

**Kingston University**

Güler Dunne

October 2013

**The Effect of Stimulus and Model Characteristics on Childhood  
Vicarious Fear Learning and Unlearning**

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## Summary

Rachman (1977) suggested that fears may be acquired via three distinct pathways: direct traumatic experience, verbal information received from others, and vicarious learning. In vicarious fear learning an individual learns from another individual by observing their response to a stimulus or situation. Mineka and Cook (1993) showed that in monkeys this observed fear response behaves as an unconditioned stimulus (US). Thus vicarious learning is likely to be similar, in a procedural sense, to classical conditioning and the success of learning is determined by the relative strength of these conditioned stimulus-unconditioned stimulus (CS-US) associations.

Recent studies suggest that vicarious learning plays a role in the development of childhood fears (Askew & Field, 2007; Gerull & Rapee, 2002). However, little is known about the mechanisms underlying this type of learning and the factors that affect it. Associative learning research shows that the salience of the US (a measure of its effectiveness) is critical for learning, if the US is more salient, learning should be more effective. Therefore, the first group of experiments in this thesis manipulated factors expected to affect US salience and hence vicarious fear learning. *Experiment 1* considered the importance of the relatedness of observers and models for US salience, specifically whether greater increases in children's fear-related responses are observed when fear responses are modelled by children's mothers compared to when they are modelled by strangers. It also looked at whether fear beliefs acquired vicariously can be unlearned via vicarious

counterconditioning and whether the type of model influenced this. Results showed that children's fear responses for animals increased following fear-related vicarious learning and decreased following positive learning. Similarly, counterconditioning led to unlearning of these responses. Model type did not affect vicarious learning or subsequent vicarious counterconditioning.

*Experiment 2* looked at another factor expected to affect US salience: the age of the model relative to the observer. This experiment examined the relative effects of same-age peer modelling and adult modelling in changing children's fear-related responses. Results were nearly identical to the first experiment: learning and unlearning were similar irrespective of whether the model was a peer or an adult. *Experiment 3* examined what effect the richness of the information source has on US salience using moving models (on film) compared to still (photographic) images. No significant effect of the threat-relevant vicarious film on children's fear beliefs and attentional bias was found.

The second group of experiments concentrate on characteristics of the CS. Research with adults suggests that when fear-relevant stimuli are used, fear learning will generally be greater (produce a larger conditioned response), occur more rapidly (in fewer trials) and will be more robust (demonstrate superior resistance to extinction) than for fear-irrelevant stimuli (see e.g. Öhman & Mineka, 2001). However, Askew, Dunne, Özdil, Reynolds, and Field (2013) showed that vicariously acquired conditioned responses for fear-relevant stimuli were not significantly greater than those for fear-irrelevant stimuli in children (6 to 11 years). A further two experiments here examined the speed and robustness of vicariously learned responses for fear-relevant stimuli. *Experiment 4* manipulated the number of CS-US pairings children saw and compared vicarious learning for two stimuli of differing fear-relevance. Results found increased fear-related responses for both types of stimuli: the effect was not affected by the fear-relevance of the stimuli, nor the number of CS-US pairings that children

were exposed to. Fear beliefs were still found to be raised at follow-up one week later, and no evidence was found for more robust learning for more fear-relevant stimuli.

The final experiment, *Experiment 5*, looked at robustness in more detail. The resistance of learnt responses to extinction was compared in two stimuli of varying fear-relevance (animals and flowers). Significant increases in fear-related beliefs and avoidance for animals and flowers were found again, but there was no significant extinction effect observed for avoidance preferences for either CS type. Unexpectedly, significantly greater extinction was observed with fear beliefs for animals compared to flowers.

In summary, the first set of experiments showed that in VL with children, the salience of the US is either not easy to manipulate or, more likely, US salience has little effect on fear learning. The second set of experiments demonstrated that the fear-relevance of the stimulus is also not important for children in VL. These findings may have an evolutionary explanation: for children of this age, acquiring knowledge of a potential threat and acting upon it may be more important in terms of survival than the salience/relevance of the US or CS that facilitates such acquisition.

I hereby declare that this thesis has not and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature.....



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# Chapter 1

## The Aetiology of Fear

### 1.1 What is Fear?

*1.1.1 The fear emotion.* When faced with a dangerous or uncertain event that may constitute a threat to their survival, all human beings experience an emotion that signals this potential, i.e. “fear” (Marks, 1987; LeDoux, 1996). Any kind of emotion, like fear, generates a feeling that is accompanied by some kind of reaction, be it cognitive, behavioural, physiological or some more explicit motor responses, and these reactions lend themselves to objective measurement. While fear may not be pleasant to experience, it is an adaptive process that provides an individual with the necessary functions of warning and protection from danger (Nesse, 1990). When considering how phobias and other anxiety disorders develop it is important to understand the distinction between fear and anxiety. Anxiety has been described as an emotion that is only distinguishable from fear due to the lack of an obvious, or ill-defined, source of threat (Taylor & Arnou, 1988). More specifically, anxiety comprises feelings of physical discomfort together with emotional turbulence and cognitive thoughts, but the primary characteristic is a sense of uneasiness associated with an unidentified threat (Hong, 1998). Whilst fear may be described as a response to potentially dangerous stimuli, anxiety refers to an emotional state entered into in the absence of a real danger. Anxiety then is different from the fear emotion in that it refers to an emotional state similar to fear but disproportionate in terms of its duration, and magnitude relative to the actual danger present (Ollendick & March, 2004).

The actual emotion of fear appears to be controlled in a physical sense by a neural network based around the amygdala (LeDoux, 1996). This part of the brain handles the

relationship between the cortical and thalamic input and the hypothalamic and brainstem nuclei responsible for controlling the many varied facets of overt fear behaviour (Davis, 1992; LeDoux, 1996; Lang, Davis, & Öhman, 2001). Its location in the brain is suggestive of an ancient origin pre-dating the emergence of more developed cortices. Its location is also the site where, much later, the neural infrastructure necessary for language and advanced cognition would also develop. The lateral nucleus of the amygdala is responsible for receiving a stimulus signal (LeDoux et al., 1990). From here signals are passed to the midbrain and other areas of the brain responsible for the varied facets of the overall fear response (Davis, 1992). Behavioural fear responses depend on projections from the central amygdala to the midbrain central grey region (LeDoux, et al., 1988) while projections from the central amygdala to the lateral hypothalamic area, (connected to the brain stem and autonomic nervous system), are involved in the control of autonomic responses.

Fear is considered to consist of three elements: a subjective expression of terror or fright, changes at the physiological level, and behavioural avoidance (Lang, 1968). These components of fear are connected to each other, loosely-linked, and partially independent. Any one of these three loosely-coupled components can assume dominance as the situation or circumstances change. Therefore, when experiencing fear, a person is liable to show signs of increased heart rate, a particular set of facial expressions, and will endeavour to flee or to avoid the situation that is causing the fear (Öhman, 1986). These elements appear consistently in the more common definitions of fear (Marks, 1969; Ollendick, King, & Muris, 2002). It is also considered by some that fear may be a feeling that can only be experienced by those who are self-aware; that is to say, it is occasioned by activation of a defence system in the brain (Debiec & LeDoux, 2004). It may therefore be unique to human beings as it is extremely difficult to infer the quality of self-awareness in non-human animals. Fear in this case might then simply be described as the way people feel when they encounter something

that they perceive to be dangerous or harmful to themselves and which they would actively seek to avoid (McClure & Pine, 2006). In accepting the self-awareness requirement in the definition of fear it would not be unreasonable then to assume that fear in very young infants and toddlers is similar to that experienced by animals, as it is not until they are around 22 months old that children begin to exhibit behaviour indicative of self-awareness (Kagan, 1981).

Although anxiety and fear are similar, there are subtle yet significant differences. Anxiety is normally associated with a sense for feeling of unease or apprehension regarding an ill-defined or unknown (imagined) threat. Fear is associated with a known or specific threat. While the symptoms may often appear the same, it is the focus (real or imagined) that usually distinguishes them (Craig, Brown, & Baum, 1995). They are of course interrelated, with fear generating anxiety and anxiety potentially eliciting fear. For example, phobic fear is an anxiety disorder. Phobias are more than just everyday fears, they differ in that they are excessive, irrational, involuntary, maladaptive, resistant to extinction, and accompanied by avoidant behaviour (American Psychiatric Association, 2000). Therefore, while fear may be described as a rational response to a threat, a phobic response differs in that it is based on an inaccurate assessment of the threat source, i.e. the stimulus is not really a threat, or the response to the threat presented by it is disproportionate (Rachman, 1998).

**1.1.2 Childhood fears.** Locke (1690) was of the opinion that human behaviour could be entirely controlled through a process of learning and experience. The mind itself started off with no pre-conceptions - a *tabula rasa*, that was filled only through various processes of learning. Descartes (1650), on the other hand, held that some innate ideas pre-exist in the mind, and that these ideas exert an influence over the way in which people learn things; humans have an innate tendency therefore to behave in certain ways and this has a defining impact on how and what humans learn. Darwin (1877) suggested that some fears may be

innate in human beings when he noticed his young son at the zoo expressing fear of the wild animals, although the child had no previous experience of these animals. In support of this idea, Hall (1897) suggested that all human beings may, through evolutionary processes, be pre-disposed to acquire certain fears more easily than others. It has been suggested that human beings may be pre-programmed to recognise certain cues that indicate the presence of danger or threat, such as, dangerous predators or natural disasters, and these are then linked to fear/defence responses (Öhman, Dimberg, & Öst, 1985). The fear system then is activated by perception of one of these cues and it automatically and immediately responds (Fanselow, 1994). Fear as a concept might therefore be considered as a collection of human defensive behaviours that have evolved over time as an aid to survival (Marks, 1987). As such, fears of such things as heights and unfamiliar animals or people can be seen as acting as a form of self-defence or protection.

Fears occurring in childhood are quite common, although they are often short-lived and age-specific (Ollendick, 1979); in fact common childhood fears may be natural and beneficial to a child's psychological and social development (Klein, 1994). These 'normal' or 'normative' fears have been the subject of much research employing a variety of methods. Reviewing the available literature, Gullone (2000) observed that a very distinctive and predictable pattern of fear development existed from infancy to adult maturity. She noted that from infancy the pattern was for children to fear what was in their immediate surroundings such as loud noises. Towards the end of their first year when they are better able to distinguish familiar objects and faces from new, they develop fears relating to things such as heights, strangers, and separation anxiety. Later, in the pre-school years, fears that relate to darkness and animals appear; and then these fears themselves are eventually replaced by the more tangible kinds of fears relating to injury, failure or criticism (Gullone, 2000). As Bauer (1976) had noted previously, in normal development the common childhood fears relating to



ghosts or spirits experienced by pre-school children are gradually replaced as the child matures by more definite fears that relate to injury or specific dangers. Öst (1987) put the mean age for the onset of animal phobias at 6.9 years, while Öst and Treffers (2001) found that the mean age of onset for animal phobias might range from 4.4 to 12.8 years. However, from about the age of 9 to 12 years, the fears that children may have developed regarding safety or fears towards animals tend to diminish (Lapouser & Monk, 1959).

The evidence suggests that normative fears in general mirror a child's normal day to day experiences as they develop (Ollendick et al., 1997). Gullone (2000) also noted that as the child matures the general level, variety and intensity of fear begins to recede until the child reaches a relatively stable point at around the age of 11 years. While normative fears may be natural and adaptive, an abnormal amount of fear may lead to real problems as too little fear might encourage maladaptive risk-taking, while excessive amounts of fear might incapacitate a person and prevent them enjoying a normal lifestyle.

Phobias are fairly common, and it has been estimated that they occur in up to 10% of young people (Chavira, Stein, Bailey, & Stein, 2004). Studies show that the majority of specific phobias actually commence during childhood (Öst, 1987). It is believed that this is due to the natural processes of development whereby the child acquires a better understanding of the differences between fact and fantasy and (at around 9 years of age) the idea of death, along with an evolving verbal system which aids in understanding and dealing with everyday life (Childers & Wimmer, 1971). It has also been suggested that many fears may be acquired through information from caregivers seeking to protect their young charges by warning them of the dangers inherent in unfamiliar objects or situations (Muris, Van Zwol, Huijding, & Mayer, 2010). The normative fears that manifest during early development may make children more susceptible to phobias as the potential learning effect may be greater at this stage (Field & Davey, 2001; Muris & Merckelbach, 2001). The

assumption is that children may be particularly susceptible to visually or verbally receive information regarding the object of their fear during periods when normative fears are known to develop. For example, between the ages of 6 and 9 years children experience normative fears about animals and consequently may be pre-disposed to developing animal phobias. However, the sensitivity they exhibit for animal information may not be present, for example, for information relating to social anxiety, for which the normative fear (and possible predisposition to phobia acquisition) develops much later (Field, Hamilton, Knowles, & Plews, 2003). Given that through the various stages of their development children become susceptible to the acquisition of particular fears it is important to look at how these fears may then be acquired.

### ***The development of pathological fear.***

There is still considerable debate over how fears are acquired; indeed whether in fact they are “acquired” in a learning sense at all, or represent something that human beings are actually born with, is still not fully clear. There are essentially two schools of thought. The first of these suggests that specific fears are the result of a biologically-based evolutionary process; that is, specific fears are thought to have developed through evolutionary processes in direct response to stimuli that would have presented a threat to human ancestors (Poulton & Menzies, 2002). Fearing these particular threatening stimuli (e.g., snakes) would have been beneficial for survival. The second school of thought suggests, in the broadest terms, that fears are learned. More specifically Rachman (1977) proposed that fears are acquired via three pathways: direct experience, verbal information provided by others, or through observation of others.

## **1.2 Early Conditioning Models Of Fear Acquisition**

Initially, classical, or Pavlovian conditioning (Pavlov, 1927) – a simple form of associative learning - was believed to be responsible for the development of pathological

anxiety (Watson, 1913). Later, as a result of continued study in this area the concept shifted to an extended model where conditioned fear facilitates and strengthens avoidance behaviours (Eysenck, 1979; Eysenck & Rachman, 1965; Mowrer, 1947, 1960). Mowrer (1947, 1956) developed a dual process (dual-factor) theory of avoidance learning (discussed in more detail later) to explain the development and maintenance of phobias. In essence the dual factor theory conceives that a phobia first develops because of a paired association between a neutral stimulus (one that in normal circumstances would not elicit a fearful response) and a feared stimulus. Then the phobic learns that that by avoiding this anxiety-provoking stimulus, unpleasant emotions are no longer experienced; thus, avoidance is rewarded and this in turn reinforces the phobic's avoidant behaviour. As a result of these processes the avoidance behaviour becomes the phobic's favoured method of coping with their fear, thus reinforcing the phobic response.

The conditioning model of fear was first suggested by Watson and Raynor (1920) as an attempt to explain how fears and phobias may be acquired. With their experiment they showed that it was possible for a person to learn behavioural avoidance and fear for a previously neutral stimulus by pairing that neutral stimulus with an aversive one. Conditioning models of affective learning indicate that if you take a neutral (conditioned) stimulus (CS) and pair it with an unconditioned stimulus (US), which itself is capable of evoking an emotional and/or a physiological response, then the response towards the CS will be mediated by anticipation of the US. For example in a fear-conditioning model a visual cue (CS) is displayed on a screen just prior to the administration of a shock (US). When the participant has experienced several of these combinations of the CS and the shock, the participant will begin to respond to the CS with fear. The fear connected with the shock has now become attached to this random visual cue (Frith, 2007). Fears may be acquired this way when a previously neutral stimulus, which initially evokes no emotional response,

subsequently acquires the facility to evoke a fear response after it has been repeatedly paired with an aversive US. At this point the neutral stimulus has become a CS which now predicts the occurrence of the aversive US, thus inducing the sort of anxious response that is associated with anticipation of the US itself.

Watson (1913) theorized that the way people behave is the result of conditioning and learning: people learn their emotional responses. He believed that people were not born with a fear of rats, but that through conditioning such fears could be acquired. In an oft-quoted study, Watson and Raynor (1920) set about demonstrating that fear could be instilled in humans using classical conditioning theory. In their study they first established that a nine month old boy ("Little Albert") had no fear of a white rat but was frightened by the loud noise made from beating an iron bar with a hammer. Next, each time Albert was close to the rat, Watson beat the bar with the hammer, which frightened Albert. Having repeated this procedure several times Albert became anxious when the rat was presented, even though there was no accompanying loud noise. Thus they had been successful in inducing fear-learning in Little Albert. They also reported that the fear generalised to other items that resembled the rat such as cotton wool, a rabbit, and a Santa Claus mask. Pavlov (1927) also described how the conditioned response to a particular CS could spread or become more generalised to stimuli similar to the original. In conditioning terminology, the rat then was the CS, the loud noise the US, and the unconditioned response (UR) was the anxiety created as a natural response by the US. When the CS-US association is created in memory the CS is then capable of inducing the conditioned response (CR), which in this case is the anxiety exhibited by Little Albert.

However, Watson and Raynor's (1920) findings are not evidence that all fears may be acquired through conditioning. Although other researchers have attempted to replicate the study, in general Watson and Raynor's findings have not been successfully repeated. In one

attempt to replicate the findings, Bregman (1934) used a number of inanimate objects such as wooden blocks and cloth as the CS, in place of the original rat. However, she was unable to demonstrate any evidence of conditioning in 15 infants over several attempts. It may be that the best that can be said of Watson and Raynor's study is that it indicates one of a number of possible routes by which fears can be acquired.

Watson and Raynor's theory of fear acquisition was later developed further by Mowrer who argued that excessive fears are the product of direct conditioning experiences and are maintained by avoidant behaviours: the *two factor* theory (Mowrer, 1960). Avoidance refers to behaviour adopted in order to evade a negative (aversive) stimulus (US) that was previously associated with a conditioned stimulus. This behavioural avoidance is known as a *Conditioned Avoidance Response* (CAR). Mowrer described two processes that he considered led to the acquisition of conditioned avoidance responses, drawing a distinction between conditioning and habit formation. He suggested that having acquired the quality to evoke fear, a previously neutral stimulus additionally acquired motivating capacities. He suggested that fear may be acquired through classical conditioning (e.g., when a person is bitten by a dog), so that a link is formed between the CS and the fear response (UR/CR). From this he concluded that the termination of the CS was a negatively reinforced response motivated by fear reduction (avoidance of the dog). In Mowrer's opinion, conditioned avoidance responses observed in individuals with phobias were simply learnt responses acquired in order to terminate the CS and its related fear response. Subsequent studies with animals provided further support for the classical conditioning paradigm (Rachman, 1977, 1990). Additional support has also been provided by studies in which phobic participants attribute the onset of their fears to classical conditioning events such as: fear associated with dental treatment (Davey, 1989); fear of dogs (Di Nardo, Guzy, & Bak, 1988); spider phobia

(Merckelbach, Arntz, & De Jong, 1991); and fears developed after traumatic combat experiences (Gillespie, 1945).

