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The Role of Caregiver Attachment in Vicarious Fear Learning in Children

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ABSTRACT

Vicarious learning is the process through which individuals acquire fear responses by observing others behaving fearfully. The current study investigates how attachment to parents may moderate vicarious fear learning in children. Although attachment to caregivers plays a crucial role in emotional regulation, its potential to moderate fear learning via vicarious experiences remains underexplored. Experiment 1 showed no moderating effect of attachment when strangers served as models. In Experiment 2, where mothers served as the models, attachment quality did not significantly affect fear beliefs. However, attachment was related to avoidance behaviour. Specifically, children's avoidance of the fear-paired animal post-learning was greater when maternal trust and overall attachment quality were lower. For paternal attachment, avoidance of the fear-paired animal was associated with overall attachment quality and communication. Hierarchical analyses confirmed that maternal trust and paternal trust and communication moderated changes in avoidance from pre- to post-learning. Additionally, the touch box task showed that maternal attachment, particularly alienation, influenced approach behaviour toward the fear-paired animal, whereas paternal attachment did not. Children with stronger maternal attachment and better communication were slower to approach the fear-paired animal. These findings suggest that lower attachment quality is linked to greater avoidance of fear-related stimuli, highlighting the role of attachment in shaping behavioural, rather than cognitive, responses in vicarious fear learning. The results contribute to understanding the complex interplay between attachment and emotional learning, suggesting potential pathways for further research into specific attachment dimensions and other moderators of vicarious fear learning.

1 | Introduction

Attachment theory is one of the most popular and well-established theories of emotional and social development (Duschinsky et al. 2023). The antecedents of attachment security are rooted in the quality of an individual's earliest relationships (Bifulco et al. 2002). Using her pioneering research tool, the Strange Situation Procedure, Mary Ainsworth first showed how the quality of a child's attachment relationship had long-term developmental implications, especially when it came to shaping the child's ability to manage distress (Ainsworth and Bell 1970). She was also the first to show patterns of attachment may differ between caregivers. Consequently, different attachment figures, such as mothers and fathers, may have distinct influences on a child's emotional development, with specific attachment dimensions like trust, communication, and alienation playing a role in shaping how children experience and regulate fear (Verhaar et al. 2022). The association between attachment and anxiety has been well-documented, with insecurely attached children demonstrating a greater propensity for heightened fear responses and difficulties in emotional regulation (Mikulincer et al. 2023). Understanding these relationships is therefore essential for disentangling the specific pathways through which attachment security or insecurity may contribute to anxiety disorders or other fear-related outcomes.

In middle childhood, attachment undergoes a shift toward a more internalised and representational level, where children's attachment relationships become increasingly influenced by implicit internal working models rather than solely by explicit, immediate interactions with caregivers (Main et al. 1985). This developmental transition reflects a growing capacity for abstract thinking and cognitive organisation of attachment experiences, allowing children to anticipate caregiver availability and support even in their absence. As a result, attachment influences not only immediate emotional responses but also broader cognitive-affective patterns that shape how children interpret and respond to their social environment (e.g., Collins and Allard 2001).

Attachment and fear acquisition share several critical developmental properties. Both constructs emerge early in life, serve adaptive functions related to protection from harm, and undergo significant developmental changes in response to environmental influences (Bowlby 1980). Furthermore, problems in either system can lead to long-term difficulties, including emotional dysregulation, behavioural problems, and reduced academic achievement (Bifulco et al. 2021). Given these implications, there has been increasing policy interest in understanding attachment-related difficulties and developing attachment-based interventions. For example, the National Institute for Health and Care Excellence (NICE)—the UK body responsible for evidence-based health and care guidelines—highlights in its 2015 Children's Attachment guidelines the importance of training professionals to recognise and assess attachment difficulties in children, particularly in educational and clinical settings. Interventions targeting attachment security have been shown to mitigate fear and anxiety in children, especially when a parent has an anxiety disorder (Ginsburg et al. 2015). This suggests that fear and anxiety may be socially transmitted within attachment relationships, yet little is known about the specifics, in terms of characteristics or processes, underlying this transmission.

One way in which fears can be indirectly acquired is through vicarious, or observational, learning (Rachman 1977). In this process, a child may develop a fear response by observing a model, typically a caregiver or another significant individual, react fearfully to a specific stimulus (e.g., displaying distress in the presence of a dog) or by witnessing the model experience an aversive event involving that stimulus (e.g., being bitten by a dog). Given the central role of caregivers in shaping children's emotional responses, attachment processes may influence the extent to which vicarious fear learning occurs. However, despite a wealth of research on vicarious fear learning (e.g., Askew et al. 2016; Dunne et al. 2017; Reynolds et al. 2014), the influence of attachment on this process remains largely unexplored. Secure attachment is believed to buffer against fear acquisition by fostering emotional regulation and encouraging exploration of potentially fear-provoking situations (Bowlby 1980). Conversely, an insecure-anxious attachment style may heighten fear responses due to a chronically activated attachment system that remains highly sensitive to potential threats (Mikulincer et al. 2023).

Individual differences in anxiety may also influence children's vicarious fear learning. Children with higher trait or state anxiety tend to interpret ambiguous stimuli as more threatening and may acquire fear responses more readily when observing others' fearful reactions (Askew and Field 2007). Importantly, attachment security may shape how anxiety affects fear learning. Securely attached children—those who feel safe and secure in their caregiver relationship—typically display better emotion regulation and may be buffered against excessive fear acquisition, whereas insecure attachment could amplify the impact of anxiety on children's fear responses (Bowlby 1980; Mikulincer and Shaver 2012).

A critical question driving this study is how attachment developmental trajectories may shed light on the process of vicarious learning in middle childhood. The afore mentioned move from behavioural to cognitive representations of attachment that occurs in middle childhood (Coulson et al. 2017) may influence the extent to which vicarious fear learning is moderated by attachment security, particularly in relation to the caregiver's role. Specifically, we examine whether the presence of a caregiver as the emotional model alters fear acquisition differently than observing a stranger's reactions. By disentangling these cognitive and behavioural influences, this study aims to clarify how attachment processes contribute to vicarious learning and broader emotional development in middle childhood.

It is hypothesised that greater attachment quality, specifically, higher trust and communication and lower alienation with the mother or father, will be associated with reduced fear responses. In addition, higher levels of anxiety, both state and trait, will be associated with stronger fear responses. Given the typically primary caregiving role of the mother in middle childhood, we expect maternal attachment to exert a stronger influence on children's fear responses than paternal attachment. Additionally, we anticipate that the presence of the caregiver as a model during vicarious learning will further strengthen the moderating role of attachment on fear-related behaviours, highlighting the interaction between attachment security and the social context of learning.

