat to survival may reduce the importance of an informant's age. Learning about threat might trigger a specific set of learning processes that bypass age-related mistrust in order to maximize chances of survival.

This proposition is supported by the current results and those of Dunne and Askew (2013), but not those of Field and colleagues (2001), who found that verbal information from same-age peers was less successful in changing children's fear beliefs than information from

a teacher or adult stranger. One obvious difference between these studies is the manner in which information was conveyed. In the first two studies information was modeled whereas in the latter it was transmitted verbally. Hence it appears that in vicarious fear learning, survival-relevant content takes priority over the age of the model, so that models of all ages are effective; whereas for the verbal transmission of threat information, adults remain more convincing sources of information. It is possible that the verbal information and vicarious learning pathways are different in this respect. In addition, same-age peer models in Field et al.'s study were known classmates of the participants; thus another possibility is that the children may have been more skeptical about the information than when it was presented visually here by unknown peer models. Children may also have been mindful that their classmates were playing a role for the study, and therefore the information they were giving was not necessarily true. Moreover, Field et al. suggested that the children may not have read the information as expressively as the adults: Child story-readers may not have delivered information with the same degree of conviction as the adults; whereas pictures of unknown children were under tighter experimental control here.

Clinical and Theoretical Implications

The finding that peers and strangers are both equally effective models for the reduction of children's fears has potential implications for clinicians, parents, and those working with children. When considering appropriate interventions, the potential for everyday peer and adult vicarious learning scenarios to increase, maintain, or moderate fear should be considered. Together with Dunne and Askew's (2013) findings, the research also indicates that adult strangers, relatives, or similar-aged children might be able to be part of early interventions to reverse the development of children's fears, particularly after a fear-related vicarious learning event.

The findings also have implications for understanding the mechanisms underlying vicarious learning, which in turn has clinical implications. It has been argued that, like conditioning, vicarious learning is underpinned by CS-US associations (e.g., Askew & Field, 2007, 2008; Mineka & Cook, 1993; Olsson & Phelps, 2007) in which the stimulus (e.g., animal) is a conditioned stimulus (CS) and the model's fearful response acts as an unconditioned stimulus (US). In conditioning terms, any differences in vicarious learning from observing adult and peer emotional faces (USs) might be considered the result of differences in US salience, a characteristic related to stimulus intensity that is known to influence the strength of conditioning (Rescorla & Wagner, 1972). Therefore, from an associative learning perspective the current findings suggest either that the age of the model does not affect US salience, or that US salience is unimportant in vicarious fear-learning in this age group. The first scenario is possible if the age of the model does not affect the potency of the information conveyed by their emotional face because, for example, 6- to 10-year-olds consider peers to be no less important sources of information about threat in the world than adults. It is known that adults vicariously learn fear more successfully from in-group members (Golkar et al., 2015) and children of this age may consider their peers to be members of an in-group. Given the established importance of salience for associative learning, the second scenario, that US salience is unimportant, seems unlikely. However, one possibility might be that the salience of the US is less important for vicarious fear-learning in childhood because the potential for survival to be threatened is particularly high at this time. Learning with less regard for US salience is logical if it is considered that the environment contains potentially deadly threats for which a swift response would be vital to ensure survival. In this scenario, as already discussed, it makes sense from an evolutionary perspective for threat-related learning to occur even when US salience is low (e.g., a child

model compared to an adult perhaps). The current study cannot distinguish between these two possible theoretical explanations and further work is required.

The current results were found for novel animal stimuli and it is unclear whether the findings are animal-specific, or if they would generalize to other sets of stimuli and types of fear (e.g., social anxiety). An interesting direction for future work would be to investigate this further. Another avenue of research would be to look at the influence of general levels of anxiety on fear reduction. Reynolds et al. (2014) found that existing anxiety symptoms were associated with increased vicarious learning of fear beliefs and this relationship was still detected 1 month after vicarious learning. But associations between general anxiety symptoms and positive modeling has not been investigated with this age group and paradigm, and could potentially explain differences in the success of positive modeling and fear reduction.

In summary, the results of this experiment show that children (aged 6 to 10 years) vicariously learn or ‘unlearn’ fear of stimuli from adults and their peers equally. This has theoretical implications for our understanding of the development and reduction of fear, as well as clinical implications for the prevention, early intervention, and maintenance of fear.