Influential as it was at the time, Mowrer's theory was not without criticism. Later experiments showed that CS-US (not CS-CR/UR) learning underpins associative learning, and contrary to dual-factor predictions, US avoidance does have a part to play in avoidance behaviour (Rescorla, 1988). Also, according to two-factor theory, fear of the CS and the strength of the avoidance response should correlate because reduction of the fear associated with the CS reinforces the avoidance response. However, subsequent experiments found that the avoidance response persisted quite a long time after the fear of the CS had been all but extinguished (Delclercq & De Houwer, 2008). Alternative theories emerged to try to address these issues, the most prominent among these being Seligman and Johnston (1973). This theory stated that it was not stimulus-response (S-R) associations, but expectancies in terms of response-outcome (R-O) contingencies that mediate the avoidance response. They suggested that in fact two R-O expectancies develop during avoidance learning; individuals either: 1) engage in avoidance behaviour with the result that there is no aversive outcome, or 2) they do not engage in avoidance behaviour and an aversive outcome is experienced as a consequence. The avoidance response therefore occurs as individuals prefer to avoid the aversive outcome. This theory emphasises the role of US avoidance in support of learning and offers an explanation for the robust nature of avoidance behaviour post fear extinction as the behaviour is derived from R-O expectancies rather than being underpinned by fear reduction.

### ***1.2.1 Limitations of the direct conditioning theory of phobia acquisition.***

The early conditioning models of fear acquisition could not account for the non-random distribution of specific fears. In fact, the conditioning model predicted that any object might become a phobic stimulus as long as it preceded an aversive event ('equipotentiality').

Yet this is not what happens and in fact fears of certain animals such as snakes occur more often than for other stimuli such as electricity, even though there is no evidence to suggest that snakes appear together with aversive events more often than electricity does (Seligman, 1971).

Conditioning models were also criticised for the fact that some phobic individuals cannot remember an aversive experience as being the cause of the onset of their fear, and not all traumatic experiences result in the development of an anxious response (Rachman, 1977). There is considerable research available to support the assertion that not all phobics can recall a triggering learning event for their fear (Menzies & Clarke, 1995; McNally & Steketee, 1985; Wolpe, Lande, McNally, & Schotte, 1985). For example, a study of female undergraduates by Rimm, Janda, Lancaster, Nahl, and Dittmar (1977) found that only 36% attributed the source of their fear to a direct conditioning experience. Therefore, it appears to be entirely possible for phobic fear to develop in the absence of a preceding causal trauma. Similarly, not all exposures to intensely aversive events necessarily result in the development of excessive fears (Poulton & Menzies, 2002; Saigh, 1984). Rachman (1977) cited the example of large numbers of people who during the Second World War endured the terrifying experience of repeated bombing raids, yet very few actually suffered any long-term adverse reactions. There are a significant number of mundane but no less relevant examples of people undergoing aversive events, with for example dogs (di Nardo, Guzy, & Bak, 1988), spiders (Merckelbach, Arrindell, Arntz, & de Jong, 1992), and dentists (Lautch, 1971), where the encounter did not result in the acquisition of phobic fears. Thus while the development of some specific phobias may be attributable to specific direct conditioning events, direct conditioning alone cannot account for the acquisition of all fears or the development of all phobias.

Seligman (1972) also outlined a number of issues that argued against the traditional conditioning model as an explanation for the development of phobias: a) The ease with which phobias are acquired, i.e. the low number of trial repetitions necessary to elicit a fearful response to a particular stimulus. More often than not a single negative event is sufficient for a phobia to develop; b) As mentioned previously, phobias are unevenly distributed: they are generally found for a specific limited set of stimuli (e.g., heights, the dark, certain animals, etc); c) The apparent irrationality of some phobias, i.e. a phobic remains fearful when exposed to the object of their phobia even after it becomes obvious that there is no threat or danger; and d) Fear persistence: phobias exhibit slow extinction rates. Seligman (1970) believed that these problems with the conditioning model could be explained by a theory that he termed ‘preparedness’.

### **1.3 Fear-Relevance and the “Preparedness” Theory of Fear Acquisition**

**1.3.1 The preparedness model.** Pavlov (1927) argued that the ability to form associations during conditioning was an evolutionary process that developed as an aid to survival. It could be said that conditioning permitted an organism to identify important stimuli in its environment that could pose a threat or provide sustenance, and thereafter to react appropriately. In this way salivary conditioning permitted Pavlov’s dog, with the knowledge that food was on its way, to begin salivating so that the food might be consumed more quickly when it arrived; perhaps before other predators arrived. In a similar way the freezing response of the rat on detection of a predator may improve its chance of avoiding detection and thus improve its prospect of survival (Lieberman, 2000). Initially Pavlov had also expected to find that some stimuli would be more easily associated with food than others. However, in his experiments he found no difference between what he termed “natural” stimuli such as the sight or smell of food, and “artificial” stimuli such as a buzzing noise or light. He therefore concluded that there was no difference between the stimuli in



terms of the ease with which they could form associations, and consequently that the rules governing associations were uniform.

Garcia and Koelling (1966) were able to show that this assumption was incorrect and that learning might in fact be dependent on the stimuli in the CS-US pairings. In their study they provided rats with strongly flavoured water from a tube along with a flashing light and a noise. When the rats licked the tube they either obtained plain water or flavoured water with the light and noise. Subsequent to the flavour, light and noise the rats would be subjected to x-rays to induce nausea. As a result they found that consumption of the flavoured water was significantly reduced but there was no effect observed for the light and noise. Their evidence then appeared to suggest that organisms may be pre-disposed to learn some CS-US combinations more readily than others. The assumption as to why some CS-US associations appear more easily learnt might be that these associations are of greater benefit to the organism in its natural environment. So for example when a rat consumes some poisoned food and subsequently becomes nauseous, there would be little advantage if it developed an aversion to all stimuli contiguous with the onset of the nausea. However, from an evolutionary perspective there would be a very real advantage if the nausea became associated with the taste preceding the nausea, which has real predictive value and thus is a real aid to survival.

Seligman (1970) believed that the apparent limitations of traditional conditioning theory could be explained by a theory based on biological predisposition, or 'preparedness'. He suggested that human beings have developed an evolutionary bias to selectively associate fear with certain stimuli or events that would have presented their ancestors with a real threat to their survival (Seligman, 1971). Seligman (1970) described this preparedness in terms of a continuum where *preparedness* – an ability to easily form an association - sat at one end of the scale with *contra-preparedness* – where an association is learnt with difficulty - at the

opposite end. In the middle of the scale, *non-prepared* described the neutral position where associations would be neither quick nor difficult to learn. Preparedness theory is based on three assumptions. First, the association (e.g., a phobia) must develop from a previously neutral stimulus being presented together with an aversive event. Secondly, the stimulus itself must be identifiable on a fear-preparedness scale, featuring anywhere on the prepared to contra-prepared scale. Finally, the assumption is made that those stimuli identified as highly prepared for fear conditioning would have been of some biological significance to pre-technology humans. It follows then that snakes and spiders, being animals that frequently evoke fear, are described as being fear-relevant, and are thus considered to be highly prepared for fear conditioning (McNally & Reiss, 1982).

The traditional view (Pavlov, 1927) suggested that the really important requirement for conditioning was contiguity, i.e. where there is a close temporal relationship between two events an association will be formed between them. However, the data in support of preparedness shows that such an interpretation is far too simplistic. In Garcia and Koelling's (1966) experiment with taste-aversion, noise was as contiguous as taste with nausea yet this on its own was insufficient for an association to be formed with noise. Furthermore there are also data which demonstrate that learning can occur in the absence of contiguity entirely. For example, Etscorn and Stephens (1973) allowed rats to drink a saccharin solution and subsequently gave the rats a drug (cyclophosphamide) that made them ill. As a result the rats developed an aversion to the saccharin, which could only have occurred if they remembered what it was that they had previously consumed. Crucially, Etscorn and Stephens had introduced a delay of 24 hours between the presentation of the CS and the US and were still able to demonstrate that conditioning had occurred. It is obvious that conditioning does not simply occur as a result of contiguous events, it is a much more complex and non-uniform process. While the rats in these experiments easily learnt to associate an olfactory cue with

sickness they appeared unable to learn to associate a visual cue with sickness. This could be viewed as evidence that the rats were biologically prepared (by evolutionary processes) to favour association with olfactory cues as these would be of more importance in terms of survival than visual cues (see Seligman & Hager, 1972).

Öhman and Mineka (2001) have argued that the development of appropriate defence mechanisms was absolutely essential in terms of mammalian evolution, and that the most common of these involved either 'fight or flight'. Invoking fight or flight required, at a minimum, some system of perceiving and identifying potential threats in order for the motor system to then initiate an appropriate defensive response. In time, these mechanisms would have evolved to become more sophisticated so that the stimulus-response relationship could become more complex and discerning. This enabled the insertion of an additional motive state between the stimulus and the response triggered by innately threatening stimuli which would allow more appropriate escape responses dependent upon contemporaneous circumstantial contingencies (Archer, 1979). This central motive state is fear (Mineka, 1979; Öhman, 1993).

**1.3.2 Öhman and Mineka's fear module.** Öhman and Mineka (2001) expanded preparedness theory further with the proposal of an evolved module of fear elicitation and learning. The module they proposed mediates fear learning at an emotional level, separate from cognitive learning of fear and has four main characteristics: 1) the module is considered to be the product of evolutionary development and triggered by events/objects described as fear-relevant (selectivity); 2) the reaction to the stimuli and thus activation of the module is wholly automatic (automaticity); 3) the process is resistant to any conscious cognitive interference (encapsulation); and 4) the module originates in specific adaptive neural circuitry based on the amygdala.

The fear module has been developed by the process of evolution - defining and reconciling the relationship between the ecological events experienced and appropriate defensive behaviours to these events. Research suggests that the neural circuitry for fear and fear learning is based on specific neural circuits found in the part of the brain called the amygdala. As LeDoux (1996) has remarked, this location ensures that that it is largely immune to cognition. Thus, while it is possible to feel fear at a conscious level, the processes in the brain responsible for generating fear or for assessing certain stimuli as being fearful are automatic and operate at a non-conscious level (Rosen & Schulkin, 1998).

**1.3.3 Evidence for preparedness: Emotion and attentional bias.** Evolutionary processes have benefitted from the role of various emotions in garnering successful feedback from exposure to threatening environments (Öhman & Wiens, 2003). Seligman (1971) believed that as they have evolved, humans have associated fear with life-threatening occurrences; once established, this fear association is of such evolutionary importance that it resists attempts from other information sources suggesting that the stimulus in question is not a threat. It has been suggested that the emotion of fear developed in order to enhance the human ability to detect and respond quickly to potential threats in the environment (LeDoux, 1996). This is achieved by harnessing the perceptual and motor systems to adapt behaviour for the detection and avoidance of danger, encouraging a bias in attention towards any stimulus that generates a fearful response and thereby allowing time for the implementation of defensive strategies (Öhman, 2000). It follows from this then that an intrinsic characteristic of any emotional stimulus is an enhanced ability to attract attention (Öhman, Flykt, & Lundqvist, 2000). Some researchers argue that 'selective associations' occur for fear-relevant stimuli, so that a relatively small amount of perceptual information is all that is required to create fear associations for stimuli such as spiders and snakes, and that such fear associations are therefore more easily developed in humans (Öhman & Soares, 1993). Support comes

from evidence of superior detection of animals compared to inanimate objects, suggestive of a visual monitoring system that has developed sensitivity for a very particular stimulus group that was presumably highly relevant in early human evolution (New, Cosmides, & Tooby, 2007). This all adds further weight to the proposition that fear-relevant animal stimuli are processed in a different and superior way to non fear-relevant stimuli such as flowers or mushrooms.

Superior processing of fear-relevant stimuli has been demonstrated in visual search studies in which participants were presented with both fear-relevant (spiders and snakes) and fear-irrelevant (flowers and mushrooms) stimuli (Öhman, Flykt, & Esteves, 2001). Participants were asked to detect whether a fear-relevant image was present among a set of fear-irrelevant images, and whether a fear-irrelevant image was among a set of fear-relevant images. For example, one snake picture among eight images of flowers. Participants were required to identify as quickly as possible whether a snake was present. They found that non-fearful participants were quicker at finding fear-relevant stimuli among fear-irrelevant stimuli than fear-irrelevant stimuli among fear-relevant stimuli. Öhman et al. (2001) suggested that this attentional bias for fear-relevant stimuli was due to enhanced attentional capture elicited by stimuli for which the participant had a specific fear. They also found evidence of pre-attentive processing of fear-relevant stimuli as the detection of the snakes and spiders (unlike the neutral stimuli) was not dependent on the number of distracters being displayed (see also Lipp & Waters, 2007; Waters & Lipp, 2008). Furthermore, they found that participants who had a particular fear of snakes located snakes in the tests faster than they did spiders; while conversely, those with a particular fear of spiders consistently located spiders faster than they located snakes. This is consistent with other studies that demonstrate a shorter reaction time in participants for a particularly feared stimulus (e.g., Flykt & Caldara, 2006; Rinck, Reinecke, Ellwart, Heuer, & Becker, 2005).

A meta-analysis of 172 threat-related attentional bias studies employing anxious participants with varied stimuli and experimental procedures, demonstrated the robustness of attentional bias for threat-related stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). These results offer support for a bottom-up model in which the effect is a direct response to the stimulus, demonstrating an innate sensitivity to stimuli that might be considered emotionally negative or threatening in nature (Öhman et al., 2001). However, Öhman et al. (2001) found that sensitization to stimuli was enhanced for participants who were highly fearful of particular stimuli, when the emotional and personal relevance of the stimuli was stressed. Their findings suggested a top-down model affecting attention capture that was driven by notions of emotion and personal relevance. Lipp and Waters (2007) also showed that, consistent with an attentional capture view, the type of control stimuli used in a visual search task can affect the results obtained. They demonstrated that where fear-irrelevant instead of fear-relevant animals are employed as a control this will affect the results obtained. That is, participants are slower to notice the absence of a neutral stimulus among phylogenetically fear-relevant distracters such as spiders or snakes than they are among fear-irrelevant distracters such as cockroaches or lizards.

In terms of research then, it is important that the type of animal being used is considered carefully. The literature suggests that a distinction should be made between animals that are believed to have presented an evolutionary threat and those that have not (Isbell, 2006; Öhman & Mineka, 2001). This is important to note as a large part of the research available from visual search studies has utilised images of inanimate flora such as mushrooms and flowers instead of fear-irrelevant animals. Öhman (2007) suggests that this has contributed to the conflicting nature of results available. Interestingly, Tipples, Young, Quinlan, Broks, and Ellis (2002), performed a study using threatening and non-threatening animal stimuli and found similar effects to studies with fear-relevant and irrelevant stimuli.

They concluded that any search advantage may actually be attributable to the unique visual properties of the stimuli used rather than fear-relevance.

Recently, however, Soares, Esteves and Flykt (2009) examined attentional selectivity using a visual search task and found that overall fear-relevant stimuli (spiders and snakes) were more rapidly detected than fear-irrelevant stimuli (mushrooms). This finding was consistent across increasing numbers of distracters of 6, 12, and 18. Soares et al. (2009) extended Öhman et al.'s (2001) study and looked at whether it was actual fear of the stimuli or fear-relevance as a characteristic of the stimuli that determined reaction times for visual search experiments where the distracters used were two distinctive groups of animals. One group consisted of images of fear-relevant animals such as snakes and spiders that were considered to have presented a threat from an evolutionary perspective. The other group consisted of images of fear-irrelevant animals such as cats and fish, that are not considered to represent an evolutionary threat. They used an attention task to evaluate how quickly participants could detect feared stimuli (spiders and snakes) against a background of fruit when compared with neutral stimuli (mushrooms). Their first experiment demonstrated no advantage for fear-relevant over fear-irrelevant animal stimuli but provided evidence of some attentional capture when large numbers of fear-relevant stimuli were used in their presentations. In their second experiment, consisting only of participants with an established fear of one or other of the fear-relevant stimuli, they specifically divided the participants according to their individual fears of snakes or spiders. Preferential processing of specifically feared stimuli was found compared to participants without the specific fear. From these findings it was deduced that fear significance (as opposed to fear-relevance) mediated visual search reaction times. Their research clearly demonstrated a search advantage for fear-relevant animals where the participant actually had a fear of the fear-relevant stimuli. This preferential attention was found for the participant's feared animal regardless of the nature of

the distracters. While participants who were particularly fearful of spiders demonstrated a greater degree of sensitivity in the detection of spiders, they also found that those participants who were particularly fearful of snakes showed no significant difference in their ability to detect snakes over spiders. Soares et al. (2009) found that the emotional ratings in their tests conformed to those of the attention tests, which indicated that while fear of snakes could be considered to be part of what might be described as a more universal fear of generally negative stimuli, fear of spiders is much more specific (see also Gerdes, Uhl, & Alpers, 2009).

Thus preparedness has provided an explanation for the observation that fear of some stimuli are more common than others by suggesting that these (“fear-relevant”) stimuli presented a danger to humans during their evolutionary development. Support for this theory has been provided by a number of studies demonstrating the ease with which fear responses could be learnt for fear-relevant stimuli compared to fear-irrelevant stimuli (e.g., Öhman et al., 1985). However, as evidenced by the visual search experiments performed by Soares et al. (2009) the factors influencing attentional bias for fear-relevant stimuli are complex.

Öhman et al. (2001) had previously found greater efficiency in detection of spiders and snakes where the participants were highly fearful of the stimuli. It is possible that the advantage observed was owed, in part at least, to the specific anxieties of the participants. In support of this idea Williams et al. (1997) have noted that general theories regarding attention and emotion observe that an attentional bias for threat-related stimuli may be restricted to individuals who are highly anxious. Clearly, while there is some evidence to support a superior processing bias for fear-relevant animals, there is still insufficient data available to enable the processes underpinning attentional bias to be clearly defined.

***1.3.4 Alternative interpretations of preparedness.*** The concept of biological preparedness slots easily into commonly accepted ideas of evolutionary development and has



gained widespread credence; however, the research on which it is based has been subject to some criticism (de Jong & Merckelbach, 1997). A number of other theories have been proposed that describe processes to explain disparities in the fear responses observed in laboratory analogue studies. Maltzman and Boyd (1984) looked at the effects of fear-relevant stimuli attributes on human visceral conditioning. They suggested that the specific properties of the stimulus itself to attract attention have been confused with fear-relevance and because of this what has been reported as “preparedness effects” could in fact be attributable to the relative disparity in attentional significance between fear-relevant (“interest-attracting”) and fear-irrelevant stimuli. Their results showed that enhanced skin conditioned responses were exhibited for both fear-relevant and fear-irrelevant stimuli when the stimuli were considered to be extremely pleasant or extremely unpleasant. They suggest that an alternative explanation for research supporting biological preparedness might be the significance of the actual stimuli used in the research. Similarly, it could be that the fear elicited from so-called “prepared” animals, such as snakes and spiders, may be more attributable to their unusual appearance and unpredictable behaviour than any survival threat they may pose (Merckelbach, van den Hout, Jansen, & van de Molen, 1988; Soares et al., 2009; McNally, 1987; Cook, Hodes & Lang, 1986).