2 | Experiment 1

Currently, little is known about the effect of attachment style on vicarious fear acquisition. This relationship is important because not only might insecure-avoidant attachment heighten children's fear responses acquired vicariously, but secure attachment may have a buffering effect on fear acquisition. The first experiment therefore sought to explore whether attachment moderates the effect of vicarious learning on fear cognitions, approach-avoidance preferences and avoidance behaviour. Previous research (e.g., Askew et al. 2013; Askew and Field 2007; Reynolds and Ewing 2021; Reynolds et al. 2014, 2015, 2016, 2017) has used a vicarious learning paradigm, whereby pictures of novel animals are presented alongside pictures of strangers looking fearful or happy, as a harmless analogue of a real life vicarious learning experience. Such studies have demonstrated that children's fear responses for animals paired with a fearful face significantly increase in comparison to animals paired with happy or no faces. The current study applies this established paradigm to examine whether attachment style moderates the effects of vicarious learning on fear acquisition.

2.1 | Method

2.1.1 | Participants

Thirty-eight children (12 boys, 26 girls) aged 7–10 years took part (M = 95.79 months, SD = 6.76). All were recruited from two primary schools in North London. Informed consent was obtained from parents 2 weeks before the study via letters sent home with children. Only children who returned signed consent forms from a parent or caregiver were permitted to participate. Parents were asked to inform their child that they could stop the study at any time without giving a reason. This was also explained to the children on the day, emphasising that there were no right or wrong answers. All children gave verbal assent. Ethical approval was obtained from the *** Psychology Department Ethics Committee.

2.1.2 | Materials

2.1.2.1 | Animal Stimuli. Children were presented with colour pictures of three Australian marsupials, a quokka, quoll and cuscus (346 × 444 pixels). It was assumed that children in the UK would not be familiar with these animals and therefore, due to their novelty, children would not have pre-existing fear expectations. During the debrief, all children were asked whether they had come across any of the animals prior to the study to ensure their novelty. All children reported that they had not heard of the animals. The animals also now have an established track record of being used in similar studies (e.g., Reynolds et al. 2014).

2.1.2.2 | Face Stimuli. Colour images (346 × 444 pixels) of one female and one male face were taken from the NimStim Face Stimulus Set (Tottenham et al. 2009). Each face displayed three expressions: fearful, neutral or happy. During the vicarious learning paradigm, children saw 10 trials per expression (five male, five female), resulting in 30 trials in total.

2.1.2.3 | State Trait Anxiety Inventory for Children (STAI-C; Spielberger et al. 1973). Children's anxiety was measured using Spielberger et al.'s (1973) self-report measure of state anxiety (how the child feels "right now") and trait anxiety (how the child "usually feels"). The STAI-C consists of two 20-item scales (one measuring state anxiety and one measuring trait anxiety) and children respond on a 3-point Likert-type scale. Higher scores indicate greater anxiety. Internal consistency for the current sample was good, with Cronbach's $\alpha = 0.84$ for the state scale and $\alpha = 0.80$ for the trait scale. These values are consistent with previously reported reliability (Spielberger et al. 1973).

2.1.2.4 | Inventory of Parent and Peer Attachment-Revised (IPPA-R; Gullone and Robinson 2005). Children completed this self-report measure of their perceptions of the affective and cognitive dimensions of relationships with their mother and father. The questionnaire is a revised version of Armsden and Greenberg's (1987) Inventory of Parent and Peer Attachment (IPPA) that is suitable for young children. The content of the questions remains the same as the original, but Gullone and Robinson (2005) simplified the wording to allow comprehension by children. The questionnaire is divided into three parts; the first assessing the child's feelings toward their mother, the second assessing feelings toward their father and the final part assessing their feelings about relationships with close others. Children were only required to complete the first two components; questions about the mother and the father. Each part comprises 28 items with children responding on a three-point Likert response scale ranging from 0 to 2 (0 = *always true*, 1 = *sometimes true*, 2 = *never true*). Three dimensions are assessed: degree of mutual trust; quality of communication; and extent of alienation. Higher scores indicate poorer trust and communication, and greater perceptions of alienation. Internal consistency for the current study was acceptable to good. For maternal attachment, Cronbach's α was 0.81 for trust, 0.78 for communication and 0.76 for alienation. For paternal attachment, Cronbach's α was 79 for trust, 81 for communication and 0.75 for alienation.

2.1.2.5 | Fear Beliefs Questionnaires (FBQ; Field and Lawson 2003). Children's fear beliefs toward the quokka, cuscus and quoll were measured using the FBQ. The three-animal version consists of eight items for each animal (24 in total) and children are required to respond on a 5-point Likert scale ranging from 0 to 4 (0 = *no, not at all*, 1 = *no, not really*, 2 = *don't know/neither*, 3 = *yes, slightly*, 4 = *yes, definitely*). Therefore, higher scores indicate greater fear. An example question is "Would you be scared if you saw a QUOKKA/CUSCUS/QUOLL?". Four of the eight items are reverse scored, for example "Would you be happy if you found a QUOKKA/CUSCUS/QUOLL in your garden?". For each item, a picture of the animal is displayed in the centre of the screen with the question above and the choice of responses below. Internal consistency (Cronbach's alpha) for the questionnaire was satisfactory to good: at pre-learning, 0.69 (quokka), 0.71 (cuscus) and 0.67 (quoll); and post-learning, 0.81 (quokka), 0.84 (cuscus) and 0.83 (quoll).

2.1.2.6 | Nature Reserve Task (NRT; Field and Storksen-Coulson 2007). Children's approach-avoidance preferences for the quokka, cuscus and quoll were measured using the NRT. Children were presented with a rectangular board (450 mm × 680 mm) embellished with green felt and pipe-cleaner trees to depict a nature reserve. The researcher simultaneously placed a picture of a quokka, cuscus or quoll at one end of the board. Children were stood at the opposite end of the board and asked to imagine that a Lego figure represented themselves. They were then asked to place the figure on the nature reserve where they would feel comfortable in relation to the animal. The distance from the animal to the figure was taken as an indication of children's approach-avoidance preferences for the animals.

2.1.2.7 | Touch Box Task (e.g., Askew and Field 2007; Field and Lawson 2003; Kelly et al. 2010 Reynolds et al. 2014). Children behavioural avoidance was measured using a touch box task whereby children were timed approaching and placing their hand in three pet carrier boxes they believe contained the quokka, cuscus and quoll. The quokka box was on the left, the cuscus in the middle and the quoll on the right. The boxes all had a touch-hole covered in hessian so that children could not see into the box. In all conditions the box in fact contained some straw and a soft toy animal. Children stood on a line measure 1m from the boxes. They were then told which animal was in each box. A picture of each animal was also displayed on the outside of the box to ensure children understood. They were then asked if they would like to step forward and place their hand into the box up to their wrist. As soon as the instructions were given, the researcher started the timer. The timer was stopped as soon as the child's hand had entered the box. If the child had made no attempt to approach the box within 15 s, the task moved on and instructions were provided for the next box. As with all other procedures, children were reminded at the start of the task that they could refuse to do any task with which they felt uncomfortable.