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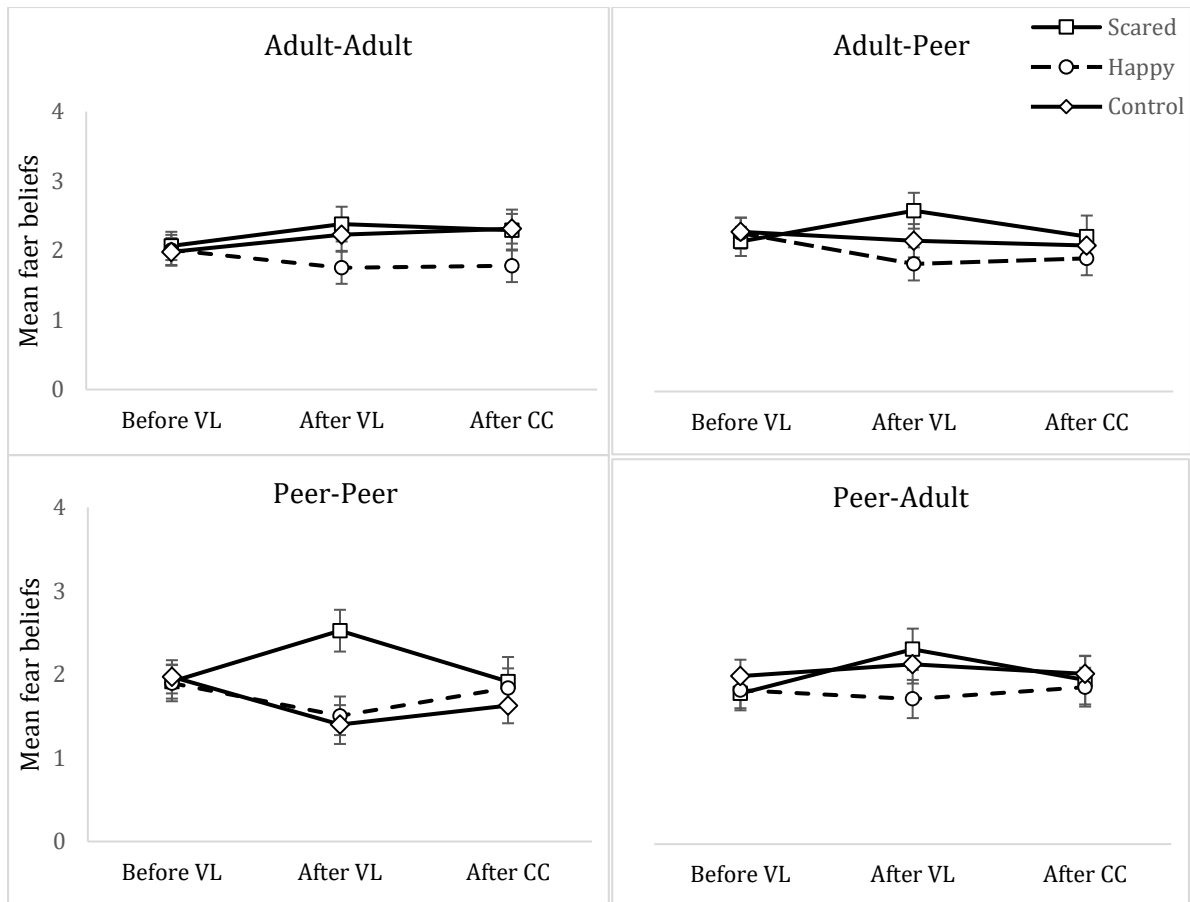


Figure 1. Mean fear beliefs (and SE) for the scared, happy, and unpaired (control) conditions, pre- and post- vicarious learning and post-counterconditioning (unlearning process).

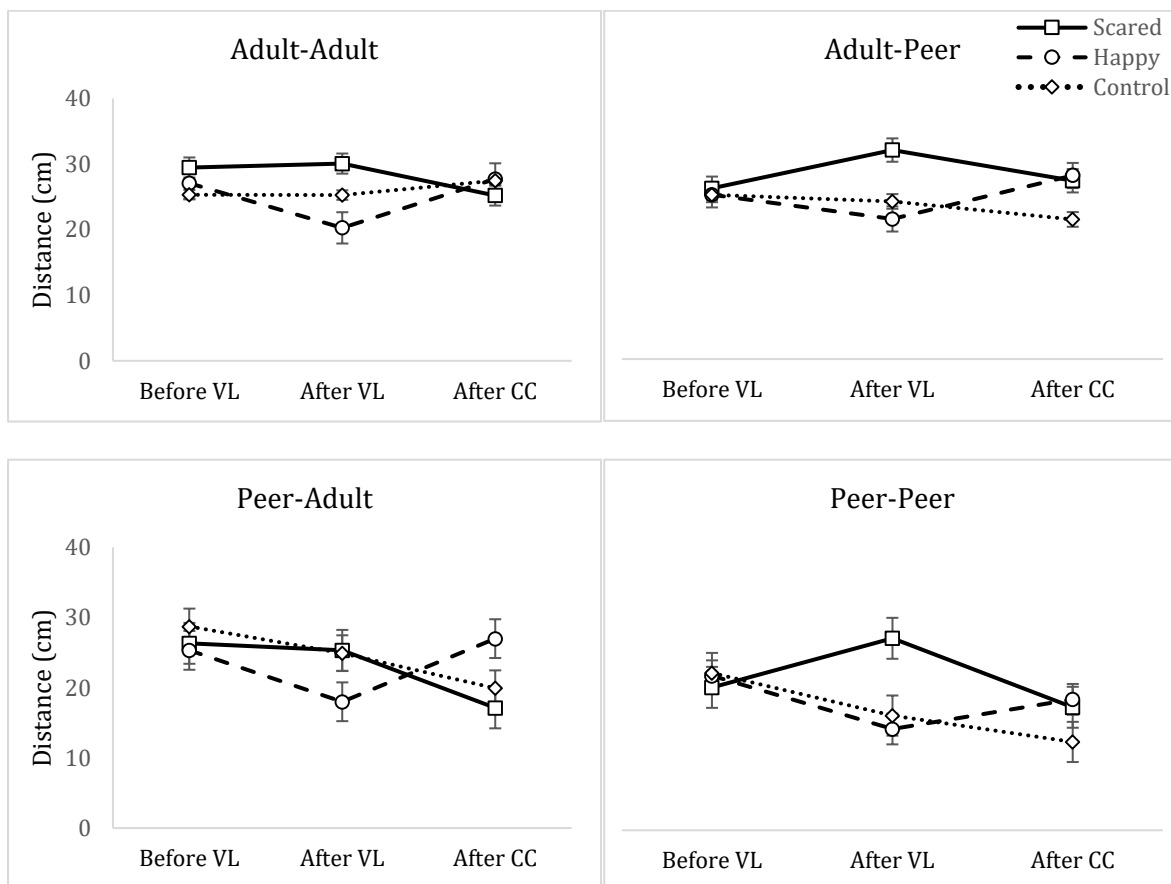


Figure 2. Mean (and SE) distance (cm) between animals and children's figures in the nature reserve tasks.