The differences in responding to fear-relevant and fear irrelevant stimuli have also been attributed to a preparedness derived from human ontogeny (how an organism develops throughout its life) or cultural influences (Delprato, 1980; Bandura, 1977). These theories suggest that human beings are influenced (or prepared) by specific cultural traits or events during their developmental history that subsequently results in some stimuli becoming more significant or evocative. Support for the role of cultural influences in preparedness has been provided by studies that have found no significant difference in conditioned electro-dermal responses when comparing technological (a set of guns) and biological (a set of snakes) fear-

relevant stimuli (Hugdahl & Johnsen, 1989; Lovibond, Hanna, Siddle, & Bond, 1994).

However, this theory has been criticised by Cook, Hodes and Lang (1986) and Hugdahl and Kärker (1981) who could find no differences between ontogenic and phylogenic stimuli; the supposed fear-relevance of the ontogenic stimuli used in these studies has also been the subject of criticism (see McNally, 1987).

McNally (1987) carried out a detailed review of the available experimental literature and noted a failure to find support for a number of the principal assumptions of preparedness theory. One of the significant issues raised was appropriateness of the stimuli used based on the assumption of their survival-relevance. For example, Delprato (1980) suggested that the threat of poisoning posed by mushrooms would be of more relevance in terms of human survival than the threat posed by both snakes and spiders together; and although a study by Merckelbach, van den Hout, Jansen, and van der Molen (1988) rated mushrooms as being more relevant from a survival perspective than spiders, a number of studies have still nevertheless used images of mushrooms as unprepared stimuli whereas conversely spiders have been used as the survival-relevant stimuli. In their study, Merckelbach et al. (1988) controlled for dangerousness and unpredictability and found that theoretical survival-relevance was no longer related to fearfulness. Because of this they suggested that there must be some other characteristic of stimuli, rather than survival-relevancy, that is responsible for results previously attributed to preparedness theory.

Preparedness makes specific predictions about fear-conditioning for fear-relevant compared to fear-irrelevant stimuli: the conditioned response should be greater in magnitude, acquired more quickly, and more resistant to extinction. McNally (1987) challenged preparedness theory, specifically addressing these predictions. While Seligman suggested that prepared associations would be easy to acquire even with degraded input (e.g., where there are fewer training trials to facilitate encoding in memory), degraded input has been found to

attenuate conditioning of both fear-relevant and fear-irrelevant stimuli equally (Hughdal & Öhman, 1980). Preparedness theory implies that, where input is the same, more conditioning should occur for fear-relevant than fear-irrelevant stimuli, thus the magnitude of the conditioned response should be greater for fear-relevant stimuli. However, as McNally points out, most studies have not found any difference between groups conditioned to prepared (fear-relevant [FR]) stimuli and groups conditioned to fear-irrelevant (FI) stimuli (McNally, 1986; Delprato, 1980). McNally (1986) used three images in a within-subjects design: a snake (FR stimulus predicting occurrence of US); a flower (FI stimulus predicting non-occurrence of US) and a triangle (neutral, non-reinforced stimulus). Responses to the non-reinforced triangle were used as a baseline against which the conditioning of the other CSs was measured. To conform with preparedness theory this model should have produced a greater magnitude difference between the snake and the triangle than between the flower and the triangle. However there were no discernible differences in magnitude between these CSs and the triangle. Turning then to the apparent irrationality of phobic responses, McNally suggested that rather than simply viewing these responses as being irrational phobic avoidance, they could actually be based on the sufferer consciously acting to avoid anxiety and its consequences. A socially anxious person may accept that there is no physical threat to them; however, their avoidance may be a perfectly rational attempt to avoid becoming extremely anxious by avoidance of the feared stimuli.

Preparedness theory also predicts that responses that have been conditioned to fear-relevant stimuli should be much slower to extinguish than responses that have been conditioned to fear-irrelevant stimuli. Some studies support resistance to extinction for prepared stimuli (e.g., Öhman & Dimberg, 1978). However, McNally and Foa (1986), amongst others, have failed to reproduce the resistance to extinction effect. They attempted to replicate the resistance to extinction effect with fear-relevant stimuli reported by Öhman and

colleagues (see Öhman, 1979; Öhman, Dimberg, & Öst, 1985), and to determine whether a pre-existing fear for the stimuli would enhance this effect. They used slides of a snake and a spider for the fear-relevant stimuli and slides of strawberries and a flower for fear-irrelevant stimuli. Participants who reported a high level of fear for the fear-relevant stimuli and some who reported a low level of fear were recruited. Unlike the findings of Öhman (1979) they found that fear-relevance did not affect resistance to extinction. This was true even for those participants who had reported a high level of fear of spiders or snakes. In fact they found that the only predictor of resistance to extinction was strength of conditioning, and this is entirely consistent with associative learning theory.

Marks (1987) has described the resistance to extinction effect as being elusive. Addressing the allegedly high resistance to extinction, McNally (1987) pointed out that it is at least as easy to treat and eliminate “prepared” as it is “unprepared” phobias, citing the ease with which height and animal phobias in particular are treated using exposure therapy. He further states that there is little real evidence supporting the idea that phobic responses to evolutionary prepared stimuli are resistant to extinction. He suggests that phobias persist not because of stimuli responses being resistant to extinction, but simply because sufferers avoid exposure to their feared stimuli and as a consequence also any therapeutic effect such exposure might have. The alternative theories proposed to explain the disparities in fear conditioning observed in studies with non-clinical participants discussed here and previously weaken the argument offered by the preparedness theory and the corresponding biologically-based evolutionary mechanisms suggested to be responsible for differential fear acquisition. While associative learning theory remains a convincing model for the way in which human fears may be acquired, the role that fear-relevance plays in the development of such fear remains somewhat problematic.

## 1.4 Biological/Genetic Accounts

**1.4.1 The ‘non-associative account’.** The non-associative theory of fear acquisition is also developed from Darwinian thinking: the theory suggests that human beings are born with innate fears rather than acquiring them and through their development they learn to moderate and overcome them (Rachman, 2002). These fears are thought to be activated after initial exposure to the relevant stimuli and are considered to include fear of: animals (e.g., snakes and spiders); heights; water; the dark; strangers; and anxiety manifested through separation (Poulton & Menzies, 2002). According to proponents of this account, no associative learning event is required to acquire these fears (hence they are termed “non-associative”). Clinical phobias are said to develop because of a failure to habituate or adjust normally to these innate fears (Menzies & Clarke, 1995). The suggestion is that in most cases people will be exposed sufficiently to innate fearful stimuli in a naturalistic setting to facilitate habituation, and thus the elimination of the fear response. Two reasons have been proposed for this failure to habituate normally: 1) a lack of proper exposure at the appropriate developmental stage (Clarke & Jackson, 1983); and 2) individual differences - while most people will habituate normally, it is assumed that others may be much slower and less efficient at habituating owing to genetic variability (Menzies & Clarke, 1995).

There is some support for this theory from those who report that their fears have, in their opinion, been something that they have always had (Menzies & Clarke, 1993, 1995). However, the use of this kind of retrospective self-report to explain the onset of a fear is problematic; being subject, not least, to the criticism of recall error, particularly in the case of adults with long-standing fears. More robust evidence may be obtained from prospective studies and some support has been suggested from analyses carried out on data from the Dunedin Multidisciplinary Health and Development Study (the Dunedin study): a longitudinal study involving over a thousand babies who were born in Dunedin, New Zealand

between April 1972 and March 1973 (Silva, & Stanton, 1996; Poulton, Davies, Menzies, Langley, & Silva, 1998; Poulton, Menzies, Craske, Langley, & Silva, 1999). For example, data from this study showed that participants reporting height phobia at 18 years of age had not experienced any serious fall before the age of nine years; the inference being that there had been no obvious conditioning event that could have led to this fear acquisition (Poulton, et al., 1998). Findings were similar when looking at traumatic events associated with water, such as being rescued after getting into difficulty (which would be considered a conditioning event) and water-based skills such as swimming up to the age of nine, and comparing these with participants who exhibited fear of water at 18 years (Poulton, et al., 1999). Thus, in these prospective studies no conditioning event prior to 9 years of age was found for participants who reported height and water phobias at 18 years of age. This suggests that neither height nor water phobia rely on direct associative learning events in order to become manifest.

Gibson and Walk's (1960) "visual cliff" study is also an oft-quoted example of fear/avoidance in the absence of any previous learning experience. The "visual cliff" consisted of a table, the top of which was made from a large sheet of toughened glass. Directly under this glass was a second solid surface extending for half the length of the glass, made of a red and white chequered pattern. This half of the table was referred to as the 'shallow side'. Beneath the remainder of the glass the red and white pattern continued at ground level (the 'deep side'), giving the impression of a sudden drop half way across the table. A wooden board was placed at the point in the middle where the deep side and the shallow side met. Gibson and Walk believed that avoidant behaviour in relation to heights was something that was not learned, but developed innately (facilitated by depth perception). Animals and young infants at various stages of development could be placed on the table to determine at what stage they perceived the apparent danger presented by the visual cliff. In

general when infants were placed on the board at the centre of the table and called by their mothers, they would readily move across the shallow side of the table; however, if the mother was at the deep end of the table they would not cross the apparent drop.

The visual cliff study has been cited by some as evidence of the innate nature of the processes driving this avoidance; however, infants used in these experiments were already 6 months old (before this age children lack the motor skills necessary to participate in such a test) so the opportunity for learning such avoidance cannot be ruled out. In fact, in a later study when infants aged between two to five months, were placed on the “deep side” of the visual cliff table they exhibited a reduction in heart rate, which is normally indicative, not of fear (where heart rate increases), but of interest (Campos et al., 1978). Evidently the younger infants had yet to learn to fear the drop and the avoidant behaviour would therefore be learned at some later stage. Gibson herself did not equate this avoidance with fear but considered that it was more to do with affordances. ‘Affordances’ describe properties of the environment that it is possible for someone to act upon, i.e. the ways in which a person might be permitted to interact with their environment. For infants then, actions such as grasping, moving, and sucking are some of the earliest responses that “afford” them information. Therefore, the findings of a reduced heart rate in later experiments with younger infants, indicates that they had not yet “afforded” falling and thus were not fearful. In contrast, Gibson believed that fear of heights is probably acquired long after motor development has matured (Gibson, 1982). Some support was offered by Bowlby (1973) and his studies into separation anxiety in children in which he observed that in the first 5 years of a child’s development there were four main categories of situations that elicited fear responses: i) noise, illumination, sudden movement or approach of objects and heights; ii) strangers and novel objects or places; iii) animals; and iv) darkness (especially if the child is alone). Animals were found to arouse most fear more frequently than any of the other categories

While all of these studies may be interpreted as adding to the evidence in support of the non-associative model, the theory has also attracted significant criticism. For example, it has been argued that the results supporting the non-associative account can also be explained by other theories of fear acquisition. Davey (2002) criticizes such evolutionary-based arguments as being based on the fallacious post-hoc attribution of characteristics to a feared stimulus. The example is given of fears acquired for insects. These fears today might on the face of it be considered as relevant evolutionary fears and thus non-associative or “prepared”, owing to the threat to humans caused by insect involvement in the spread of disease. However, it was not until the beginning of the 20<sup>th</sup> century that human beings began to understand the role that insects actually play in the spread of disease and only then did people’s attitude regarding insects change (in particular for the common fly) and this fear emerged. Although this recently developed fear is now pervasive the understanding of threat is too recent to have influenced the gene pool (Muris, Merckelbach, de Jong, & Ollendick, 2002; see also the discussion on Davey’s, (1997) conditioning model and the role of expectancies in the development of fear).

Muris et al. (2002) in their critique suggested that the non-associative theory generally ignores elements believed to be essential in the development of childhood fears, e.g., the characteristics of the stimuli (such as aversiveness and unpredictability) and the stage of development (see Marks, 1987) of the child. Muris et al., point out that certain fears will only appear at particular stages in a child’s development, e.g., fear of heights is associated with the development of locomotor skills (Bertenthal et al., 1984), and fear of separation is linked to the development of object permanence for faces (Kagan et al., 1975). As to why new stimuli or changes in the environment should be associated with fear, they suggest that the child’s weaknesses, such as lack of strength and poor coordination, promote such an association. Muris et al. also suggest an explanation why an encounter with novel stimuli may generally



produce a brief orientating response but occasionally result in fear. The reason may be found in the operation of the Behavioural Inhibition System (BIS) proposed by Gray (1982). The BIS is suggested to be a sub-cortical circuit permanently comparing the information that it receives from the outside world to that already stored in memory. Its purpose is to predict possible future events. On receipt of unfamiliar, aversive or novel stimuli the BIS generates fear as a response; the more aversive, novel or unpredictable the stimuli, the greater the fear that is generated. Different outcomes may arise as the varying temperament of individuals may affect the BIS differently.

The non-associative account takes much of its support from participants' inability to recall learning experiences; however, this may simply be due to limitations of long-term memory. Mineka and Öhman (2002) point out that non-associative theorists exclude from the conditioning category of onset those phobics failing to recall a specific triggering stimulus for their fear, contiguous with the presentation of the object of their phobia, instead classifying them as non-associative. They argue that simply because a phobic cannot remember a learning event, in which the object of their phobia predicted the occurrence of a negative outcome, does not mean that the learning event did not occur. They may not remember it or simply have been unaware of the association as the negative outcome may have been internal in nature (interoceptive, where internal sensory receptors in the gut, lungs, etc., are stimulated) instead of external (exteroceptive, which relates to stimulation of the external senses). The non-associative theory does not consider the important contribution of interoceptive cues (internal bodily symptoms such as temperature, heart palpitations, or dizziness) in learning events, where physiological responses contiguous with the encounter of an animal or object stimulus are believed to facilitate the development of fear for that stimulus (Mineka & Öhman, 2002). Thus learning occurs but an individual may not be conscious of, or remember it as the identifiable responses occurred within rather than without

the body. Consequently those cases regarded by some theorists as non-associative were likely examples of interoceptive rather than exteroceptive negative outcomes. For example, in the case of panic disorder—a disorder which is characterized by unexpected and re-occurring panic attacks—a small increase in the heart rate may predict a larger rise in heart rate that is symptomatic of such a panic attack. For an individual with panic disorder any cardio-respiratory changes (such as an increase in heart rate or minor breathing difficulty) may then act to induce feelings of fear in another scenario owing to the fact that such changes had previously predicted a negative outcome: the panic attack (Pappens et al., 2012).

Although fears of blood (haemophobia), and open spaces (agoraphobia) along with developmental fears such as the fear of strangers (xenophobia) or heights (acrophobia) (Menzies & Clarke, 1995) have been suggested as possibly being prepotent (see Marks, 1987, 1969), hard evidence for prepotency is difficult to come by. The non-associative theory has also been criticised by Kleinknecht (2002) as not being a fully-fledged fourth pathway for learning fears. He suggests that its proponents have not taken fully into account the alternative associative and cognitive theories (such as Davey, 1992; Thorpe & Salkovskis, 1995). Nor have they answered the questions posed by critics such as Forsyth and Chorpita (1997) who criticize the non-associative model for, amongst other things, relying exclusively on retrospective self-reported evidence for support; and a failure to account for the apparent inability of some persons to habituate properly to prepotent fears, when clearly the majority of the population does. Ultimately, it may be that in fact fear cannot be considered to be merely either wholly associative or non-associative (Marks, 2002). Instead, Marks (2002) suggested that the development of fears should be viewed as processes that occur within a range of learning demands. At one end the scale, some fears require little or no learning (what might well be categorized as innate fear); for example, the neo-natal startle response to noise. At the other end of the scale are fears that demand a significant amount of learning. This view

is in some way similar to that of Poulton and Menzies (2002) who suggested that the associative and non-associative accounts are not necessarily mutually exclusive and instead propose that the non-associative view be considered as a fourth pathway, alongside Rachman's three associative pathways: direct conditioning, verbal information and vicarious (observational) learning (although see also Kleinknecht, 2002). Fears would develop whether via individual pathways or a combination of two or more pathways.

**1.4.2 Genetic mechanisms and fear acquisition.** It has been observed that anxiety, fear, and the various disorders derived from both states tend to run in families (Rapee, Schniering, & Hudson, 2009). It is believed by some researchers that a variety of factors within families, such as attachment issues and over-protection, are important contributors to the development of anxiety and go some way towards explaining familial aggregation of these disorders (Bögels & Brechman-Toussaint, 2006). However, it has also been suggested that as much as 50% of the variance in childhood anxiety may be attributable to genetic traits (Eley & Gregory, 2004). The genetic acquisition hypothesis suggests that anxiety or phobic fear occurs when an inherited (genetic) vulnerability is exposed to a threatening stimulus at a stage in development when children are primed to acquire fear for that particular stimulus (Boer & Lindhout, 2001). This is based on the assumption that normative fears appear at different stages of a child's development in a natural and adaptive way as an aid to survival (DaSilva, Rachman, & Seligman, 1977).

An interesting perspective on the acquisition of fear through a genetic mechanism has been suggested by the findings from twin studies, which provide the most convincing evidence for the role of genetic factors. With twin studies an attempt is made to disassociate the genetic from the environmental factors in the development of fears by looking at the degree to which both twins are affected and comparing identical and non-identical sets of twins. These studies show that it is possible to predict the fear responses of one or the other

of a set of twins to a particular event by simply observing the other twin's responses to the same event (Rose & Ditto, 1983; Stevenson, Batten, & Cherner, 1992). In a large twin study by Rose and Ditto (1983), 354 pairs of twins aged between 10 and 34 years completed the Fear Survey Schedule (FSS-II) (Geer, 1965). A twin's level of fearfulness was found to be predicted from the co-twin's score: approximately 20% of the variance in "fear of water" scores could be accounted for in this way. In an analysis of seven fear factors in 250 pairs of twins (144 monozygotic and 106 dizygotic twins), Phillips et al. (1987) also found heritability estimates for fear of water to be 20%, although this was at the lower end of the scale as other fear factors ranged from the lowest at 19% up to 39%. These findings support a view that, as far as phobic fears are concerned, inheritance appears to be specific rather than attributable to a general predisposition to the acquisition of fear (see also Fyer, Mannuzza, Chapman, Martin, & Klein, 1995). Furthermore, there is more similarity found in the magnitude of these fears for monozygotic twins whose genetic makeup is identical, as opposed to dizygotic twins who are genetically no more alike than other siblings would be (Stevenson et al., 1992).