2.1.2.8 | Debrief. At the end of the experiment, children were verbally debriefed about the nature of the study. Written information was given in the form of age-appropriate worksheets that children were required to complete, containing true and positive information about the animals used in the study to redress any false impressions that may have been conveyed.

2.1.3 | Procedure

The experiment was automated using E-Prime 2.0 and lasted approximately 30 min. Children were tested individually in a quiet room free from distractions.

2.1.3.1 | Questionnaire Measures. After providing verbal assent, children completed the STAIC, and IPPA.

2.1.3.2 | Pre-Learning Measures. Children then completed the FBQ on the laptop. This was immediately followed by the NRT.

2.1.3.3 | Vicarious Learning. During the vicarious learning procedure (see also Reynolds et al. 2014), children were first given the instructions "You will now watch a slideshow of pictures of the quokka, cuscus and quoll. Sometimes you will also see a picture of someone's reaction to the animal." They were then presented with 30 face-animal picture pairing trials; 10 fear-paired, 10 happy-paired and 10 neutral-paired (control). That is, each of the 10 fear-paired trials consisted of pictures of one animal (e.g., a quokka) presented together with either the male or female face displaying fear. Happy-paired trials consisted of 10 pictures of the second animal (e.g., a cuscus) presented together with a face displaying happiness. Neutral-paired trials consisted of 10 pictures of the third animal (e.g., a quoll) presented together with a face with a neutral expression. Trials were presented in a random order with the animal always appearing first for 1s followed by the picture of the face appearing for a further 1s. The inter-trial interval varied randomly between 2s and 4s. The procedure was counterbalanced to ensure that each child received different animals as different pairing types.

2.1.3.4 | Post-Learning Measure. Following vicarious learning, children completed the FBQ and NRT a second time to determine whether there had been changes in cognitions and avoidance preferences as a result of vicarious learning. Children then completed the touch box task to determine whether behavioural avoidance was greater for the fear-paired animal compared to the happy-paired and neutral-paired animals. This was followed by a full debrief (see above).

2.2 | Results

All significant effects are reported at $p < 0.05$, with effect sizes presented as partial eta squared (η^2_p). To avoid artificial categorisation, scores on the STAI-C and IPPA-R (for communication, trust, and alienation) were treated as continuous variables. Table 1 displays the descriptive statistics for the state and trait versions of the STAI-C, and the three dimensions of the IPPA-R (and total score) with regards to attachment to both the mother and the father. Correlation coefficients between the measures are also reported.

2.2.1 | Fear Cognitions (FBQ)

Figure 1 illustrates mean fear belief scores prelearning and postlearning for the fear-paired, happy-paired, and neutral-paired animals. The data indicate an increase in fear beliefs for the fear-paired animal and a decrease for the happy-paired animal, with a slight decline for the neutral-paired animal.

A 2 (time: prelearning vs. postlearning) × 3 (pairing type: fear-paired vs. happy-paired vs. neutral-paired) repeated measures ANOVA on fear belief scores revealed no significant main effect of time, $F(1, 37) = 0.04$, $p = 0.85$, $\eta^2_p = 0.001$. However, a significant main effect of pairing type was observed, $F(2, 74) = 5.33$, $p = 0.007$, $\eta^2_p = 0.13$, along with a significant time × pairing type interaction, $F(2, 74) = 5.64$, $p = 0.01$, $\eta^2_p = 0.13$. Planned comparisons demonstrated that fear beliefs significantly increased postlearning for the fear-paired animal compared to the neutral-paired animal, $F(1, 37) = 4.03$, $p = 0.05$, $\eta^2_p = 0.10$. However, no significant change was found for happy-paired animals relative to neutral-paired animals, $F(1, 37) = 1.16$, $p = 0.29$, $\eta^2_p = 0.03$.

Correlational analyses between IPPA dimensions (trust, communication, alienation) for both maternal and paternal attachment and children's postlearning fear beliefs revealed no significant associations. Similarly, no significant correlations were found between STAI-C scores and postlearning fear beliefs.

A hierarchical multilevel model explored whether perceived trust, communication, or alienation moderated vicariously acquired fear beliefs, with time (prelearning and postlearning) and pairing type (fear-paired, happy-paired, neutral-paired) nested within the child. Separate models were created for maternal and paternal attachment. For maternal attachment, all interactions between time and IPPA dimensions for the fear-paired animal versus the neutral-paired animal were nonsignificant: time × communication, $b = 0.04$, $SE = 0.15$, $t(170) = 0.24$, $p = 0.81$; time × alienation, $b = -0.01$, $SE = 0.11$, $t(170) = -0.14$, $p = 0.89$; and time × trust, $b = -0.003$, $SE = 0.22$, $t(170) = -0.02$, $p = 0.99$. The same pattern emerged for the happy-paired versus neutral-paired animal comparisons.

TABLE 1 | Descriptive statistics and correlation coefficients between the anxiety (STAI-C) and attachment to the mother and father (IPPA-R) measures (experiment 1).

	1	2	3	4	5	6	7	8	9	10
STAI-C (State)	1.00	0.75**	0.43**	0.21	0.57**	0.61**	0.36*	0.04	0.41*	0.38*
STAI-C (Trait)		1.00	0.49**	0.38*	0.52**	0.49**	0.28	0.11	0.42**	0.31
IPPA-R Communication (Mother)			1.00	0.79**	0.79**	0.76**	0.38*	0.34*	0.49**	0.27
IPPA-R Alienation (Mother)				1.00	0.65**	0.34*	0.24	0.58**	0.46**	0.05
IPPA-R Trust (Mother)					1.00	0.89**	0.46**	0.36**	0.67**	0.40*
IPPA-R Total (Mother)						1.00	0.46**	0.10	0.56**	0.48**
IPPA-R Communication (Father)							1.00	−0.05	0.35	0.70**
IPPA-R Alienation (Father)								1.00	0.11	−0.52
IPPA-R Trust (Father)									1.00	0.66**
IPPA-R Total (Father)										1.00
Mean (SD)	27.39 (5.38)	28.71 (7.27)	13.92 (3.39)	11.53 (3.54)	14.79 (3.88)	17.18 (4.81)	14.39 (3.24)	12.16 (3.78)	15.29 (3.76)	17.53 (6.74)

Correlation is significant at., *$p < 0.05$. **$p < 0.01$.

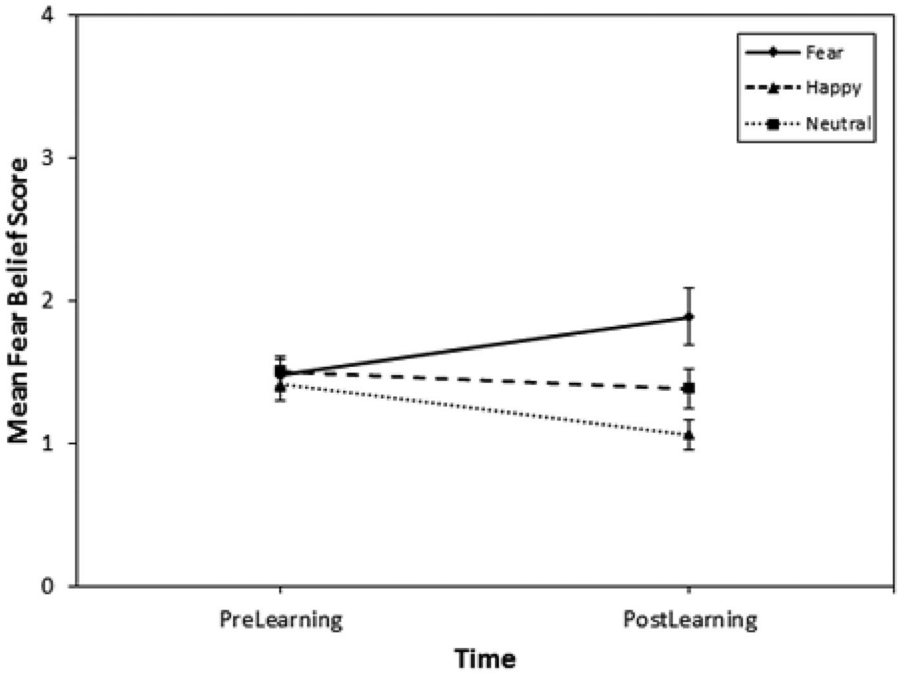

FIGURE 1 | Mean fear belief scores prelearning and postlearning for the fear-paired, happy-paired and neutral-paired animals with strangers as models (error bars = SEM).

For paternal attachment, all interactions were also nonsignificant for the fear-paired versus neutral-paired animal: time × communication, $b = 0.08$, $SE = 0.09$, $t(170) = -0.92$, $p = 0.36$; time × alienation, $b = 0.05$, $SE = 0.07$, $t(170) = 0.75$, $p = 0.45$; and time × trust, $b = -0.07$, $SE = 0.08$, $t(170) = -0.87$, $p = 0.39$. Again, no significant interactions were found for the happy-paired versus neutral-paired animal.

2.2.2 | Avoidance Preferences (NRT)

Figure 2 presents the mean distance children placed between themselves and the fear-paired, happy-paired, and neutral-paired animals on the nature reserve task. Avoidance preferences increased from prelearning to postlearning for the fear-paired animal but decreased for the happy-paired and neutral-paired animals.

A 2 (time: prelearning vs. postlearning) × 3 (pairing type: fear-paired vs. happy-paired vs. neutral-paired) repeated measures ANOVA on avoidance scores revealed no significant main effect of time, $F(1, 37) = 2.84$, $p = 0.10$, $\eta^2_p = 0.07$. However, a significant main effect of pairing type was observed, $F(2, 74) = 3.54$, $p = 0.03$, $\eta^2_p = 0.09$, along with a significant time × pairing type interaction, $F(2, 74) = 5.31$, $p = 0.007$, $\eta^2_p = 0.13$. Planned comparisons indicated that the increase in avoidance preferences for the fear-paired animal compared to the neutral-paired animal approached significance, $F(1, 37) = 3.73$, $p = 0.06$, $\eta^2_p = 0.09$. No significant changes were found for the happy-paired animal compared to the neutral-paired animal, $F(1, 37) = 1.14$, $p = 0.29$, $\eta^2_p = 0.03$.

All correlations between IPPA dimensions, state/trait anxiety and postlearning avoidance preferences were nonsignificant. Hierarchical multilevel modelling revealed no significant interactions between IPPA dimensions and avoidance preferences for maternal or paternal attachment.

2.2.3 | Avoidance Behaviour (Touch Box Task)

Of the participants, 13 approached the box believed to contain the fear-paired animal, while 17 approached the boxes containing the happy-paired and neutral-paired animals. Children who did not approach within 15s were assigned the maximum approach time.

Table 2 presents the mean approach times for each condition, indicating that children took the longest to approach the fear-paired box and the shortest to approach the happy-paired box.

Paired samples *t*-tests found no significant differences between approach times for the fear-paired versus neutral-paired animals, $t(37) = 1.22$, $p = 0.23$, or the happy-paired versus neutral-paired animals, $t(37) = -1.40$, $p = 0.17$. However, children took significantly longer to approach the fear-paired than the happy-paired animal, $t(37) = 2.23$, $p = 0.03$.

Correlational analyses revealed a significant relationship between perceived trust in the mother and approach times for the happy-paired animal, $r = 0.42$, $p = 0.01$, as well as between total maternal attachment scores and happy-paired approach times, $r = 0.38$, $p = 0.02$. Lower perceived maternal trust and overall attachment quality were associated with increased hesitation in approaching the happy-paired box. No other significant correlations were found, including those related to paternal attachment or state/trait anxiety.

Hierarchical multilevel modelling indicated that, for maternal attachment, perceived trust significantly moderated approach

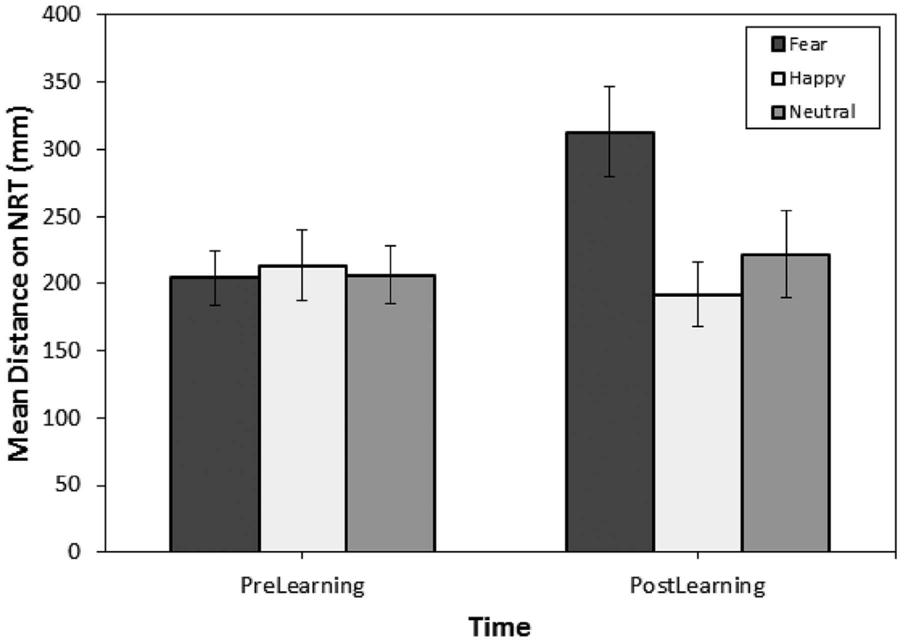

FIGURE 2 | Mean distance children placed themselves on the nature reserve task from the fear-paired, happy-paired and neutral-paired animals at prelearning and postlearning with strangers as models (error bars = SEM).