Away from twin studies, Kleinknecht and Lenz (1989) found that there was a strong parent-child correlation in fainting responses for exposures to stimuli commonly associated with blood-injection-injury phobias. It is possible that these are attributable to the genetic traits of phobics who exhibit increased disgust-sensitivity (Manassis, Hudson, Webb, & Albano, 2004). Another study that looked at the occurrence of phobias within families: Fyer et al. (1990) found that occurrences of phobias were higher among all of the first-degree relatives of simple phobics than amongst the first-degree relatives of controls who had no such phobias. Similarly, Noyes et al. (1986) found that 12% of first-degree relatives of agoraphobia sufferers also suffered from agoraphobia. Also, while the prevalence rate for panic disorder in the general population is approximately 1 to 2% (Yates, 2009), 17% of the

first-degree relatives of panic disorder sufferers were reported as suffering from panic disorder. The findings are suggestive of a general underlying genetic factor for anxiety disorders. Öst (1989) found that 64% of blood phobia sufferers reported at least one close relative who was blood phobic. Female snake or spider phobics typically report a positive familial history for these phobias (Frederikson, Annas, & Wik, 1997).

Of course, while these results are consistent with the idea of the involvement of genetic influences, the possibility of imitation and learning cannot be ruled out. Other evidence supports a non-learning, non-associative account. For example, only 2% of children with fear of water report a prior aversive conditioning event with water leading to the onset of the fear (Menzies & Clark, 1993). Parents also often report that their children's fear of water was present from their first contact with water (Graham & Gaffan, 1997). However, Graham and Gaffan (1997) also found that children with fear of water were more likely to be firstborn children, which offers more support for social learning than genetic influence. Furthermore, they found that, for children of parents considered highly water-competent, if their parents frequently accompanied them in the water they were most likely not to fear the water. By contrast, however, the opposite pattern did not occur; so that for children whose parents were considered to have lower competence, there was no adverse effect from frequent contact. They also found no consistency across the groups in terms of parental competence with the "current fear" group (those who were visibly fearful) reporting low competence with the fathers and the "losing fear" group (had been fearful previously but the fear was no longer apparent) reporting lower competence with the mothers. They report that while there was little evidence to suggest that familial social learning played a causal role in learning water fear, there was evidence that it could help in preventing the development of this fear. Whilst not ruling out genetic influences, they reported that their findings suggest familial influences are complex and varied.

Available data suggest then, that familial aggregations could be the result of genetic or social influences, or a combination of both (Graham & Gaffan, 1997). While there is considerable evidence to suggest that the onset of fears relating to animals such as dogs are often preceded by associative learning events (Öst, 1995; King, Clowes-Hollins, & Ollendick, 1997; DiNardo et al., 1988; King, Gullone, & Ollendick, 1998), this is not the case with fears relating to heights or water (Graham & Gaffan, 1997; Menzies & Clarke, 1993). In a review of phobia studies relating to behavioural and genetic influences, Taylor (1998) suggested that general genetic influences act as a vulnerability factor for a variety of phobias, whereas specific factors predispose phobics to particular fears. Support for this view comes from Hofmann, Lehman, and Barlow (1997) who reported that where a person suffers from one phobia they are more likely to suffer less pronounced or subclinical fears of other phobia subtypes. The results of the studies discussed here do lend themselves to various interpretations; for example, evidence of the familial aggregation of specific types of phobia might be indicative of a genetically determined propensity; however, it could just as easily be the result of vicarious learning events or other shared experiences by members of the family.

**1.4.3 Disease avoidance model.** Some researchers have also suggested that feelings of disgust for a particular stimulus may contribute to the development of fears or phobias. They argue that the characteristics of a stimulus that evoke a sense of disgust may, regardless of the actual danger potential of the stimulus, contribute to the acquisition of fear for the stimulus (Davey, 1992, 1993, 1994; Davey, Forster, & Mayhew, 1993; Jain & Davey, 1992; Matchett & Davey, 1991; Ware, Jain, Burgess, & Davey, 1994). Davey (1992) found that spider fears co-vary with small fear-evoking animals such as snakes and lizards, and also with animals that evoke disgust such as maggots and slugs, but not larger predatory animals such as lions. Ware et al. (1994), referred to this category of animals (inclusive for example of, cockroaches, eels, mice and lizards) as ‘fear-relevant’, because although they are capable of

evoking a fearful response, they are not actually predatory animals. This led to the proposition that a number of commonly held animal fears may in fact have originated from a disease or contamination avoidance rather than a predator-avoidance process (Davey, 1992; Matchett & Davey, 1991). Thus the characteristics that make a specific animal disgust-evoking may relate to the degree that the animal is associated with disease; dirty places or places linked to disease or rotting foods; and/or stimuli that, while natural, are also disgust-evoking, such as faeces.

Some researchers have suggested a role for disgust in fear acquisition, and for individual sensitivity to disgust as a personality trait mediating fearful and non-fearful responses to particular animals (e.g., Davey, 1992; Matchett & Davey, 1991), but this theory is not without problems. In the first instance, a question arises over the validity of the measures employed by Davey in his earlier experiments to assess disgust and disgust-sensitivity. In relation to animals, disgust in his studies was measured on a scale based on a willingness to eat contaminated but otherwise desirable food (e.g., Davey, 1994; Davey et al., 1993). Employing this measure, Merckelbach, de Jong, Arntz, and Schouten (1993) were also able to show that spider phobics demonstrate greater disgust sensitivity than controls; however, due to its specificity, concern remains over its appropriateness as a measure of disgust sensitivity to animals. More recent research has also shown that disgust consists of two interdependent factors: disgust propensity and disgust sensitivity (van Overfeld et al., 2006). Disgust propensity refers to an individual's likelihood (how quickly) to respond with the disgust emotion in a particular scenario, whereas disgust sensitivity refers to the degree of negativity which that person attaches to the disgust experienced.

While more conventionally valid measures of disgust are available, e.g., the Disgust Scale (Haidt, McCauley, & Rozin, 1994, and modified by Olatunji et al., 2007), their use has been relatively inconsistent. In one study that did use this scale (a study involving spider and

blood-injection-injury phobics) researchers found higher scores on five of the Disgust Scale's subscales for phobics than for controls (Tolin, Lohr, Sawchuk, & Lee, 1997). More recently Muris et al. (2007) employed both the Disgust Scale and the Disgust Sensitivity Questionnaire, in a study of 9 to 13 year olds and found a significant correlation between disgust sensitivity and the symptoms of specific phobias. Consistent and accurate measuring of disgust has also proved somewhat problematic. Armfield (2006) points out that in their analysis of animal fear ratings, Ware et al. (1994) attributed the labels of "predatory" and "fear-relevant" somewhat arbitrarily to factors in their principle components analysis that could just as accurately have been alternatively labelled (e.g., "large" and "small"). They subsequently also equated fear-relevant to disgust-evoking animals and suggested a significant association between fear-relevant animals and disgust in eliciting fear. However, their arrival at this conclusion is problematic as the study itself did not involve any measurement of disgust (Armfield, 2006). Also the associations identified between disgust sensitivity and fear of either predatory animals, or fear-relevant animals, were small in both cases with no significant difference between the pairings. Following these findings, Davey (1994) suggested that fear of fear-relevant animals, but not predatory, animals was highly correlated to disgust sensitivity, suggesting that animals such as maggots, cockroaches, rats, etc. command our attention as they have historically been associated with disgust. Rats have been associated with the spread of bubonic plague and spiders with outbreaks of disease and infection generally, while maggots have been associated with contaminated foods and "slimy" snakes and slugs with mucus.

There has also been mixed support for the disease-avoidance model in relation to fear acquisition. Research has shown that even where participants were presented only with disease-relevant information about a particular animal, their self-rated fear was significantly more associated with the idea of danger in terms of possible attack by the animal than to any



perceived risk of infection from being bitten (Davey, 1994). Arntz et al. (1993) demonstrated that disgust is not a significant factor for spider phobics, but their study has been criticised for lack of robustness in terms of the self-report measure employed which consisted of the single question, “When there is a spider in my vicinity, I believe that the spider is dirty” (Armfield, 2006).

It would appear that disgust does attribute, to some animals at least, considerable aversive qualities. For example, Tucker and Bond (1997), demonstrated that fear of non-fear-relevant animals could be predicted by gender and sensitivity to disgust. Specifically, they found a significant correlation between femininity and fear of all categories of animal. Femininity and disgust predicted fear of fear-relevant animals; disgust was a predictor of fear with regards to “repulsive” animals. They also found that femininity predicted fear of “predatory” animals while disgust did not. The relationship between disgust and fear is illustrated well by the case of a woman who having mowed over a number of frogs while gardening subsequently developed a significant fear of frogs (Davison & Neale, 1994). It is thought that her fear resulted not from any sense of danger but from the disgust associated with the act of shredding the frogs.

Other research has seen disgust more closely associated with avoidance behaviour than fear (Woody & Tolin, 2002). Disgust is a more significant predictor of spider avoidance than anxiety (Woody, McLean, & Klassen, 2005), while an expectancy bias for consequences that are disgust-relevant, not fear-relevant, has been found to be a predictor of spider fear (van Overveld, de Jong, & Peters, 2006). A recent study also raises the possibility that fear of spiders is actually a fear that might be specific just to spiders, as findings indicate the rate of occurrence of spider fear cannot be explained simply by its potential for harm alone (Gerdes, Uhl, & Alpers, 2009). As spiders normally prey on insects their venom has not evolved to harm large vertebrates, the bite of approximately just 0.1%–0.3% of the world’s spiders is

potentially fatal for humans (Steen, Carbonaro, & Schwartz, 2004). Spiders will rarely use their bite against a vertebrate, even for defence (Foelix, 1996). By comparison, bee or wasp stings occur much more frequently and usually generate an immediate pain excessively out of proportion to the wound inflicted, yet there are virtually no reports of fear of arthropods other than the highly prevalent fear of spiders (Gerdes et al., 2009). Gerdes et al. (2009) presented 76 students with pictures of various arthropods (invertebrates with pairs of jointed limbs, the pictures consisted of 15 spiders, 15 beetles, 15 bees/wasps, and 15 butterflies/moths), and asked the participants to categorise them in terms of fear, disgust and dangerousness. They found significantly greater ratings of fear and disgust for spiders compared to other arthropods and spiders were also considered more dangerous. Significantly, they found that disgust was not a predictor of estimates of harmfulness; disgust ratings for spiders exceeded ratings of fear; and while the dangerousness of beetles was rated much lower than bees/wasps, the disgust ratings were similar. While the study clearly demonstrated a general correspondence between subjective estimates of dangerousness and fear, in the case of spiders the participants' fear ratings did not correspond with the objective dangerousness of spiders. Gerdes et al., remark that the stronger fear reactions toward spiders compared to other arthropods may suggest support for the preparedness theory. However, this should logically, given their prevalence and potential for harm, also apply to bees and wasps; yet these arthropods were considered less dangerous and elicited less fear. While research indicates that disgust does have some role to play in the aetiology of anxiety disorders then, the extent of its role and effect, in particular with regard to the development of specific phobias, remains largely undefined. Its effect on the acquisition of fear may be difficult to quantify but evidence suggests it is real and it may therefore play a significant role in facilitating fear acquisition.

Evidence for the non-associative account of fear acquisition remains weak, but the associative model of learning appears to offer a fairly robust explanation of how fears are acquired. Nevertheless, some questions remain. The model works well for direct conditioning events but it is unclear how it accounts, for example, for fears that develop with no direct aversive experience of the feared stimulus. Rachman (1977) proposed a solution to this dilemma; he suggested that as well as learning through direct conditioning events, fears may be learnt just as effectively through indirect methods such as verbal information and the observation of others. It would therefore be sufficient for someone to simply observe another person reacting in a fearful way to a stimulus for that person to then learn to fear the same stimulus.

## **1.5 Vicarious Learning**

***1.5.1 Evidence for the verbal information pathway.*** The classical conditioning theory of fear acquisition can at best offer only a partial explanation for the aetiology of fears (Rachman, 1998). Rachman (1998) suggested that the key points that classical conditioning theory failed to adequately address may be summarized as: (i) the fact that some people fail to acquire fear in what are unequivocally fear-evoking situations; (ii) the differential acquisition of fear amongst those with phobias; and (iii) the apparent ability to acquire fear through other processes such as vicarious learning and verbal information. As an alternative to the simplistic classical conditioning model, Rachman (1977, 1990, 1998) proposed that three pathways, one 'direct' and two 'indirect', could lead to the acquisition of fear: direct conditioning (having a direct traumatic experience with a stimulus); verbal transmission of information and instructions (being told that a stimulus is threatening in some way); and vicarious exposure (observing a person acting fearfully or in an encounter with a stimulus that has a negative outcome). Rachman also suggested that some people may be more

susceptible to the acquisition of fear by conditioning while others would be more affected by indirect, socially transmitted processes such as vicarious learning or information.

A number of studies have provided support for Rachman's theory, demonstrating a significant number of those with phobias attribute the onset of their fears to one or more of the three pathways (Hekmat, 1987; Himle, Crystal, Curtis, & Fluent, 1991; Merckelbach, Arntz, & de Jong, 1991; Merckelbach et al., 1989). Ollendick and King (1991) investigated Rachman's (1977) three pathways theory of the onset of fear in over one thousand American and Australian school children aged between 9 and 14 years. They used a self-report questionnaire developed to assess the pathways for 10 commonly reported fears found in children. Children were asked to specify on a self-reported questionnaire their own fear level and then whether: (1) they recalled having a disagreeable or fear-provoking experience with the feared stimulus (direct conditioning); (2) their family, friends or other associates ever showed fear or avoidance behaviour of the feared stimulus (vicarious learning); and (3) they had been informed of, or listened to, stories about fear-provoking things relating to the feared stimulus from their family, friends, teachers or other associates (information or instruction pathway). The results showed that most of the children attributed their fear onset to vicarious experiences (56%) and verbal instructional factors (39%) rather than to direct-conditioning (37%). Nevertheless, they also found that for those children who reported high levels of fear, it was necessary for them to have experienced direct conditioning as well as an indirect source such as information or vicarious learning. They suggested that Rachman's three pathways should be considered to be interdependent, so clinical fears in particular are more likely to develop in conditions where all three pathways are engaged.

Initial evidence, for the role of modelling and information in the development of fears and phobias came largely from retrospective studies such as the one just described (King et al., 1998; Merckelbach, De Jong, Muris, & van den Hout, 1996; Muris & Merckelbach, 2001;

Öst & Hugdahl, 1981). These studies suffered from the criticism that retrospective accounts were inevitably subject to memory bias or loss (Field, Argiris, & Knowles, 2001; King et al., 1998). They also relied on the use of questionnaires (e.g., Phobic Origin Questionnaire: Öst & Hugdahl, 1981) and these have been criticised for misattributing the causal pathway by their failure to fully identify the various components of the conditioning process (see Menzies & Clarke, 1994; Field, 2006). In order to address these shortcomings, Field, et al. (2001) developed and utilised a prospective paradigm to investigate the effects of negative verbal information in the acquisition of animal fear beliefs in children. Their results supported the earlier retrospective self-report studies, confirming that providing children with negative information about a stimulus they had not previously experienced can increase fear-related responses for that particular stimulus (Field & Lawson, 2003; Field, Lawson, & Bannerjee, 2008).

A more recent study involving 8-13 year olds and their parents examined whether negative information facilitates the transmission of fear from parents to children and found that changes in children's fear beliefs were determined by the type of information provided by the parent (Muris, van Zwol, Huijding, & Mayer, 2010). Parents were given positive, negative or ambiguous information regarding a novel animal and directed to recount a number of imagined encounters with this novel animal to their children. Parents who were provided with negative information told their children more frightening stories regarding the animal and as a consequence the children had significantly increased self-reported fear beliefs than those children whose parents had been provided with positive information regarding the animal. The children whose parents had received positive information reported a significant decrease in their fear beliefs regarding the animal. Thus the verbal information pathway to fear acquisition is supported both by retrospective self-report evidence with adults and prospective experiments with children.

**1.5.2 Self-report evidence for vicarious learning.** The second of Rachman's (1977) indirect pathways, vicarious learning, is also referred to as observational or social learning and refers to learning that takes place during observation of others, i.e. without any first-hand experience by the observer of direct conditioning. There is a great deal of self-report evidence (see Askew & Field, 2008 for a review) to indicate that fears are acquired in this way. The Phobic Origin Questionnaire (POQ: Öst & Hugdahl, 1981) is a self-report questionnaire that has been used extensively in assessing the function of Rachman's (1977) various pathways in the development of fears and phobias. It consists of nine questions to which 'either "Yes" or "No" responses are required of the participant, along with one open-ended question. The "Yes" or "No" responses are used to attribute the origin of their phobia to one of the following sources: *direct conditioning; vicarious learning; informational events; mixed onset; or no recall*. Thus, the respondent is asked to retrospectively assess which, if any, of the pathways contributed to the onset of their fear. Overall, this research has shown that between 57% and 78% of respondents attribute the onset of their fear to direct conditioning events, while the second most common source reported was vicarious learning events (17% to 42%). Information classed events rank third at between 10% and 25% (Merckelbach, De Ruiter, van den Hout, & Hoekstra, 1989; Öst & Hugdahl, 1981).

While some researchers believe that a combination of pathways is the most common cause of fear development (see e.g., Merckelbach et al., 1989), there is evidence to suggest that particular pathways occur more frequently in the acquisition of certain types of fears. The vicarious learning pathway, for example, has been associated more with fears relating to animals (22% - 27.5%), blood (24% - 25%), and dental phobia (12% - 15.6%), while being reported at much lower percentages as contributing to the onset of fears such as social phobia (12.9 - 15.6%) and claustrophobia (6.5% - 8.6%) (Öst, 1985, 1987, 1991; Öst & Hugdahl, 1981, 1985). However, as previously noted, direct conditioning events are reported at

significantly higher percentages than any other pathway: animals (48%); dental phobia (68%); social phobia (58%); and claustrophobia (5.5%) (Öst, 1987). While a small majority of phobics attributed the onset of their fears to direct conditioning events, the negative information pathway was found to be the least reported source across all phobia types (Öst, 1987). Research has also shown that vicarious and information learning events have been reported for fears that were acquired earlier, and direct conditioning events more for fears acquired later (Öst, 1987). It may even be the case with those relating their fears to later direct conditioning events that the original onset may be attributable to an earlier vicarious or information event (particularly if this was many years previously) as direct conditioning events are generally more easily remembered (Withers & Deane, 1995). In support of Rachman's (1977) suggestion that indirectly acquired fears will not be as strong as those acquired directly, indirectly acquired fears relating to animals do tend to be milder than those acquired directly; however, the same is not true for other fears such as social phobia (Öst & Hugdahl, 1981). In the case of severe spider phobics, a later study, again employing the POQ (Öst & Hugdahl, 1981), showed 71% reported modelling as the onset of their fear, while those reporting a direct conditioning source reported less severe fear-related cognitions than those who had attributed onset to indirect pathways (Merckelbach, Arntz, & De Jong, 1991). While these studies looked at clinical phobics and may be considered too narrow to be representative of fears in general, a later study (Merckelbach et al., 1989) found no difference in physiological or cognitive measures between those reporting fear onset attributable to direct or indirect pathways.