TABLE 2 | Mean approach times on the touch box task for the fear-paired, happy-paired and neutral-paired animals in experiments 1 and 2.

	Experiment	
	Exp 1. Strangers	**Exp 2. Mothers**
Fear-Paired	12.63 (4.02)	12.84 (4.14)
Happy-Paired	9.92 (5.91)	7.18 (6.14)
Neutral-Paired	11.18 (5.08)	6.66 (5.85)

times for the happy-paired animal, $b = 0.99$, $SE = 0.32$, $t(76) = 3.11$, $p = 0.002$. No significant interactions were found for communication or alienation, nor for the fear-paired animal. Similarly, no significant moderating effects emerged for paternal attachment.

2.3 | Brief Discussion

As expected, children developed stronger fear beliefs and avoidance preferences for the fear-paired animal following learning, while beliefs about the happy-paired animal decreased. However, attachment dimensions (trust, communication and alienation) and anxiety levels were not significantly associated with children's overall fear beliefs or avoidance preferences. In contrast, attachment played a role in approach behaviour. Children with lower perceived maternal trust and weaker overall maternal attachment were slower to approach the happy-paired animal, suggesting that a secure attachment may facilitate positive social learning experiences. No such effects were found for paternal attachment. These findings align with theories suggesting that secure attachment may buffer against fear responses while also supporting the internalisation of positive information. Overall, while attachment did not moderate fear acquisition, it influenced children's willingness to engage with a positively paired stimulus. This highlights the nuanced role of attachment in shaping children's learning and behavioural responses, not least in the way that the child uses the mother as a 'secure base' and waits until they feel confident enough to go out and explore the world (Ainsworth and Bell 1970).

3 | Experiment 2

Surprisingly, Experiment 1 demonstrated that attachment with the mother or father had no moderating influence on the cognitive or behavioural effects of vicarious learning. One possible explanation for this is the developmental nature of attachment representations; it may be that for the children in our sample, they were still at the more physical rather than representational level of attachment, which could explain the lack of effect in the previous study. The children may have not yet fully internalised attachment representations that would influence how they process fear-related learning in a vicarious context. It is also worth considering that the lack of effect may be related to the use of models in the vicarious learning paradigm who were strangers, rather than attachment figures. Previous research (e.g., Dunne and Askew 2013) has shown that children can learn fear responses vicariously when the model is either a stranger or a parent, with no significant difference in the magnitude of those fear responses. However, it is conceivable that attachment may only moderate fear learning when the parent acts as the model in the vicarious learning paradigm.

To further investigate this, Experiment 2 presents children with pictures of their mother during vicarious learning, rather than a stranger, to explore whether attachment figures specifically influence fear learning when they are present as models. Although the vicarious learning model was the mother, paternal attachment was also assessed to examine whether broader parent–child attachment patterns relate to children's fear responses, and to explore potential differential effects of maternal versus paternal attachment on vicarious learning outcomes.

3.1 | Method

3.1.1 | Participants

Children aged 7–10 years took part in study ($M = 95.11$ months, $SD = 7.30$). Thirty-eight children (16 boys, 22 girls) were recruited from three primary schools in North London. All parents provided written consent for children to participate and all children gave verbal assent. The study was approved by the *** Psychology Department Ethics Committee.

3.1.2 | Materials and Procedure

All mothers were female and served as the attachment figure and model in the vicarious learning task. Information regarding whether the parents were biological was not collected. The materials and procedure were identical to experiment 1 with the exception that the strangers faces were replaced with pictures of the mother's face. When providing consent, mothers were asked to email three photos of themselves to the researcher. One photo displayed a happy face, one photo displayed a fearful face and one photo displayed a neutral face. Mothers were provided with clear guidelines (based on Ekman and Friesen 1975; Izard 1971) to instruct them on exactly how their expression should look. For example, for the happy expression, mothers were instructed that the corners of the mouth should be raised along with the cheeks, the eyes should be open with the forehead kept smooth and the smile should be wide enough to appear more than content. For the fearful expression, the mouth should be slightly open with the corners pulled straight back and lips stretched horizontally but without baring teeth, the eyes should be wide open with the eyebrows raised and the forehead should be wrinkled. For the neutral expression, there should be no forced expression. Internal consistency was good for the STAI-C state ($\alpha = 0.84$) and trait ($\alpha = 0.80$) scales. Maternal IPPA-R dimensions showed $\alpha = 0.82$ (trust), 0.79 (communication) and 0.76 (alienation), and paternal IPPA-R dimensions $\alpha = 0.78$ (trust), 0.75 (communication) and 0.73 (alienation). At pre-learning, the FBQ showed $\alpha = 0.71$ (quokka), 0.71 (cuscus) and 0.73 (quoll); and post-learning, 0.83 (quokka), 0.82 (cuscus) and 0.82 (quoll).

3.2 | Results

Table 3 displays the descriptive statistics and correlation coefficients between the state and trait versions of the STAI-C, and the three dimensions (and total) of the IPPA-R with regards to attachment to both the mother and the father.

3.2.1 | Fear Cognitions (FBQ)

As shown in Figure 3, similar to Experiment 1, when children viewed the mother as the model during vicarious learning, fear beliefs for the animal paired with the mother's fearful face (fear-paired) increased from prelearning to postlearning. In contrast, fear beliefs for the happy-paired animal decreased, and fear beliefs for the neutral-paired animal decreased to a greater extent than in Experiment 1.

A 2 × 3 repeated measures ANOVA revealed a significant main effect of time, $F(1, 37) = 5.38$, $p = 0.03$, $\eta^2p = 0.13$, a significant main effect of pairing type, $F(2, 74) = 13.10$, $p < 0.001$, $\eta^2p = 0.26$, and a significant time × pairing type interaction, $F(2, 74) = 14.38$, $p < 0.001$, $\eta^2p = 0.28$. Planned comparisons indicated that fear beliefs for the fear-paired animal significantly increased postlearning compared to the neutral-paired animal, $F(1, 37) = 17.56$, $p < 0.001$, $\eta^2p = 0.32$, whereas no significant change was found for the happy-paired animal compared to the neutral-paired animal, $F(1, 37) = 17.56$, $p = 0.80$, $\eta^2p = 0.002$.

All correlations between the three dimensions of the IPPA (trust, communication and alienation) for both the mother and father, and children's fear beliefs for the fear-paired, happy-paired, and neutral-paired animals postlearning were nonsignificant. Similarly, all correlations between state and trait anxiety and fear beliefs postlearning were nonsignificant.

A hierarchical multilevel model with time and pairing type as nested within the child revealed that for the fear-paired animal compared to the neutral-paired animal, there were no significant interactions between attachment to the mother (communication, alienation or trust) and fear beliefs. The same was found for attachment to the father (communication, alienation or trust), with no significant interactions for any pairing type.

3.2.2 | Avoidance Preferences (NRT)

Figure 4 illustrates the mean distance the children placed themselves from the fear-paired, happy-paired, and neutral-paired animals on the nature reserve task. The data show an increase in avoidance preferences for the fear-paired animal from prelearning to postlearning, but a decrease in avoidance preferences for the happy-paired animal. Notably, when the model was the mother, avoidance preferences for the neutral-paired animal decreased more than for the happy-paired animal, which differs from Experiment 1 when the model was a stranger.

A 2 × 3 ANOVA showed no significant main effect of time, $F(1, 37) = 0.05$, $p = 0.82$, $\eta^2p = 0.001$, or pairing type, $F(1, 37) = 2.51$, $p = 0.08$, $\eta^2p = 0.06$, but a significant time × pairing type interaction, $F(2, 74) = 5.12$, $p = 0.008$, $\eta^2p = 0.12$. Planned comparisons revealed that the increase in avoidance preferences for the fear-paired animal from prelearning to postlearning was significant compared to the neutral-paired animal, $F(1, 37) = 5.76$, $p = 0.02$, $\eta^2p = 0.14$, but no significant change was observed for the happy-paired animal compared to the neutral-paired animal, $F(1, 37) = 0.26$, $p = 0.61$, $\eta^2p = 0.01$.

Correlational analyses indicated a significant relationship between avoidance preferences for the fear-paired animal at postlearning and attachment quality with the mother, $r = 0.37$, $p = 0.02$, and specifically trust in the mother, $r = 0.35$, $p = 0.03$.

TABLE 3 | Descriptive statistics and correlation coefficients between the anxiety (STAI-C) and attachment to the mother and father (IPPA-R) measures (experiment 2).

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
STAI-C (State)	1.00	0.63**	0.39*	0.22	0.51**	0.54**	0.31	0.04	0.43**	0.40*
STAI-C (Trait)		1.00	0.38*	0.15	0.39*	0.48**	0.37*	−0.08	0.41*	0.47**
IPPA-R Communication (Mother)			1.00	0.74**	0.81**	0.91**	0.70**	0.34*	0.43**	0.51**
IPPA-R Alienation (Mother)				1.00	0.80**	0.57**	0.47**	0.38*	0.54**	0.41*
IPPA-R Trust (Mother)					1.00	0.89**	0.62**	0.26	0.68**	0.62**
IPPA-R Total (Mother)						1.00	0.70**	0.23	0.53**	0.61**
IPPA-R Communication (Father)							1.00	−0.13	0.35*	0.85**
IPPA-R Alienation (Father)								1.00	0.23	−0.37*
IPPA-R Trust (Father)									1.00	0.64**
IPPA-R Total (Father)										1.00
Mean (SD)	26.97 (5.59)	26.00 (5.27)	14.37 (3.40)	11.05 (2.77)	14.08 (3.89)	17.39 (4.95)	15.00 (3.90)	11.63 (2.58)	13.63 (3.29)	17.00 (6.36)

Correlation is significant at., * $p < 0.05$. ** $p < 0.01$.

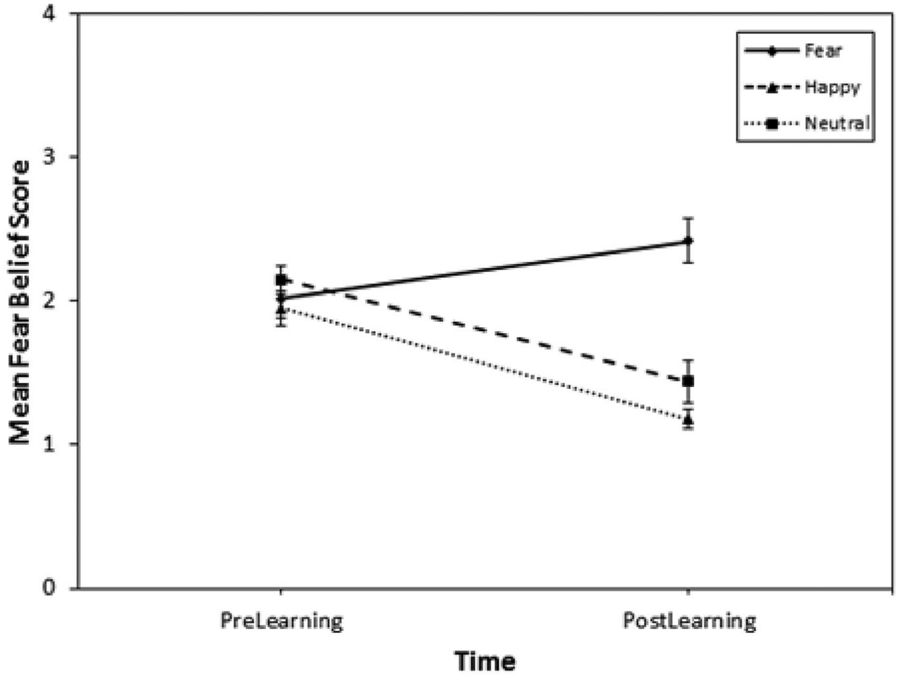

FIGURE 3 | Mean fear belief scores prelearning and postlearning for the fear-paired, happy-paired and neutral-paired animals with mothers as models (error bars = SEM).

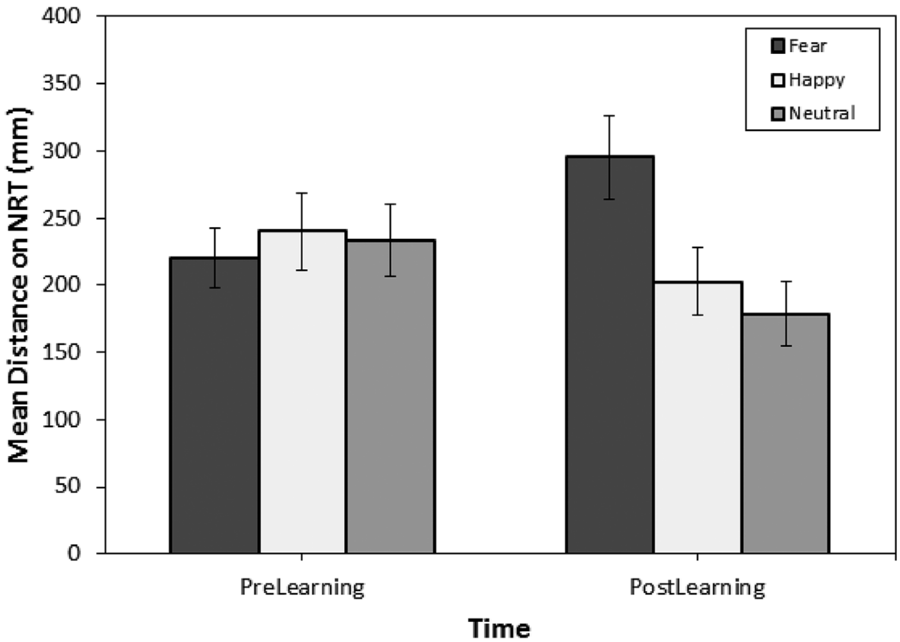

FIGURE 4 | Mean distance children placed themselves on the nature reserve task from the fear-paired, happy-paired and neutral-paired animals at prelearning and postlearning with mothers as models (error bars = SEM).