The use of the POQ has been criticised on a number of grounds. Firstly it is retrospective and thus prone to memory bias. It has been mentioned previously that specific phobias normally commence during childhood; animal phobias, for example have a mean onset age of 7 years (Öst, 1987). Adult recall of childhood events is not always reliable and it

may therefore lead to misattribution of onset (Menzies & Clarke, 1994). It is unsurprising then that when asked to remember an event that happened 10 or 20 years previously many report that they have no memory of such an event or for that matter when exactly their phobia commenced (Ollendick & King, 1991). Secondly, no strict definition of what constitutes a conditioning event has been employed within these studies (Menzies & Clarke, 1994; Withers & Deane, 1995). A further criticism suggests that the POQ is itself biased towards Rachman's pathways in that it does not incorporate any options other than conditioning, modelling and negative information. Menzies and Clarke (1993) argue that the POQs artificially inflate the role of direct conditioning events by narrowing the respondent's choice for onset of their phobia to one or a combination of Rachman's pathways. For example, it does not offer an option for someone who might consider that they have always had a particular fear, i.e. no learning event was involved. When such an option was available on a questionnaire used by Jones and Menzies (1995) they found that the majority of their respondents chose it (68%: 13 from a total of 19 undergraduates), which they argue offered support for a non-associative model of phobia aetiology (see also Kirkby, Menzies, Daniels, & Smith, 1995, in which 86% of adult respondents claimed that their spider phobia had always been present). However, Kheriaty, Kleinknecht, and Hyman (1999) also looked at the role of learning events in the onset of fears with undergraduates in which they not only employed the POQ, but also used the Phobia Origins Structured Interview (POSI). Consistent across both methods, they found that conditioning experiences were reported as the most frequent cause of fear onset. Significantly, for the majority of the reports they were also able to obtain confirmation of their findings from the phobics' parents (see also Merckelbach & Muris, 1997; Merckelbach, Muris, & Schouten, 1996). Where studies have concentrated on fears that are believed to have been of particular importance in mankind's evolutionary history (e.g., fear of heights and fear of water) the results have favoured a non-associative



explanation (Menzies & Clarke, 1993; Graham & Gaffan, 1997) leading to Poulton and Menzies' (2002) suggestion that the non-associative account be viewed as an additional pathway to fear specifically applicable to the acquisition of evolutionary-relevant fears.

Studies that have employed structured interviews have, on occasion, shown indirect learning events to be less significant for animal fears than POQ studies show (see McNally & Steketee, 1985). In another study looking at the development of blood fear, Kleinknecht (1994) found that while 53.1% of respondents attributed onset to conditioning events, only 15.5% of respondents attributed onset to vicarious learning events. In this study, however, the respondents (all undergraduates) had been classified as fearful by virtue of a self-reported response on a questionnaire and the results contrast with other POQ studies such as Öst (1991), which looked at blood phobics undergoing or having recently completed treatment. Öst found that while 53% attributed onset to conditioning events, 24% attributed onset to vicarious learning events. Arguably, the level of fear experienced by those participating in Öst's study may have been more intense than the respondents in Kleinknecht's (1994) study, and this may go some way in accounting for the contrasting results.

Studies where structured interviews have been used have also found low reporting of vicarious learning events as a cause of fear onset. In one such study, Rimm et al. (1977) found that only 7% of participants reported vicarious learning events as causing onset of their fears. The largest number (35%) attributed onset to a conditioning event, while those who were unable to attribute their fear to any causal event represented 29% of the sample. In contrast to these findings, Murray and Foote (1979) found little evidence for direct conditioning events in onset, while reporting a significant role for vicarious learning events. They categorized the participants as having either a low, high or phobic fear of snakes and found that for the phobic group, reports of vicarious learning events were significantly higher than for the low-fear group. They also found that for males, snake fear correlated with

parental snake fear, while mothers' snake fear was reported as significantly higher for members of the phobic-fear group. However, there was no correlation between the participants' level of snake fear and the experiences of either parent with snakes. This suggested that simply observing a parent's fear of snakes, rather than experiencing a parent interacting with a snake, may be sufficient to represent an emotional modelling event. Additionally they reported that the phobic-fear group reported obtaining more negative information regarding snakes from parents or television and other such visual media, hinting at a wider role for observational learning. Furthermore, it is possible that participants recalling a specific event regarding onset or recalling that their fear was always present may be recounting a narrative as opposed to historical truth (Spence, 1982), i.e. describing events in a way that makes sense to them of their lives rather than what did actually happen. Similarly they may recall a real event that was not in reality the cause of onset (Brewer, 1988). In an effort to appease leading questions participants may imagine an event that never took place at all (e.g., Hyman, Husband, & Billings, 1995; Lindsey & Read, 1994; Loftus, 1993; McNally & Steketee, 1985).

Taylor et al. (1999), used the Origins Questionnaire (OQ: Menzies & Clarke, 1993). Unlike the POQ it was designed to allow participants to report that they had always had their driving fear, or that they could not attribute onset to a particular event. Taylor found that 46% of those who had attributed the onset of their fear to a particular pathway had changed their choice one year later and only 56% of those who had attributed the onset of their fears to associative learning events still maintained that this was the case. Such issues are a legitimate concern for all studies relying on retrospective data, and a final concern for POQ and OQ studies must be the fact that such measures only report subject appraisals of the cause of onset, and not necessarily the actual cause of the fear.

A further criticism of self-report studies is that they generally lack control groups (participants with no fear of the stimuli), hence it is not possible to know if the reported learning events actually occur more often among those reporting fears than those who do not (Di Nardo, Guzy, Jenkins Bak, Tomas, & Copland, 1988). In a study involving dog phobic students, Di Nardo et al. (1988) divided participants into high and low fear groups and found direct conditioning experiences (such as bites or scratches) accounted for 56% of fears (with 44% not classified). When compared to the low-fear group this figure was not significantly higher. They concluded that aversive experiences with the stimulus did not accurately predict onset of fear (see also Merckelbach, Arntz, Arrindell, & De Jong, 1992; Lauth, 1971). While these studies appear to show that the fearful and non-fearful share similar experiences (with different outcomes), it remains entirely possible that the experiences of fearful individuals are indeed different to non-fearful participants, as the POQ reports narrowly on the occasion of events and not on their perceived intensity (Merckelbach et al., 1992). This factor may be significant in determining whether a fear develops or not. Other factors, such as individual vulnerability or latent inhibition may also be significant in the learning of fear leading to very different outcomes for persons sharing an experience (Davey, 1997; Mineka & Öhman, 2002; Mineka & Zinbarg, 2006).

One possible solution to these problems (at least as far as child studies are concerned) is to compare the results of the study with parental reports. Merckelbach, Muris, and Schouten (1996) did just this with a revised version of the POQ. While a large number of the parents and children ascribed onset to direct conditioning events (41%), a similarly large number of children (46%) claimed to have always been afraid. Interestingly, the results seemed to suggest that rather than being responsible for onset, vicarious learning and information contributed to the subsequent chronic development of fear. This study also indicated that for those children who attributed their fears to vicarious learning events, it was

the mother, not the father, who appeared to be the model (see also Muris, Steerneman, Merckelbach, & Meesters, 1996; Muris, Merckelbach, & Collaris, 1997).

The problem remains that self-report literature offers inconsistent and conflicting findings, with some, none or all of Rachman's pathways variously being implicated in the development of fears (Merckelbach et al., 1989). While some studies claim a large role for vicarious learning in the development of certain fears (e.g., animals) others claim little evidence of vicarious learning in development and none in onset. While parental reports may be used in studies involving children to provide additional validation of memories recalled by the participants, such reports are also of questionable efficacy. In one such report for example, researchers found that the parents of the young children involved reported 41% fewer fears for their children than the children themselves actually did (Lapouse & Monk, 1959), while in another for 21% of the cases where a child had claimed recall of an onset event, parents reported an onset event prior to that mentioned by their child (Kheriaty, Kleinknecht & Hyman, 1999). These issues affecting the efficacy of self-report studies have been recognized by a significant number of researchers and the desire for more prospective research is now widely accepted (e.g., Field et al., 2001; King et al., 1998; Kleinknecht, 2002; Mineka & Ohman, 2002; Poulton & Menzies, 2002).

***1.5.3 Longitudinal evidence.*** The *Dunedin Multidisciplinary Health and Development Study* has been used in a number of studies to examine the aetiology of fear. An early study reported a correlation between dental phobia and the number of tooth cavities that a child had developed by the age of 15 years. Assuming the higher number of cavities indicated a higher number of (potentially aversive) dental treatment events, this suggested that direct conditioning events are important (Poulton et al., 1997). In contrast, it was subsequently demonstrated that for 18 year olds with height fear, none had experienced a significant fall before the age of 9 years. This was interpreted as suggesting that their fear

was not predicated on a direct conditioning event (Poulton, Davies, Menzies, Langley, & Silva, 1998). Furthermore, it was shown that children aged between 5 and 9 years old who had experienced significant falls were less likely to have a fear of heights, suggesting a role for habituation. Further support for this non-associative model of fear acquisition is provided by a later study of 18 year old water phobics that produced similar results. The non-associative account predicts that increased familiarity with heights or water should lead to a reduction in fear, in the absence of aversive experience or poor habituation (Poulton & Menzies, 2002). This account, however, makes no allowance for the possibility that individuals may have acquired their fears at an earlier age, either through direct conditioning or through some vicarious learning event. Such earlier learning events might themselves lead to avoidant behaviour, thus explaining for example why they would be less likely to experience significant falls later (Davey, 2002).

When researchers used this longitudinal data to look at the importance of vicarious learning they found that parents' avoidance of fearful situations may provide negative modelling, or at least reinforce such behaviour in their children (Poulton, Milne, Craske, & Menzies, 2001). When Poulton et al. (2001) looked at the development of anxiety in children at 3, 11 and 18 years of age their findings generally supported the non-associative model. They found that separation before the age of 9 years was negatively related to separation anxiety reported at 18 years. However, vicarious learning was the most significant conditioning variable for separation anxiety at the age of 11 years, suggesting a potentially critical role for the interactive effects of associative and non-associative processes at particular periods during a child's development.

While longitudinal studies attempted to address some of the methodological limitations discussed previously in relation to the self-report studies, Mineka and Öhman (2002) have remarked that the Dunedin studies are nonetheless still based upon retrospective

accounts gathered over intervals of a number of years documenting recollections of events that occurred in the intervening periods. Given the doubts cast upon the reliability of such memories (e.g., Taylor et al., 1999), how dependable the recall data provided by longitudinal studies such as the Dunedin studies actually are remains uncertain. Another limitation that longitudinal studies such as these share with the available self-report literature is a lack of enquiry depth; for example, Kleinknecht (2002) has noted that these studies provide no information on what it is exactly that water phobics fear: clearly not water as such, as they drink it and wash in it without any issue.

In seeking to reconcile the two accounts of fear development, non-associative and associative, Davey (1995, 2002) has described the non-associative account as an ultimate explanation of phobias whereas associative learning is proximal, i.e. the non-associative account attempts to explain phobias in terms of evolutionary development and their adaptive function, while associative learning attempts to explain the biological or psychological processes that facilitate the acquisition and maintenance of fear. Such a difference in the levels at which both accounts operate permits for operational independence without mutual exclusivity; for example, affording some degree of innateness to fear of water would not preclude a mechanism supporting its development via a process of CS-US associations (Davey, 2002).

**1.5.4 Experimental evidence for vicarious learning.** Experimental studies indicate that in many species, observation of expressions of distress in another conspecific can be an efficient and less risky method of acquiring fear-relevant information regarding shared stimuli and events. For example, observational fear-learning has been reported for rodents (Heyes & Dawson, 1990; Kavaliers, Choleris, & Colwell, 2001); fishes (Mathis, Chivers, & Smith, 1996); cats (John, Chesler, Bartlett, & Victor, 1968); dolphins (Yeater & Kuczaj, 2010) and perhaps more importantly various studies involving primates (Cook & Mineka,

1990; Mineka & Cook, 1993; Mineka, Davidson, Cook, & Keir, 1984; Mineka et al., 1984; Cook et al., 1985); and humans (Berger, 1962; Vaughan & Lanzetta, 1980; Gerull & Rapee, 2002; Olsson & Phelps, 2004). These studies have demonstrated that the observation of fearful behaviour and fear in facial expressions constitutes an effective US. That is, simple observation of another's fearful response to a stimulus is sufficient for the observer to learn to fear that stimulus (de Rosnay, Cooper, Tsigaras, & Murray, 2006).

**Monkeys.** The clearest evidence for observational learning comes from studies carried out in the laboratory with Rhesus monkeys (e.g., Mineka et al., 1984; Cook & Mineka, 1989). Mineka et al. (1984) were able to induce a persistent fear of snakes in a laboratory monkey that had been briefly exposed to a model behaving fearfully towards a snake. Cook and Mineka (1989) achieved similar results using edited videos, rather than live monkeys models. Mineka and Cook (1986) also reported that it was possible to “immunize” a monkey for fear of snakes by exposing the monkey to a model behaving in a non-fearful manner with a snake prior to learning. This suggestion that positive modelling might be used to reduce or immunize against fear is an important one for those involved in the prevention of phobias and other fear-related disorders in children.

Cook and Mineka's experiments showed that monkeys can vicariously acquire fear (CR) of snakes (CS) by observing films of model monkeys reacting fearfully to snakes (US) (Cook & Mineka, 1989, 1990). Significantly, monkey research has also demonstrated that the relationship between the US, UR, and the CR in classical conditioning paradigms is replicated in observational learning, in that a relationship exists between the degree of distress expressed by a model, the immediate response of the observer to that distress, and the resulting fear learning acquired by the observer (Cook & Mineka, 1990; Mineka & Cook, 1993).

Interestingly, Cook and Mineka (1989) found that rhesus monkeys were more susceptible to the vicarious acquisition of fear towards predator-like stimuli (toy snake or a crocodile) than for fear-irrelevant stimuli such as flowers or a toy rabbit. Cook and Mineka trained laboratory-reared infant monkeys, who had no previous experience of snakes, to take food without any exhibition of fear even when the food was placed beside a toy or even a live snake. Nevertheless, these monkeys also subsequently developed fear of snakes after observing snake-fearful monkeys refusing to reach for food placed close to the snakes. But these infant monkeys did not acquire a fear of flowers after observing another monkey apparently displaying fear of the flowers (Cook & Mineka, 1989, 1990).

In summary then, Mineka and Cook (1993) demonstrated that vicarious learning is a form of CS-US associative learning (Mineka & Cook, 1993) in which observer monkeys learn fear responses (UR) in response to other monkeys' fear (US) for snake stimuli (CS). Finally, Cook and Mineka (1990, 1989) demonstrated that monkeys selectively associate fear-relevant stimuli with fear. Mineka and Cook (1993) were able to demonstrate compelling evidence that vicarious learning leads to rapid, robust, and persistent fear learning in monkeys. However, it is less clear whether this evidence from monkeys can be generalised to humans.

**Adults.** Berger (1962) carried out a number of experiments demonstrating that it was possible for an observer to vicariously acquire emotional responses to a stimulus, i.e. without direct experience of an aversive outcome. In these experiments observers watched a classical conditioning procedure in which a model appears to receive an electric shock, feigning a painful response shortly after a buzzer had sounded. The observers subsequently demonstrated conditioned galvanic skin responses to the sound of the buzzer alone. Hygge and Öhman (1978) looked at autonomic fear conditioning in adults and found that the fear responses acquired for fear-relevant CSs (e.g., a snake), which had been paired with an



adult's fear expression (US), were similar to those acquired during CS-US fear conditioning. Studies of this type have received some criticism with the suggestion that the measures used, such as skin-conductance, may be indicative of responses other than just fear; for example "attention" or "interest", which are associated with fear but are also associated with other emotional responses (Öhman & Mineka, 2001). However, more support for observational learning in human adults was provided by a more recent study carried out by Olsson and Phelps (2004). They demonstrated that fear for a CS acquired through observation of a model exhibiting distress was expressed both when the CS was seen and unseen ('backwardly masked'). Participants observed a film of a person conditioned to fear what would ordinarily be considered a neutral stimulus (a blue square) using electric shocks; something they would naturally find aversive. Whenever the blue square was presented on screen the person in the film received a mild electric shock, while a yellow square did not have any shock associated with it. The person in the video would respond with obvious distress when the blue square appeared and would clearly be in distress in anticipation of the shock even before it was administered. Conversely, when a yellow square was presented he would be calm and relaxed. The participants in the study were then informed that they would be taking part in a similar experiment. When they were subsequently presented with a blue square they responded with fear in anticipation of the shock, which they did not actually receive (see also Olsson, Nearing & Phelps, 2007).

***Pre-school children.*** Children consistently attribute the onset of fear to modelling experiences (Muris, Steerneman, Merckelbach, & Meesters, 1996) and many studies have suggested that modelling is a significant component in the acquisition of childhood fear beliefs (Craske, 1999; Moore, Whaley, & Sigman, 2004; Muris & Merckelbach, 2001; Rapee, 2001). A number of studies have provided evidence of infant children actively engaging in a search for emotional information in the face of their primary care-giver (usually a mother) in

an attempt to appraise a novel object or event (Feinman, Roberts, Hsieh, Swayer, & Swanson, 1992). This is known as social referencing and has been suggested as a source of vicarious fear acquisition in children (de Rosnay et al., 2006).

When in an ambiguous situation, young children appear to regard the emotional responses of others as the direct result of some cognitive evaluation process and thus they modify their own response to the situation accordingly. Studies have demonstrated support for the notion that appraisals of certain attitude objects can be changed by modifying their affective properties. A number of studies have suggested that children make use of social referencing, particularly at the stage in their development where they have not yet acquired the skill of speech. In circumstances where they are uncertain they will look to the emotional responses of others and formulate their own response based on the signals that they perceive. In social referencing studies, children's mothers have typically conveyed emotional signals by either displaying archetypal facial expressions (Klinnert, 1984; ; Sorce, Emde, Campos, & Klinnert, 1985), giving verbal signals (Svejda & Campos, 1982), or by a combination of reactions where they managed positive affect (speaking to their infants or the stranger in either a positive or a neutral tone) (Feinman & Lewis, 1983). For example, Klinnert (1984) showed infants (either 12 or 18 months) three unfamiliar toys chosen to cause them to react with uncertainty. During the trials, when children were presented with the novel toy and would look at their mothers' faces, the mothers would adopt either: a smiling, a fearful, or a neutral expression. Regardless of their ages, infants moved furthest from their mother when she adopted an expression of joy, and remained at an intermediate distance when she adopted a neutral expression. The results indicated that by the age of 12 months children search for information in facial expressions and then adjust their own behaviour in line with the information obtained (Klinnert, 1984).