Additionally, avoidance preferences for the neutral-paired animal were negatively correlated with attachment quality with the mother, including communication, alienation, and trust, with correlations ranging from $r = -0.32$ to $r = -0.43$ ($p \leq 0.05$).

For the father, attachment quality was positively correlated with postlearning avoidance preferences for the fear-paired animal ($r = 0.39$, $p = 0.02$), with a significant relationship between communication and avoidance preferences ($r = 0.41$, $p = 0.01$). No other correlations were significant, and no correlations between state and trait anxiety and avoidance preferences were found.

Hierarchical multilevel modelling indicated a significant time × trust interaction for attachment to the mother for the fear-paired animal compared to the neutral-paired animal, $b = 64.15$, $SE = 24.45$, $t(170) = 2.62$, $p = 0.01$. However, no significant interactions were found for communication or alienation. For attachment to the father, significant time × trust and time × communication interactions were observed for the fear-paired animal compared to the neutral-paired animal, $b = 32.80$, $SE = 16.07$, $t(170) = 2.04$, $p = 0.04$, and $b = 38.53$, $SE = 13.30$, $t(170) = 2.90$, $p = 0.004$, respectively.

3.2.3 | Avoidance Behaviour (Touch Box Task)

Ten children approached the box thought to contain the fear-paired animal, 24 approached the box thought to contain the happy-paired animal, and 26 approached the box thought to contain the neutral-paired animal. Table 2 shows that children took longer to approach the box containing the fear-paired animal, but were quicker to approach the box thought to contain the neutral-paired animal compared to the happy-paired animal. Paired samples t-tests revealed that children took significantly longer to approach the box thought to contain the fear-paired animal compared to the happy-paired animal, $t(37) = 2.66$, $p = 0.01$, but the time to approach the fear-paired animal compared to the neutral-paired animal approached significance, $t(37) = 1.89$, $p = 0.07$, suggesting a trend although this should be interpreted cautiously. No significant difference was found between the happy-paired and neutral-paired animals, $t(37) = -0.89$, $p = 0.39$.

Correlational analyses indicated that approach times for the fear-paired animal were positively correlated with communication ($r = 0.34$, $p = 0.01$) and overall attachment quality ($r = 0.44$, $p = 0.01$) for attachment to the mother. No significant correlations were found for attachment to the father, and all correlations between state and trait anxiety and approach times were nonsignificant.

Hierarchical multilevel modelling for approach times showed no significant influence of communication or trust on approach times for the fear-paired animal, but a significant interaction with alienation was found, $b = -1.23$, $SE = 0.49$, $t(76) = -2.54$, $p = 0.01$. For the father, communication and alienation did not significantly influence approach times for the fear-paired animal, with $b = 0.35$, $SE = 0.20$, $t(76) = 1.76$, $p = 0.08$, and $b = 0.50$, $SE = 0.28$, $t(76) = 1.80$, $p = 0.08$, respectively. No significant results were observed for the happy-paired animal.

3.3 | Discussion

The present study aimed to explore the role of attachment in vicarious learning by investigating whether attachment to the mother and father influenced children's fear beliefs and avoidance behaviours in a vicarious learning paradigm. In Experiment 1, where a stranger served as the model, children demonstrated increased fear beliefs for the animal paired with the fearful model and decreased fear beliefs for the happy-paired animal. However, attachment did not moderate these effects. Some correlations approached significance, but these trends were not statistically reliable, and we caution against overinterpreting them. This aligns with some previous research, which has shown that children can learn fear responses from both familiar and unfamiliar models with similar intensity (e.g., Dunne and Askew 2013), indicating that the attachment figure's physical presence may not always be necessary for such learning to occur, which has also been shown to be the case in adults (see Toumbelekis et al. 2021). In terms of avoidance preferences, children showed increased avoidance for the fear-paired animal post-learning, yet no significant difference was found between avoidance of the happy-paired and neutral-paired animals, implying a generalised fear response rather than one mediated by attachment.

In Experiment 2, where the model was the mother, children again showed increased fear beliefs for the animal paired with the mother's fearful face, and a decrease in fear beliefs for the neutral-paired animal. However, similar to Experiment 1, attachment did not significantly moderate fear beliefs. This highlights the possibility that attachment may not always directly influence cognitive responses to fear in vicarious learning, or that such effects might be more dependent on other factors such as the security of the child's relationship with the model, or the developmental stage of the child and their capacity to have enduring mental representation of their caregiver.

A key finding from Experiment 2 was the influence of attachment on avoidance behaviours. Children with lower overall maternal attachment and lower trust tended to keep greater distance from the fear-paired animal, while stronger attachment was associated with less avoidance of neutral animals. For paternal attachment, higher overall attachment and better communication were linked to increased avoidance of the fear-paired animal. Hierarchical analyses confirmed that trust (for both mothers and fathers) and communication (for fathers) moderated changes in avoidance behaviour from pre- to post-learning, highlighting that specific aspects of parent–child attachment influence how children respond behaviourally to fear-related stimuli. This finding aligns with the fundamental premise of attachment theory: that attachment bonds can shape children's emotional and behavioural responses to threat (Bowlby 1980). It also aligns with theoretical ideas about the more physically proximal nature of attachment at this age (Main et al. 1985). That is, being in close proximity to others who care for one's safety, particularly at an early age, generally can lead to a higher likelihood of survival. The fact that attachment quality was related to avoidance in Experiment 2, but not Experiment 1, suggests that the presence of an attachment figure may be more critical for behavioural responses than for cognitive ones, possibly due to the emotional security provided by the attachment figure, and this ties in with longstanding empirical evidence showing that attachment system activation reduces stress responses, particularly when accompanied by the physical presence of a loved one (Coan et al. 2006; Ditzen et al. 2008).

The approach behaviour, as assessed using the touch box task, showed that children took longer to approach the fear-paired animal. This behaviour was influenced by attachment to the mother, with stronger overall attachment and better communication with their mother being associated with slower approach the fear-paired animal, indicating greater caution. Hierarchical analyses further showed that maternal alienation also influenced approach times, whereas paternal attachment did not significantly affect approach behaviour. This supports the idea that attachment quality can influence how children approach potentially threatening situations, even in a controlled context. In contrast, no significant effects were found for attachment to the father, suggesting that the maternal attachment figure may play a more prominent role in regulating approach behaviours related to fear, at least in this context. This discrepancy may reflect the typically primary caregiving role of mothers during middle childhood or the fact that mothers were the models in the vicarious learning task, making maternal attachment particularly salient for regulating approach behaviour. Cultural expectations and socialisation patterns may also contribute, alongside potential measurement limitations of the IPPA-R in capturing paternal attachment. Taken together, these results align with work showing that promoting positive mother–child relationships in early development may reduce the incidence of psychological disorders, particularly those involving fear-related memories (Bosquet Enlow et al. 2014).