Gerull and Rapee (2002) adapted the social referencing paradigm and were able to show that children (17-months-old) had learned anxious and avoidant behaviour towards novel stimuli by having their mothers display negative facial expressions when the stimuli were presented. This provided support for previous studies that had suggested children from 12 months refer to the emotional reactions of others when evaluating an ambiguous event or novel stimuli and these learned responses persist later in the absence of the facial reference (e.g., Campos & Stenberg, 1981; Feinman, 1992; Sorce et al., 1985). Moreover, studies have shown that this effect may be achieved by affective expressions from adults that are facial (Klinnert, 1981; Sorce et al., 1985), vocal (Svejda & Campos, 1982), or a combination of both (Gunnar & Stone, 1984). De Rosnay et al. (2006) also showed that it was possible for young children to develop fear of a stranger by observing their mothers' fearful responses to the stranger; although it remains unclear in this case whether this reflected a genuine *learnt* emotional response or was simply a behavioural change typically demonstrated in social referencing experiments. Maternal modelling can also affect pain behaviour in children. Having observed their mothers' exaggerated pain response to a cold-pressor task, children also subsequently exhibited increased facial pain responses (Goodman & McGrath, 2003).

***Significance of primary carer.*** While the purpose of these early studies was to show that children's behaviour was influenced by a process of social signalling, the studies also assumed the basic premise that if a child is susceptible to another's affective signals, then it is the mother's signals that would be most effective (Campos & Stenberg, 1981). Social referencing theory suggests that children are discerning when referencing and will express a preference for adults who they are familiar with and who presumably they can trust more than strangers (Klinnert, Campos, Sorce, Emde, & Svejda, 1983). In a self-report study involving 9-12 year olds, measures were taken of fear for both the children and their parents. Additionally the parents were asked how frequently they might express fear in front of their

children. The results showed a positive association between the parents' trait anxiety and the children's. It also showed that the children's fearfulness was positively correlated to their mothers' fearfulness, not their fathers', with the highest levels of fearfulness reported by children whose mothers most frequently expressed fear in front of their children and the lowest by children whose mothers claimed to have rarely expressed fear in front of their children.

Studies have suggested that children will give more weight to the emotional responses of their mothers than to those of strangers (Zarbatany & Lamb, 1985; Sorce et al., 1985). Children (aged 10-14 months) look to their mothers more frequently than towards other mothers or other infants (Field, 1979). However in one study, a familiarised experimenter presented 12 month olds with an unfamiliar and unusual toy and adopted either a happy or a fearful expression. The majority of children (83%) referenced the familiar experimenter and modified their behaviour accordingly. The results demonstrated that it is possible for children to be influenced by the facial expressions of adults other than their primary care giver (Klinnert, Emde, Butterfield, & Campos, 1986). In another study designed specifically to look at the function of emotional signalling within the realm of the attachment relationship, 12-month-old children were placed in an uncertain situation (visual cliff) that required social referencing (Bradshaw, Goldsmith, & Campos, 1984). Bradshaw et al. (1984) assumed that children would refer more to their mothers than to another adult who was also present but unfamiliar to them. They expected a preference for the mother which could be explained as indicative of a pre-existing attachment relationship. However, they found that children referred to the stranger to almost the same degree as they referred to their mothers. Unfortunately, they were unable to determine from their results whether the children modified their behaviour based on the strangers' signals, as both the mothers and strangers were presenting the same emotional signals in their study.

Bradshaw et al.'s findings were supported by Zaratany and Lamb (1985) who, in a study of 14-month old infants, also found that infants referred to strangers as much as they did to their mothers. Their results did, however, demonstrate that infants modified their behaviour based on their mother's signals, but not on the signals of the strangers. Zaratany and Lamb (1985) exposed infants to an unfamiliar stimulus (a novel toy spider) selected so as to cause uncertainty in the child. They placed their 12-month-olds in a room with either their mother or a stranger; the infants were then presented with a novel stimulus and received either positive or fearful facial cues toward it from the adult present. Depending on the condition, the children's mothers or a female stranger would display either a happy or a fearful expression for the children to observe. In the positive condition they found that the children reacted more positively to the stimulus, the toy spider, compared to the fear condition: children were more prepared to approach the spider if their mother displayed a happy expression than if their mother was conveying fear. However, whether the stranger expressed a happy or a fearful face, children did not respond any differently. Children did seek information from strangers as much as from their mothers but even though the signals conveyed by the strangers were stronger than those of the mothers, they did not use the stranger information to modify their behaviour towards the toy spider. These findings support the idea that infants selectively reference their mothers as opposed to strangers. However, the results may have also been affected by the fact that the children were left alone with the stranger: the anxiety that they would have experienced in this situation may have affected their ability to perceive or use the strangers' signals appropriately. Furthermore, the results of this study supported the findings of Klennert et al. (1983), who also reported behaviour modification in infants in response to the affective signals of strangers.

***School-age children.*** In view of the limitations associated with data presented by retrospective studies, a prospective paradigm was developed by Field, Argyris, and Knowles

(2001) to investigate the effect of Rachman's (1997) indirect pathways in the aetiology of fear. They investigated the effects of verbal information and vicarious learning on a sample of children aged 7-9 years old. This age group was chosen because of its apparent relevance in the onset of animal phobias (Öst, 1987). Their experiment involved the presentation of novel (unknown to UK children) stimuli with positive or negative information either as a video or verbally in the form of a story. They provided information in relation to two novel toy monster dolls using one of two pathways: the first was vicariously, in the form of 30-second video of the reactions of an adult to each monster either happily or with fear; the second pathway was verbal information in the form of positive/negative stories relating to the monsters. Before and after learning children completed a questionnaire to ascertain their fear beliefs for the novel toys. Their results showed that fear beliefs towards the monsters changed significantly as a consequence of negative verbal information, but not video information (although a non-significant increase in fear beliefs was observed for the monster that the children saw presented with the fearful model). It is possible that the video used may not have been effective in conveying the relevant information or was poor in doing so (Field et al., 2001). An alternative interpretation could be that vicarious learning is only effective where the stimuli used are fear-relevant and as such would be ineffective with the make-believe monsters employed in their experiment (c.f. Cook & Mineka, 1989).

Support for the vicarious pathway was provided by two experiments carried out by Askew and Field (2007) in which they demonstrated that relatively mild vicarious learning experiences could create both cognitive and behavioural changes in fear beliefs. Children (aged 7-9 years) were shown three novel Australian marsupials novel to UK children, (the quokka, the quoll and the cuscus) along with counterbalanced pictures of adult faces, either happy or scared, or no faces (control). Children's fear beliefs significantly increased for animals they had observed with scared faces in contrast to animals observed with no faces

(unpaired), and stayed higher one week later. What is more, they also detected increased fear beliefs using an affective priming task (indirectly) for scared-paired animals, and this persisted for up to three months. The basic effect has since been replicated for a variety of stimuli including flowers, caterpillars and snakes (Askew et al., 2013) and prior negative information about animals has been shown to facilitate learning (Askew, Kessock-Philip, & Field, 2008).

In their second experiment Askew and Field (2007) demonstrated that children were significantly slower to approach a box which they believed contained an animal they had previously seen together with scared faces. Overall, their results suggested that this procedure produced changes in children's fear beliefs for animals via CS-US associative learning, in which a neutral stimulus (CS) becomes associated with a model's response (US) to it. They also demonstrated persistence for the changes produced.

A subsequent study using a similar methodology (but different stimuli) looked at filmed peer modelling and found positive peer modelling led to significant decreases in fear beliefs and avoidant behaviour for the modelled, but also the non-modelled animal (Broeren, Lester, Muris, & Field, 2011). This was interpreted by the researchers as possibly being due to a generalization effect. Conversely negative modelling led to an increase in fear beliefs for the modelled animal only, and not for the non-modelled animal. This the researchers attributed to a possible comparison effect. In general they also found effects obtained with negative modelling to be slightly weaker than for positive modelling. This they attributed to a combination of procedural issues and the potency of the negative modelling film, which may have been less effective because the stimulus (a novel guinea pig) might not have been readily associated with danger.

The methodology in the prospective paradigm employed in these later experiments addresses limitations in previous retrospective studies. To begin with the prospective nature

of the paradigm means that sample populations are assessed at a period in their development when it is believed phobias develop. Findings from such studies are more generally applicable as the sample population is normal, not clinical. Participants in these studies are not asked to make any decision as to the onset of a pre-existing fear; consequently there is no compulsion for them to attribute the origin of their fear to one of Rachman's pathways. Importantly, the use of an experimental manipulation like this affords the experimenter the ability to control the learning events in a study, maintaining a consistent learning event across the sample population, thus enabling an accurate attribution of causality to any change in fear beliefs. This is a major advantage over the previous retrospective studies where it was difficult or impossible to be confident about the assumed equivalence of the retrospectively reported events across the experimental groups. Nevertheless the retrospective literature is predicated on the assumption of this equivalence.

As discussed, it has been suggested that vicarious learning is a form of associative learning underpinned by CS-US pairings (Askew & Field, 2007, 2008; Mineka & Cook, 1993). In studies such as Askew and Field's the CS is an unfamiliar animal and the US is the visual fear information that the children observe. Associative learning has a specific set of known characteristics. If vicarious learning is a form of associative learning then these characteristics should also apply to vicarious learning. Both classical conditioning and vicarious learning events have been shown to exhibit similar behavioural characteristics. For example Olsson and Phelps (2004) suggest that recent research has demonstrated a commonality in the neural networks that support personal emotional experiences and those that support the perception of emotions in others. This may explain the potency of observational fear learning, i.e. observing another's fearful reactions serves as a US as potent as a direct conditioning event. Further support for this consistency is also provided from more recent research which has shown that fears acquired via vicarious learning engage similar



neural mechanisms to classical fear conditioning procedures (Olsson, Nearing, & Phelps, 2007). Therefore to understand vicarious learning fully we need to understand these shared characteristics, and whether what we currently understand with regards to classical fear conditioning is applicable to vicarious fear-learning. Thus, associative learning models may provide an understanding of the mechanisms involved in vicarious fear acquisition and suggest interventions to inhibit or reverse fear development.

### **Characteristics of Associative Learning**

#### **1.6 General Conditioning Procedure**

Associative learning in general, but more specifically fear conditioning, is of significant clinical importance in developing a better understanding of anxiety disorders and in assisting with the development of more effective treatments. To understand the role that associative learning might play in the acquisition of specific fears it is necessary first of all to understand the processes that underpin this type of learning. Short-delay conditioning is the procedure most commonly used for Pavlovian conditioning. During this procedure the CS in each trial is followed after a brief (less than a minute) interval by the US. The CS may finish when the US starts or it may continue with the US.

For conditioning to be most effective, it is necessary for the CS to be a good signal for the imminent presentation of the US. This is best facilitated by the short-delay conditioning procedure where the CS is followed after a short delay by the US. It follows then that as the CS-US interval is increased, the CS becomes a less potent signal for the presentation of the US. Conversely, where the CS and US are presented simultaneously the CS cannot be a signal for the US. With trace conditioning, as the CS is followed by a trace interval instead of the US, it is the trace interval itself that is the predictor of the US.

## **1.7 Counterconditioning**

Research to date has shown that associative learning theory offers a convincing explanation of fear acquisition. It may also offer an insight into the mechanics of unlearning such fears in an effect known as counterconditioning (Field, 2006). During counterconditioning procedures, a CS that has previously been associated with one US is subsequently associated with a second, alternative, US with characteristics that are usually contrary or incompatible with the first US. As a result, it is typically observed that responses congruent with the first association are replaced by responses congruent with the second (Bouton, 2004).

It has long been reported that a previously conditioned response can be extinguished by associating the CS with a response that is incompatible with the previous response (Pavlov, 1927). Indeed, Watson and Raynor (1920) suggested that one method of reducing or removing fears would be to form an association between the feared stimulus and some alternative enjoyable experience. Seeking confirmation of this theory, Jones (1924), who was a student of Watson, carried out a counterconditioning experiment on a boy (Peter) who had a fear of rabbits. Jones presented a rabbit to the boy while he was engaged in a pleasurable activity: eating his favourite food. Initially the rabbit was presented in a cage, in a part of the room far from Peter. Over a series of days the researcher slowly introduced the rabbit; on each presentation it was moved a little closer to the boy's chair. Eventually Jones reported that the boy did lose all fear of the rabbit and in fact ultimately, actively sought out the rabbit's company.

From a clinical perspective, two types of counterconditioning have been employed with human beings: aversive (negative) and appetitive (positive) counterconditioning. In aversive counterconditioning the goal is to reduce the desirability of the CS by pairing it with an aversive US, such as an electric shock. Conversely, the goal in appetitive conditioning is

to use a pleasant US (e.g. food, water, praise) to increase the desirability of the CS. If a tone is sounded or a light is turned on immediately prior to the presentation of food, and this is repeated over a number of trials, then simply the sound of the tone or the light being turned on alone (a positive CS+) will cause an animal to salivate (in anticipation of the food) (e.g. Pavlov, 1927). This is *appetitive conditioning* as the US is pleasant or rewarding. Thus, Jones' (1924) study is an example of *appetitive counterconditioning* because Peter's fear of rabbits diminished when his favourite food became the pleasant US predicted by the rabbit CS. This is an early example of *systematic desensitisation*, the most commonly used therapy based on this type of counterconditioning, in which a feared stimulus is associated with something positive. Another example comes from Wolpe (1958) who first induced anxiety in cats by giving them electric shocks (aversive US) when they were in a specific box (CS). Hence the cats would exhibit anxious behaviour whenever they were in or near the box. Wolpe observed that their anxiety could be reduced by subsequently introducing a counter-anxiety behaviour; in this case feeding the cats, initially at some distance away from the box, but over time feeding them closer and closer to the box that had originally induced their anxiety. Wolpe argued that one association, between the box and the electric shocks (CS and negative US), was being countered by another between the box and feeding (CS and positive US).

The concept of *reciprocal inhibition* was also introduced by Wolpe (1958). Borrowed from physiology, it argues that counterconditioning is facilitated by the inhibitory effect of one part of the nervous system operating on another part of the nervous system. For example in the case of desensitisation, it may be that the parasympathetic system (responsible for recuperation and returning the body to a balanced state after experiencing pain or stress) is exerting an inhibitory effect on the sympathetic nervous system (which is responsible for fight or flight responses). In effect the part of the nervous system responsible for exerting a

calming influence is overruling the part that would otherwise induce anxiety and a desire to act, i.e. inhibiting anxiety. However, reciprocal inhibition has been criticised for a lack of supporting evidence. For example, Wilson and Davison (1971) argue that the primary process involved in systematic desensitisation is actually extinction, not reciprocal inhibition. Extinction occurs when the CS is repeatedly presented in the absence of the US so that while the CS is present there is no bad experience to associate it with. Repeated exposures to the feared CS on its own, without anything bad happening, thus leads to a gradual reduction in fear. So it is argued that counterconditioning is really only extinction albeit with a procedural difference in its application. With both procedures (counterconditioning and extinction) a CS is presented alone as in the case of extinction; however, with counterconditioning a US evoking an incompatible response to the CS is also presented, which could be said to be purely motivational or facilitatory of the crucial process in operation: extinction (Wilson & Davison, 1971). Others (e.g. Guthrie, 1935) argue the reverse; that extinction is actually counterconditioning in which extinction is viewed less as a passive reduction in a behavioural response and more as an active learning of new behaviours. From this perspective, counterconditioning is actively offering an alternate incompatible behaviour to be learnt (a specific new association is learnt to replace the original) while extinction simply allows for the occurrence of some alternative incompatible behaviours (allowing some other non-specific association to be learnt). More recent associative learning theory elaborates on the concept of counterconditioning by predicting that positive experiences with the feared CS will actually weaken previously established CS-US associations involving the aversive US. This association is then eventually replaced with a new CS-US association involving the positive US (Kelly et al., 2009).

Counterconditioning shares a similarity with extinction in that it offers a model that in performance, involves a process of retroactive interference. However, there are differences,

not least of which is that extinction requires that during trials the CS is presented on its own, in the absence of the US.

## 1.8 Extinction

Conditioning models of fear acquisition (Pavlov, 1927; Rescorla & Wagner, 1972) posit that fears are acquired through associations created in the memory between CSs (neutral stimuli) and USs (aversive stimuli). Because the US already evokes an unconditioned response (UR), the CS acquires the ability to evoke a conditioned response (CR) via its association with the US. Subsequent exposures to the CS in the absence of the US should then lead to a reduction in the association between the CS and the US with a corresponding reduction in the CR. Extinction occurs then, where a CS is presented on its own and the CR steadily weakens or becomes extinguished entirely. However, in spite of extinction, the connection between a CS and US still exists and *spontaneous recovery* to the CS may still be witnessed after a period of time. It should also be noted that extinction training does not always result in reduction of CR towards the CS. This phenomenon is described as *resistance to extinction*. Fear intervention strategies, such as behaviour therapy, are predicated on the efficacy of extinction training on the reduction of CR and the observation that the CR is a function of aversive outcome expectancies (Wolpe, 1961; Zinabarg, 1993). Understanding the mechanics of extinction resistance is therefore important as it may shed light on the persistence of fears in anxiety disorders, e.g. phobias (Field, 2006).

In order to explain the apparent disappearance of the excitatory response through subsequent exposure to the CS alone, Pavlov (1927) believed that a new inhibitory association was created to counter the pre-existing excitatory one. This condition inhibition occurs when a CS+ is accompanied at intervals by presentations of CS- in the absence of the US. Thus the inhibitory CS- acquires the ability to block the CS+ response. The potential for inhibition may be measured in one of two ways: a summation test with the CS- shown with a

new CS+ which has been associated with the same US; or with a retardation test wherein the CS- is simply repeatedly paired with the US until the association develops.

Resistance to extinction has been observed for Pavlovian conditioning; however, it is not common and is most often seen with phylogenetically fear relevant stimuli (McNally, 1987; Öhman, 1979). However, McNally (1987) has noted that shock or threat of shock seemed to be necessary, but not on its own sufficient, for the effect to be observed. He also suggested possible alternative explanations, including the ontogenetic hypothesis (e.g. Delprato 1980; see also Levis, 1979), and stimulus significance (Maltzman & Boyd, 1984). Biological preparedness (Öhman & Mineka, 2001; Seligman, 1971) or a cognitive bias (Davey 1997, 1995) may be responsible for maintaining negative expectancies and the consequent resistance to extinction observed when the CS-US contingencies have been reduced. Resistance to extinction runs counter to what is normally observed in expectancy-learning (Mackintosh, 1983); nevertheless it is much more prevalent in a form of associative learning called evaluative conditioning (a specific subset of Pavlovian conditioning).

### **1.9 Evaluative Conditioning Models**

Evaluative conditioning (EC) occurs when a change in the liking of one stimulus is brought about by the pairing of that stimulus with another stimulus. A prime example of this is provided by advertising where a product is repeatedly presented together with appealing images (such as smiling people) in the assumption that the pairings will increase the target audience's liking of that product (De Houwer, 2007). Research has shown this to be the case; for example when a picture of a human face, originally rated as neutral by participants, is subsequently presented with another either liked or disliked face participants will usually demonstrate a change in affective valence for the originally neutral face congruent with the liked or disliked face (Grillon et al., 2004). Thus there are some parallels between EC and

Askew and Field's (2007) vicarious learning procedure (see 1.5.4), in that two picture stimuli are presented together and the emotional valence of one of the stimuli changes as a result.

While classical conditioning refers to a change in any observable response, EC differs in that it always involves a change in "liking" (De Houwer, 2007). The first model of EC suggests that EC effects are the result of conceptual or perceived similarities and thus EC represents conceptual learning rather than associative learning (Davey, 1994). According to this model, pairing the CS with a US leads to an increase in the salience of features of the US that are perceived to be similar to those of the CS. However, studies where such conceptual similarities were reduced or absent entirely have shown this model to be inadequate (Baeyens, Eelen, Van den Bergh, & Crombez, 1990; Van Reekum, Van den Bergh, & Frijda, 1999).

The second EC model was suggested by Levey and Martin (1987) and this envisaged EC being part of a more general *holistic learning* process. Holistic learning is considered to encompass the whole of the conditioning process such that EC, rather than being standalone or distinct, is merely part of an overarching learning scheme. In this model a single presentation of the learnt stimulus is sufficient to elicit an idea of the stimulus comprising not just the "if-then" stimulus properties but also the evaluative "like-dislike" properties. However, it is apparent that to develop an associative bond within this model necessitates contiguous presentation of the CS-US (De Houwer, Thomas, & Baeyens, 2001). Therefore the model is inadequate to explain any EC effect observed via pre-conditioning, in which the CS is never presented contiguously with the US.

The third EC model asserts that EC and classical Pavlovian conditioning are in fact two distinct forms of learning (Baeyens, Eelen, Combez, & Van den Bergh, 1992). This is based on the assumption that Pavlovian conditioning is a form of expectancy learning with the purpose of eliciting a preparatory response to the CS that predicts US onset; whereas EC

is assumed to be somewhat less complex and operates via a more automatic referential process (Baeyens, Eelen, & Crombez, 1995). According to this model when the CS is presented a calculation of the average valence of all previously contiguous stimuli is performed, which then motivates approach or avoidance behaviour towards the CS (Baeyens & De Houwer, 1995). The difficulty with this is the assumption that the formation of associations is a gradual process predicated on the presence of stimuli, yet the referential model essentially seeks to explain EC as being the result of instructions (De Houwer, 2009). EC may, more conventionally, derive from propositions regarding the CS-US relationship (De Houwer, 2007; De Houwer, Baeyens, & Field, 2005). This propositional model suggests that the participant's liking of the CS is determined by a prior conscious proposition that the CS in question is associated with a valenced US. The requirement of conscious propositions in this model infers that EC is dependent upon CS-US relation awareness, supporting the idea that EC is primarily driven by contiguity rather than contingency (Baeyens & De Houwer, 1995; Martin & Levey, 1978); however, it should be noted that in a meta-analysis of 214 studies it was found that contingency awareness is in fact an important moderator of EC in the same way as it is in classical Pavlovian conditioning (Hofmann, de Houwer, Perugini, Baeyens, & Crombez, 2010). As this model suggests knowledge of the US is necessary for EC, revaluation of the US will as a consequence affect EC (De Houwer, 2009).

Finally, it has been suggested that the evaluative response induced by the US can become associated directly with the CS, instead of being elicited by the US, in trials where the CS and US are contiguous. This is referred to as the *implicit misattribution model* (IMM, Jones, Russell, & Michael, 2009). According to this model a response evoked by the US may be misattributed instead to the CS. This misattribution, which occurs without any awareness of it happening, means that the response becomes permanently associated with the CS not the US. The assumption is that S-R associations can be formed without awareness of the CS-US



relationship, and participants mistakenly assume the evaluation they make is derived from a response to the CS, rather than the US. However, one limitation of this model is that IMM assumes an absence of information regarding the stimulus properties of the US, so it cannot account for US-revaluation effects in EC because the US has no capacity during revaluation trials to activate CS representation (De Houwer, 2009). This is problematic because demonstration of US revaluation was one of the main ways that CS-US associations, rather than S-R associations, were originally shown to underpin classical conditioning (Rescorla, 1974). Although there have been quite a number of studies looking at EC, its effect and its underlying processes, the mechanisms of EC largely remain elusive and may rely on multiple psychological processes (De Houwer et al., 2005; Gawronski & Bodenhausen, 2006; Janiszewski & Warlop, 1993).

### ***1.9.1 Resistance to extinction in evaluative conditioning.***

There are functional differences between classical and evaluative conditioning, primarily concerning the degree to which awareness of CS-US contingencies affects learning, the type of responses acquired (either expectancy or affective), and the resistance of the CR to extinction (De Houwer et al., 2001). In Pavlovian conditioning the CS usually signals the relevant US; therefore an absence of the US during extinction reduces US expectancy and consequently the CR. However, the affective CRs in EC are resistant to extinction, and therefore appear to operate independent of contingency awareness (Lovibond, 2004, Lovibond & Shanks, 2002). This is explained in classical conditioning in terms of expectancy learning, which relies on the contingencies between stimuli, whereas EC on the other hand represents a referential type of learning (Baeyens et al., 1995; Baeyens et al., 1992). Referential affective learning is different from expectancy learning in that it is affected by the contiguity of the CS and US but not the contingency, and is assumed to be predicated on referential associations between the stimuli which remain unaffected by changes to CS-US

contingency during extinction. With expectancy learning presentation of the CS predicts occurrence of the US. This prediction or proposition may be true or false, hence US-expectancy responses are subject to the statistical likelihood of CS-US occurrence. So, for example, as the likelihood of CS-US occurrence decreases in extinction, so too do US-expectancy responses. In EC however, while an association does exist and presentation of the CS makes one think of the US, it is assumed that the presentation of the CS merely makes one consider or “refer” to the US, without an active expectation of the US occurring. An example of this might be a song that is frequently encountered when on a particularly pleasant holiday. This leads to a change in liking towards that song; thereafter, hearing the song again in a different context may bring back memories of the pleasant holiday experience. However, hearing the song again and again is unlikely to extinguish the memory/association. So unlike the expectancy learning proposition which might be true or false, this mere reference without any active expectation is incapable of being supported or rebutted by an occurrence or absence of the US (Baeyens, Vansteenwegen, Hermans, & Eelen, 2001).

Evidence of resistance to extinction in EC was demonstrated by Baeyens and colleagues (Baeyens, Crombez, van den Bergh, & Eelen, 1988). Baeyens et al. showed that 10 unreinforced CS presentations had no effect on self-reported CS valence, previously acquired during 10 CS-US pairings. In a follow-up test two months later, they still found evidence of EC. Similarly, Baeyens, Eelen, Van den Bergh, and Crombez (1989) found facial EC to be resistant to extinction. Some authors have argued that these findings may be an artefact of the procedure typically used in EC (Shanks & Dickinson, 1990; Field & Davey, 1997, 1999). However, more recent studies, taking care to overcome the possible methodological shortcomings of earlier studies have also reported resistance to extinction in EC (e.g. De Houwer et al., 2000; Diaz, Ruiz, & Baeyens, 2005; Field, 2003). Interestingly,

while Baeyens, et al. (1989) found resistance to extinction, they still found EC was influenced by counterconditioning, suggesting that counterconditioning may be more effective at changing conditioned responses than extinction.

Having considered the development and salient points of associative learning it is time to consider contemporary views. These elaborate on some of the principles established earlier and offer answers for some of the criticism aimed at the earlier associative learning models.

### **1.10 Contemporary Models of Fear Acquisition**

The classical conditioning pathway for the acquisition of fear is predicated on a direct encounter with a CS and US. It does not account for scenarios where a direct traumatic conditioning event with a CS is wholly absent. Davey and colleagues (Davey, 1989, 1997; Field & Davey, 2001) proposed a model for the development of phobias that would both explain the failings of the classical conditioning paradigm and accommodate the role that cognitions and cognitive processes play in the acquisition of fears. The model explains how fears may be acquired via a direct traumatic experience, and also how threat information might be instrumental in creating expectancy evaluations as regards the consequences of encountering the CS. Contemporary models of fear acquisition address many of the criticisms levelled at earlier conditioning models (Field, 2006; Mineka & Zinbarg, 2006; Davey, 1997). Two crucial concepts underpin these explanations: expectancy evaluations and US revaluation (Davey, 1997; Field & Davey, 2001).

**1.10.1 Expectancy evaluations.** Seligman (1971) suggested that the uneven distribution of phobias derives from an innate pre-disposition to selectively associate certain stimuli with aversive outcomes that were of phylogenetic fear relevance (e.g. snakes and spiders) to human ancestors. However, it has also been argued that selective associations might actually be explained in terms of participants' prior-expectancies that a certain stimulus

will be accompanied by an aversive outcome, and these could be innate or learnt (Davey, 1992; 1995; 1997). Expectancy evaluations are concerned with how the individual perceives the relationship between a CS and the US. This perception may be the product of many diverse sources such as the individual's personal expectancies in relation to the consequences associated with encountering the CS, information received from others, or be culturally transmitted (Dawson & Grings, 1968). Existing beliefs regarding the outcome of a potential encounter directly affects the later conditioned and unconditioned stimulus associations responsible for fear acquisition (see also Field & Storksen-Coulson, 2007). For example, believing that the outcome of an encounter with a stimulus will be negative enhances learning in future negative encounters with the stimulus (e.g. Davey, 1997).

**1.10.2 Latent inhibition.** Latent inhibition refers to the fact that repeated presentation of a stimulus has the effect of making learning about the stimulus slower (compared to a new stimulus) when it is subsequently employed as a signal or conditioned stimulus in a classical conditioning procedure. It occurs when an earlier non-traumatic CS exposure results in the inhibition of CR acquisition when the CS is later paired with an aversive US (Davey, 1988). In addition, Davey (1992) suggests that the person exposed to the CS may make a subjective evaluation as regards the US which will then have a direct effect on the CR. To illustrate this Davey gives the example of a dental patient who may consider that the pain (US) experienced during dental treatment (CS) is more than offset by the benefits of the treatment thus inhibiting the acquisition of fear (CR). Similarly, if an individual has had several non-aversive encounters with a particular stimulus and then experiences an aversive one, they are unlikely to associate that stimulus with an aversive experience. It is worth noting that this strategy is actually successfully employed in the preventative treatment of dental and other medical phobias (Gullott & Adams, 2005).

**1.10.3 US Revaluation.** US revaluation describes a scenario where the initial learning encounter with a stimulus does not elicit fear; however, this is later reevaluated because of subsequent experiences (Davey, 1989; de Jong, Muris, & Merckelbach, 1996). This process is derived from the concept of causal relationships described as latent or behaviourally silent learning (Dickinson, 1980) which suggests that associations can be formed without the need for high levels of motivation and only surface at a later date. As discussed, a CR may be amplified or reduced as a result of US re-evaluation processes. The re-evaluation processes derive from the individual's subjective assessment of the US; for example; in the perception of physiological responses as indicating a threat, or the adoption of adaptive coping strategies to minimize threat. The adaptive coping strategies can lead to devaluation (e.g. "could have been worse" or "worse things happen to other people") and so offer an explanation for the fact that not everyone who experiences a traumatic event develops a phobia associated with that event.

**1.10.4 Incubation.** While general conditioning theory suggests that fear should decrease over successive non-reinforced presentations of the CS, research has shown that this is often not what happens, and a subsequent increase in fear may in fact be observed. Eysenck (1979) termed this phenomenon 'Incubation' and following his review of a number of studies concluded that there was significant support for the existence of this phenomenon (Eysenck, 1981). The incubation effect refers to the increase in anxiety (CR) that is observed post presentation of the CS alone. For example, although no traumatic outcome occurs when spider phobics come across a spider, fear often increases rather than extinguishes. However, Nicholaichuk, Quesnel, and Tait (1982), carried out a review of the available literature and failed to find any support for an incubation effect citing numerous problems with the research alleged to provide evidence of an enhancement effect attributable to incubation. Davey (1992) has suggested that in some cases this incubation effect could be explained by US

inflation. This occurs following earlier CS presentations, when a person then rehearses the trauma in their mind after the initial event. This then results in an inflation of the US prior to a subsequent encounter with this CS. Field, St. Leger, and Davey, (2010) also found evidence to suggest that rumination on the consequences of a phobic encounter could lead to an increase in heart rate and self-reported fear, and promote catastrophic thoughts in relation to the consequences of future encounters.

Field and Davey (2001) argue that what they consider to be the four main criticisms levelled at traditional learning theories of phobia acquisition can be addressed by contemporary conditioning theory. To summarise:

- (i) Some phobics cannot recall an aversive conditioning event leading to the onset of their phobia: US revaluation can explain the inability of some phobics to remember an aversive event involved in the onset of their phobia because the original learning episode could be silent and only inflated later;
- (ii) Not all those who experience a fearful or traumatic event go on to develop a phobia: For example, while most people will experience a potentially traumatic weather event such as a thunderstorm, very few develop a phobia as a result. Expectancy evaluations, and in particular latent inhibition, could explain why not all of those who experience trauma in a particular situation go on to develop a phobia (Liddell & Lyons, 1978). Prior neutral or positive experiences (e.g. being with others who were not afraid) with a stimulus could inhibit future negative learning for it;
- (iii) The uneven distribution of fears (Seligman, 1971): The classical conditioning model predicts that all stimuli should be equally likely to enter into an association with an aversive consequence (stimuli equipotentiality). Expectancy evaluations may offer an explanation of the uneven distribution as individuals may learn via familial, social and cultural pathways to expect that certain stimuli are threatening or dangerous. This

may make the stimuli ‘fear-relevant’ and subsequently enhance future fear-related learning for them;

(iv) Incubation as described by Eysenck (1979): As discussed above this may be explained by US revaluation in which the individual rehearses and inflates the US.

Mineka and Zinbarg (2006) support the contemporary learning model, while also endorsing Seligman’s (1971) view that fear may be acquired more easily by Pavlovian conditioning with phylogenetically prepared stimuli and less easily, or not at all for other unprepared stimuli. In contrast, Davey (2008), while accepting the important role of evolutionary adaptations in relation to specific fears such as heights, water, and animals, suggests that empirical confirmation of a more general application of this concept remains elusive. Field (2006) adds to this general model an interpretation that allows for the CS and US to be construed as representative stimuli of, rather than being actual physical stimuli. As such the CS is not necessarily of phylogenetic significance. His suggestion is that the input from all of Rachman’s (1977) learning pathways, such as vicarious learning or fear information, themselves represent conditioning episodes (associative learning) where the CS forms a relationship with the US. This model, allows for all three of Rachman’s (1977) pathways to have the capacity to create a relationship between the stimulus and the traumatic outcome. Equally any of the three pathways is individually or collectively capable of having an effect on the quality of the relationship created by any of the other pathways either strengthening or weakening the CS-US link (Silverman & Field, 2011).

The contemporary conditioning model offered by Davey and colleagues builds on earlier conditioning models and incorporates a broader cognitive perspective. In so doing, the contemporary model enhances earlier conditioning models and enables some of the more problematic issues related to the acquisition of fears and phobias to be addressed. Whereas traditionally it was the number of CS-US pairings that were considered to be important in

determining the strength of an association, and by extension the strength of the CR (Rescorla, 1980), it has now become clear that there are many other contributing factors involved. This includes factors occurring before, during, and after a potentially traumatic direct or vicarious conditioning experience.

## **1.11 Other factors affecting development of CS-US associations**

### ***1.11.1 Novelty & belongingness***

Familiar stimuli do not elicit as strong a response as novel stimuli (habituation). Hence stimulus novelty is important in quickly developing a strong CS-US association. Pavlov (1927) noted that if a dog was already familiar with the sound of a bell in a different context, then he found it difficult to develop an association between the bell and food with the dog: Linked to this is the relative intensity or strength of the stimulus, the use of intense stimuli facilitates the CS-US association (Bevins, McPhee, Rauhut, & Ayres, 1997). For example, rats that have previously been made salt averse (using lithium chloride—a toxic salt), and are subsequently made salt deficient will nevertheless become more attentive to the taste of salt (Kriekhaus & Wolf, 1968). A contributing factor to the enhancing effect of intensity may be the novel characteristic of intense stimuli. CS-US relevance or belongingness (Garcia & Koelling, 1966) is also important. Garcia and Koelling (1966) showed that it is more difficult to form an association with stimuli that appear inappropriate together. Stimulus intensity and belongingness are two of the factors that contribute to the salience of the stimuli.

### ***1.11.2 Salience***

*Salience* refers to the generally perceived strength or effectiveness of stimuli—how noticeable or significant they appear to an observer. The salience of a stimulus may be derived from emotional, motivational cognitive or other factors. It may in some instances refer to a physical characteristic that may be measured by its intensity e.g. a very bright light



or a loud tone. However, it is actually a subjective measure of the intensity of experiencing a stimulus. It is a product of the physical characteristics of the stimuli and the sensory systems of the individual experiencing the stimuli. Hence, to some degree its effect may vary between individuals. For example, in conditioning terms the feelings a child has about a particular model is likely to affect the model's (US) salience. The associative learning literature shows that the salience of the US has an important influence on learning. Learning is more successful for more salient stimuli, i.e. more intense CSs and USs generally lead to stronger conditioning effects. Given that vicarious learning is a form of associative learning, the basic principles that underpin associative learning should apply and the salience of the US should be equally important in vicarious learning procedures. What is important to note, is that ultimately, the strength of CS-US learning depends on the salience of the stimuli (McLaren & Mackintosh, 2000). The variability of this effect is also suggestive of another of the characteristics of the CS that is often overlooked and yet may have a significant impact on the development of associations, particularly in fear-learning, the unpredictability of the CS.