The finding that attachment influenced behavioural responses, particularly avoidance, in vicarious learning contexts. This is in line with research that suggests attachment figures play a key role in regulating emotional responses to threatening stimuli, especially in contexts where emotional security is important (Bryant and Chan 2015; Bryant and Datta 2019; Bryant and Forde 2016). However, the lack of direct modulation of cognitive processes by attachment in this study contrasts with some previous work that has found stronger links between attachment and fear cognition. These discrepancies may be due to methodological differences or the specific developmental characteristics of the sample; for example, Toumbelekis et al. (2021) used a fear learning protocol that involved startle stimuli delivered via electric shocks.

Beyond these methodological considerations, the findings have theoretical implications for understanding the interplay between attachment and fear learning. The study supports the view that attachment serves a regulatory function, guiding approach–avoidance behaviour in emotionally salient contexts. The stronger effects of maternal compared to paternal attachment further indicate that primary caregiver relationships may be more influential in modulating fear-related behaviour during middle childhood. Furthermore, and traditionally, the paternal caregiving relationship has been more associated with rough-and-tumble play (Paquette and Dumont, 2012), which might also partly explain our findings. From a fear learning perspective, these results highlight that vicarious fear learning is not only driven by observed model behaviour but also by the child's attachment system, which interacts with the emotional significance of the model to shape behavioural responses. Such findings underscore the value of integrating attachment and social learning theories to understand the diverse ways in which children acquire and express fear.

One possible explanation for the lack of moderation of fear beliefs by attachment is the developmental stage of our participants. Middle childhood involves a transition from behavioural to cognitive representations of attachment (Coulson et al. 2017). At this stage, children may rely more on physical presence or overt reactions of caregivers when learning about fear. As cognitive representations mature, children might increasingly use mental models of attachment figures to guide learning even when the caregiver is not present. These developmental dynamics may help explain why attachment quality influenced avoidance behaviours more strongly than cognitive fear beliefs in our sample. Understanding how the shift from behavioural to cognitive representations of attachment influences vicarious fear learning is important because it clarifies when and how attachment shapes fear acquisition in middle childhood. This adds to the existing literature by highlighting a potential developmental boundary for attachment effects, showing that attachment may be more relevant for behavioural than cognitive fear responses at this stage, and providing guidance for future studies on the timing and context in which caregiver influence is most impactful.

Several limitations should be noted in the interpretation of these findings. First, while attachment to the mother was shown to influence certain behaviours, the role of attachment to the father was less clear. Future research should systematically compare the influence of maternal versus paternal attachment, including cases where fathers or other caregivers serve as primary attachment figures, going beyond the notion of fathers traditionally conceptualised playmate role. Additionally, the study did not directly measure how attachment influences the emotional or physiological responses of children during the learning task. Incorporating physiological measures, such as heart rate or skin conductance, to capture real-time fear responses could provide deeper insights into the underlying mechanisms of fear learning (see the work of Bryant and Chan 2015). Additionally, information on whether the parents were biological was not collected, which may limit the generalisability of the findings. It is important to note that attachment dynamics can vary depending on factors such as biological relatedness, co-residency, or caregiving role (see Bifulco et al. 2017, 2008 for investigations of the efficacy of attachment-based approaches in the field of adoption and fostering). Future research could therefore examine whether similar patterns of vicarious fear learning and behavioural responses are observed across diverse family structures or non-biological caregivers. Finally, future research should use longitudinal designs to examine how attachment and vicarious learning interact over developmental transitions such as early adolescence.

The effect sizes reported in the study, particularly η^2p values, offer important information about the power of the statistical tests used. For example, the main effects of time and pairing type in some analyses had moderate effect sizes (η^2p = 0.13–0.28), indicating that there were meaningful differences in the dependent variables between the time points and pairing types. These moderate to large effect sizes suggest that the study had sufficient power to detect differences in fear beliefs and avoidance preferences. However, some of the nonsignificant interactions and correlations, particularly those involving attachment dimensions, may reflect the complexity of the relationships under investigation or the smaller sample size. Although the results do not provide strong evidence of attachment moderating cognitive processes in this context, the moderate effect sizes suggest that future studies with larger samples might be able to detect more subtle effects, particularly if additional measures (e.g., physiological responses) are incorporated. Similarly, while both state and trait anxiety were examined in correlational analyses and were significantly related to several attachment indices, they were not included in the hierarchical multilevel models. This was a deliberate choice, as the primary aim of the models was to examine the moderating role of attachment on children's vicarious fear learning, rather than to control for or test the effects of anxiety. Including multiple predictors, attachment dimensions plus both anxiety measures, would have substantially increased the number of parameters relative to the sample size, risking unstable estimates and reduced interpretability of the models. By focusing on attachment dimensions alone, the models remained sufficiently powered to examine the primary hypotheses regarding the role of caregiver attachment in vicarious fear learning. Nevertheless, the observed correlations suggest that anxiety may play a complementary role in children's responses to vicarious learning, and future studies could explicitly investigate the combined or interactive effects of attachment and anxiety on both cognitive and behavioural fear outcomes.

In conclusion, the present study provides important insights into the role of attachment in vicarious learning, specifically regarding the influence of attachment to the mother and father on fear-related cognitive and behavioural responses. Although attachment did not significantly moderate cognitive processes such as fear beliefs, attachment quality was linked to avoidance behaviours in both experiments. These findings suggest that attachment may play a more prominent role in shaping behavioural responses to fear, particularly when an attachment figure is the model. The lack of significant correlations with father attachment and the absence of consistent results across attachment dimensions highlight the complex and specific role of caregiver attachment in vicarious learning. The findings have important practical implications for intervention and prevention efforts targeting child anxiety. By fostering secure attachment relationships, particularly with primary caregivers, it may be possible to buffer children against fear-related avoidance and promote adaptive behavioural responses in anxiety-provoking situations. Interventions could, for example, involve guided exposure tasks in which caregivers act as supportive models, using the attachment bond to help children regulate fear and reduce avoidance. In the wider context of children's and social care, where attachment continues to be promoted (See NICE 2015 guideline on Children's attachment), our findings provide the necessary data to shed light on *how* and *why* attachment-based approaches are effective. Overall, this study emphasises the importance of considering attachment processes not only in understanding fear learning but also as a practical target for promoting resilience and emotional regulation in childhood.

Conflicts of Interest

No conflict of interest to declare.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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