### ***1.11.3 Unpredictability***

The role of unpredictability in fear-relevance and specific phobias is one that has had little attention. In general, research into anxiety (see Bennett-Levy & Marteau, 1983; Davey, 1989; Doogan & Thomas, 1992; Ehlers, Osen, Wenninger, & Gieler, 1994; Murray & Foote, 1979), that has looked at the features of prepared stimuli, has not been concerned with the particular aspects of such stimuli that underpin and mediate these features. For example, one such study found that individuals with high dog fear were significantly more afraid of dogs making sudden movements, barking, growling, or jumping than individuals who reported a low fear of dogs (Doogan & Thomas, 1992). The actual cause of these fears was not however looked into. While growling might plausibly be feared as it is indicative of aggression and increases the likelihood of an attack, a fear of sudden movements is not so easily explained. It

might be caused by an individual's fear of the general unpredictability of dogs or fear derived from a feeling that they might not be able to escape if the dog attacks. The fear could in fact be due to a combination of both or neither. Some research has found that vulnerability-related perceptions were highly correlated with spider fear (Armfield & Mattiske, 2006) and a recent study reported that perceptions of unpredictability along with dangerousness, disgustingness, and uncontrollability were highly related to self-reports of animal fears and predictive of the uneven distribution of fears relating to animals (Armfield, 2007). However, while the predictability of a stimulus' actions may possibly be interpreted as a source of comfort, they could just as well be interpreted as being aversive in nature. An individual may be aware for example that a particular animal will always attack when encountered or that the animal might always flee from encounters with human beings. Therefore the fact that an animal's behaviour may be predicted is not necessarily always a source of comfort. In reality circumstances or stimuli that are predictably aversive are extremely rare though. Few animals can be predicted to attack upon encountering them, just as not every aeroplane flight can be expected to end in a disaster. While there is evidence to show that humans harbour a preference for predictability over unpredictability (Abbott & Badia, 1979; Lejuez, Eifert, Zvolensky, & Richards, 2000), studies remain inconclusive in determining the degree of its significance and whether unpredictable aversive events are more anxiogenic than predictable aversive events (Grillon, Baas, Lissek, Smith, & Milstein, 2004).

### **1.12 Summary of factors affecting associative learning**

Contiguity alone is insufficient for conditioning. Where there is contiguity, it is necessary that the CS must be a good predictor of the occurrence of the US. If there is a likelihood that a US might still occur in the absence of the CS then very little or no conditioning may occur (Rescorla, 1966). Conditioning has also been shown to be dependent on the particular CS and US presented, as organisms appear to have an innate preference to

learn some CS-US associations more easily than others (Garcia & Koelling, 1966). In fact, contiguity is not even necessary in the formation of an association. This was eloquently demonstrated by Etscorn and Stephens (1973) who showed that an association between taste and nausea could be formed with a 24 hour CS-US interval.

Rescorla and Wagner (1972) took Kamin's (1969) basic premise that surprise was necessary for learning and developed what is now termed the Rescorla-Wagner Model. This refers to the hypothesis that the element of surprise is important in determining how effective a US is. Thus, while learning will, as Kamin suggested, only occur if there is an element of surprise, the degree of surprise actually determines the level of conditioning that occurs. If the US provides a large surprise then there will be stronger excitatory conditioning (excitatory), whereas if the surprise is small or non-existent then inhibitory conditioning will occur. Thus the degree of conditioning is determined not just by the US, but also by how much the subject had expected the occurrence of the US (Lieberman, 2000).

It is not just providential but necessary in an evolutionary sense that conditioning does not simply occur for any stimuli that precede a US. Lieberman (2000) provides the example of a rat that manages to evade an attack from an owl. Certainly, if the rat then develops a fear of owls it will be advantageous to its survival. But if it were to develop a fear of the other contiguous stimuli such as the grass, trees, birdsong, or other animals in the immediate vicinity, then it would die of exhaustion attempting to evade all of these potential "threats". In order to survive it is essential that the conditioning process be more discriminating, so that not every preceding stimulus is associated with the US. The process that facilitates the formation of these CS-US associations has therefore evolved to prevent this, concentrating instead on the stimuli that act as good predictors of the particular US. These predictors may be selected as a result of evolutionary processes that have determined them as being the most likely (Garcia & Koelling, 1966) or simply because in the current environment they are the

most likely predictors of the US available (Kamin, 1969; Rescorla, 1966). In essence the conditioning process evolves and adapts to deal with new situations seeking out cues in the environment that are the most probable predictors of significant events.

What has been discussed in the preceding pages is indicative of the current state of knowledge regarding associative learning theory and how this is believed to facilitate the development of fear. While considerable research has been carried out and there is a wealth of knowledge now available, there are still key areas, particularly with reference to the viability of Rachman's indirect pathways, which will benefit from further research and clarification to provide a clearer understanding of the development of childhood fears.

### **1.13 Aims and Objectives of this Thesis**

Given the assumption that vicarious learning is a form of associative learning and is therefore similar in a procedural sense to classical conditioning (Askew & Field, 2007; 2008; Mineka & Cook, 1993), the overarching aim of this thesis is to see whether, and to what extent, some of the most important characteristics of associative learning apply to vicarious learning. If vicarious learning shares these characteristics, this will have important implications for: 1) our understanding of the development of children's fears; and 2) early interventions and treatments of children's fears.

To this end, an adaptation of Askew and Field's (2007) prospective procedure is used to examine the effect of vicarious learning procedures on children's fears. The thesis is essentially in two halves, each half investigating the role of the US (model) and CS (stimulus) in vicarious learning. The first part of the thesis looks at the effect particular characteristics of the US have on its salience and effectiveness in vicarious learning. As discussed, the associative learning literature suggests that the salience of the US is critical for learning: the more salient the US (i.e. the model's emotional response), the more effective the learning should be. This thesis investigates this in a vicarious fear learning paradigm with children. In

*Experiment 1* a comparison is made between the effectiveness of mother and stranger models during the vicarious acquisition of fear-related responses in children. It is predicted that children's mothers will be more salient models than strangers for children. The study also examines whether fear-related responses can be unlearned using vicarious counterconditioning and looks at whether mothers are more effective positive models than strangers. *Experiment 2* looks at the effect the model's age relative to the observer has on US salience and subsequent learning: learning and unlearning is compared for adult and same-aged peer models. The final experiment in this part of the thesis (*Experiment 3*) investigates the effect that motion has on the salience of the US and therefore learning. Specifically the effectiveness of using moving USs (in video films) compared to inert USs (still images) to determine whether the increased "realism" and richness of information contained in moving images leads to greater learning than when using still images.

In the second group of experiments, characteristics of the conditioned stimulus (CS) are examined, i.e. how manipulation of specific characteristics of the CS can affect vicarious learning. As discussed, one of the most important CS characteristics in the fear-learning literature is the fear-relevance of the CS. Research suggests that when fear-relevant stimuli are used, fear learning is *greater, more rapid* and *more robust* than for fear-irrelevant stimuli. However, Askew et al. (2013) investigated the effects of CS fear-relevance on vicarious learning for a variety of stimuli and found no difference in the *magnitude* of the learnt effect. This suggests that fear-relevance might not be important when a vicarious fear-learning process is employed with children of this age. The final two experiments here are designed to investigate the effect of fear-relevance on the *speed* of vicarious learning in children and how *robust* the learning is. *Experiment 4* looks at whether, as the associative learning literature suggests, learning will occur in fewer vicarious learning trials for CSs of greater fear-relevance compared to fear-irrelevant stimuli. As previously mentioned, research to date

suggests that resistance to extinction is generally observed for fear-relevant CSs in direct conditioning experiments. The final experiment (*Experiment 5*) looks at extinction and resistance to extinction following vicarious learning with fear-relevant CSs compared to fear-irrelevant CSs.

## **Chapter 2.**

### **Vicarious Learning and Salience of the US:**

#### **Effect of Relatedness of Model on Vicarious Learning and Unlearning**

##### **2.1 Introduction**

Rachman (1977) suggested that fear could be acquired through three pathways: direct conditioning, vicarious exposures, and from verbal communication. Direct fear conditioning is a process of aversive conditioning in which a neutral conditioned stimulus (CS), such as an object, sound or image that initially elicits no emotional response, is paired with an unpleasant unconditioned stimulus (US), such as a loud noise or some form of physical discomfort. The US evokes an unconditioned fear response (UR), and after a number of repeated CS-US pairings, the CS alone subsequently evokes a conditioned fear response (CR) (Estes & Skinner, 1941; McAllister & McAllister, 1971). Thus, through a process of associative learning the CS acquires fear-eliciting properties related to the US. Research looking at the role of vicarious processes in learning demonstrates that most experiential derived forms of learning, including conditioned emotional responses, can also be acquired through observation of the experiences of others (Bandura, 1969).

A number of studies have demonstrated that primates can vicariously acquire a significant fear of snakes simply by observing adult monkeys behaving in a fearful way towards snakes (Mineka & Cook, 1986; Cook & Mineka, 1989). In these examples of conditioning with primates, an observing monkey associates a snake (CS) with a monkey's fearful response to the snake (US), so that the snake later elicits a fearful conditioned response (CR) in the observer. Mineka and Cook (1986) also investigated the potential for observational learning to immunize against development of fears. In their experiments they noted that young monkeys who had previously observed a model behaving in a non-fearful

way with a snake were subsequently resistant to observational conditioning and did not develop fear. Associative learning models also predict that a process of un-learning such as pairing the feared stimulus with a positive experience ('counterconditioning') will reduce fear as it weakens the association between the CS and the US (e.g. the snake and the fearful monkey's response) creating a new association between the CS and the newly introduced US (e.g. a monkey's neutral or positive response).

Ollendick and King (1991) reported that a significant number of phobic patients attribute the onset of their fears to the observation of fearful responses in others. While Ollendick and King relied on the long-term memory of adults when determining the source of their fears, Muris, Steerneman, Merckelbach, and Meesters (1996) have reported that children also consistently traced the origin of their fears to modelling experiences. A series of experimental studies have now confirmed that a child's fear beliefs towards new objects or events can be altered by observation of another person's fearful reactions towards them (e.g. Askew & Field, 2007; Askew et al., 2008; Gerull & Rapee, 2002). Askew and Field, (2007) showed that the stimuli (in this case novel animals) used in these types of experiments need not be, of themselves, inherently fear-provoking for vicarious learning to take place. They found that the children's fear beliefs significantly increased for animals they had observed alongside scared faces when compared to the controlled condition. These effects persisted up to 3 months. In their second experiment they also demonstrated that children were significantly slower in approaching a box which they believed contained an animal they had previously seen presented together with scared faces.

Field, Argyris, and Knowles (2001) gave children threat-related information about fictitious monsters and found increased fear beliefs for animals. The effect was generally greater with primary carers, although any young adult or older peer was effective with 7-8 year olds, perhaps due to the increased interaction with these age groups at this stage of a



child's development (Field et al., 2001). Field et al. (2003) modified the paradigm to use real but unfamiliar marsupials to establish a more ecologically-relevant connection to animal phobia. While both of these studies demonstrated a significant effect for negative information, the effects observed for positive information were variable. However, while attempting to control for possible differences in salience of positive and negative information, Field and Lawson (2003; see also the longitudinal study by Field, Lawson & Bannerjee, 2008) found comparable significant effects of both positive and negative information, supporting the proposition that positive information can reduce fear beliefs and avoidance behaviour (see also Muris, Bodden, Merckelbach, Ollendick, & King, 2003).

Using a modified version of Field and Lawson's (2003) experiment, Kelly et al. (2009) examined whether fear beliefs acquired through negative verbal information could subsequently be reduced by positive information and positive modelling. They found that both positive information and modelling significantly reduced fear beliefs and avoidance behaviour. However, positive information was significantly more effective at reducing fear beliefs than positive modelling, though modelling was equally as good as positive information at reducing avoidance behaviour. Further, positive information was found to be more effective at reducing fear beliefs than it was at reducing avoidance behaviour, while modelling was equally effective at reducing fear beliefs and avoidance behaviour. This experiment supports the assertion that weakening the association between the CS and an aversive US, or replacing it with a new CS-US association, can reduce children's fear beliefs. Kelly et al. (2009) suggest that a greater congruence between verbal information and fear beliefs may be responsible for the relative effectiveness of positive information over modelling information in their study.

Alternatively, it is possible that the pathway via which a fear is 'learnt' may be more effective when employed to unlearn the fear than one that was not (Öst, 1985). The

suggestion in this case is that the fear having been learnt from the information pathway would be more effectively unlearned by employing the same pathway. Subsequent research has also provided further support for this proposition. In a study of 9 to 13 year olds, researchers induced fear beliefs for a novel animal through the provision of negative information (Muris, Huijding, Mayer, van As, & van Alem, 2011). The children were all told the same details about an unfamiliar animal (a cuscus): that it was a scary and dangerous animal. Children were then assigned to one of three groups, either: positive information, imagery, or control. Children in the positive information group were told that the previous information they had been given about the animal was false and that in fact the cuscus was a friendly animal that posed no threat. In the imagery group, children were told to imagine that they were a well-known cartoon character, Ash (from the *Pokemon* cartoon series), who could capture and train the cuscus. Results showed that both positive information and imagery were effective at reducing the children's fear beliefs, but once again positive information produced a superior effect, suggesting that information processing is more effective at countering fears that had been acquired through the information pathway.

There is also some evidence to suggest that the more a child likes or admires a particular model the greater that model's influence will be and the more likely it is that the child will imitate them (Lieberman, 2000). For example, evidence suggests children may be more influenced when observing primary caregivers (Egliston & Rapee, 2007). Zabatany and Lamb (1985) found that infants modified their behaviour based on information from their mother but did not use information from strangers to do so.

The focus of the first group of experiments (Experiments 1 to 3) is on characteristics of the US that are likely to affect the strength of vicarious learning. Three factors that are likely to influence US salience (i.e. the salience of the model's response): relatedness of model to observer, age of model, and richness of visual information, are manipulated to

investigate the effect on vicariously learnt fear responses. All experiments use an adaptation of Askew and Field's (2007) procedure. The first of these experiments looks at what effect increasing the relatedness of the model to the observer (mothers vs. strangers) has on learning CS-US associations formed. It also investigates whether the vicarious learnt association can be unlearned during counterconditioning. More specifically, it looks at whether the relatedness of an observer to a model not only affects the strength of the vicariously learnt association, but also the success of subsequent unlearning.

The methodology was modelled on the experiments carried out by Askew and Field (2007) where a novel animal (CS) is presented together with an emotional face (US). In order to examine US salience in the current experiment, pictures of unfamiliar adults and children's mothers were used as USs. Children aged 6 to 10 years were presented with images of novel animals (CSs), paired with counterbalanced images of fearful or happy facial expressions, posed by their mothers or strangers (US) or left unpaired (control). In line with previous research (Askew & Field, 2007; Askew et al., 2008; Askew et al., 2013), it was expected that children would show significant increases in fear-related beliefs and avoidance preferences for animals they saw paired with pictures of adults displaying fear. It was also predicted that children's mothers, because of their close relatedness, would be more salient than strangers and therefore increases in fear-related responses would be greater for animals in these pairings. Finally it was hypothesised that counterconditioning would be effective in unlearning fear acquired through modelling as the same pathway is employed and that this effect would be more significant where the model used for the counterconditioning was the more salient mother model. Likewise it was expected that fear associations learnt via mothers might be more resistant to counterconditioning by strangers. Fear-related beliefs were assessed before and after the vicarious learning task and again after the counter-conditioning task by means of a self-report questionnaire and a behavioural task.

## 2.2 Method

**2.2.1 Participants.** Sixty children (29 boys, 31 girls) aged between 6 and 10 years ( $M = 8.73$  years,  $SD = 1.28$  years) took part in the experiment. In this experiment the required sample sizes were estimated on the basis of 4 groups and 3 measurements in a mixed ANOVA analysis. A G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) sample size calculation determined that 60 participants would be necessary to detect a moderate effect size of an  $\alpha = .05$  with power of .95. Previous research indicates that for this age group normal developmental fears often focus on animals (Field & Davey, 2001). Children were recruited via schools in south-west London, UK. The consent procedure was identical for all of the experiments discussed in this thesis. Informed consent was obtained from parents prior to the experiment (see appendix G) and children gave verbal assent. Additional *in loco parentis* consent was also obtained from the head teacher at each school involved in these experiments. Approval was granted by the Kingston University Faculty Research Ethics Committee.

### 2.2.2 Materials.

**Animals:** Nine colour images (400 x 400 pixels) of three Australian marsupials (quoll, quokka and cuscus) were used as novel stimuli CSs (Askew & Field, 2007; Field & Lawson, 2003): three unique pictures of each animal (see appendix A). These images were used throughout all of the experiments and were chosen because UK children are generally unaware of them (Askew & Field, 2007). No children in any of the experiments reported any knowledge of the animals.

**Faces:** A total of 186 adult portrait images were created specifically for these experiments and were used as visual USs. Thirty one mothers each provided three fearful and three happy colour portrait images on a uniformly plain background (300 x 400 pixels) (see Appendix C and Appendix D). As with the animal images, more than one example of each

type of image was required so that children avoided seeing one particular image of an adult being paired with one particular image of an animal. Each mother was individually taught how to pose using the guidelines and descriptions of Izard (1971) and Ekman and Friesen (1975). So, for example, for the happy images, the corners of the mouth had to be raised along with the cheeks, and the eyes open and the forehead kept smooth. When conveying fear, the mouth had to be slightly open with the corners pulled straight back and lips stretched horizontally but avoiding baring teeth. Eyes were kept wide open with the eyebrows raised but drawn together and the forehead was wrinkled. Prior to their use in the study, the happy face/scared face image stimuli were independently assessed and rated by a panel of 12 adults (8 female, 4 male; Aged 19-48 years:  $M = 26.67$  years,  $SD = 10.61$  years) who had not been informed of the reason for the assessment or the overall purpose of the study. The panel was invited to assess what emotion the model in each of the images was portraying from a list of the following options: happy, sad, angry, frightened, neutral, or disgusted. All 31 of the “happy face” images were unanimously rated as happy. Of the 31 “scared face” images, 26 were assessed as appearing frightened by all 12 of the rating panel. Five of the faces were considered to be frightened by just 10 (83.3%) or 11 (91.7%) of the rating panel: two of the faces were rated as disgusted twice, while one other face was rated once as disgusted. One image was rated once as angry, and one rated once as neutral. When children participating in the experiment had completed their trials, they were asked to rate the three scared and happy pictures that they had seen. As with the results of the rating panel, all the “happy face” images were rated as happy by all 60 children with the exception of one child rating as neutral one of their three happy pictures. For the “scared face” images, all three images were rated as frightened by 52 of the children, seven considered that one of the three scared images presented to them was either sad or disgusted, with just one child rating two of the faces presented as angry. In general children were presented with different pictures from one

another and there was no evidence to suggest that one particular face was repeatedly found to be non-frightened.

**Fear Beliefs Questionnaire (FBQ):** In the FBQ (Field & Lawson, 2003) children are asked about how they would feel in seven hypothetical situations with each animal (see appendix E). Children respond to 21 questions total, on a 5-point Likert scale (0 = 'No, not at all'; 1 = 'No, not really'; 2 = 'Don't know/Neither'; 3 = 'Yes, probably'; 4 = 'Yes, definitely'). There were 12 reverse scored questions. An average fear beliefs score from 0 to 4 was calculated for each animal, with 4 being the highest level of fear beliefs. Internal consistencies were in line with previous studies (e.g. Askew et al., 2008; Field, 2006): before learning, Cronbach's  $\alpha = .74$  (Quoll subscale), .69 (Quokka subscale) and .72 (Cuscus subscale), and after learning, .86, .84 and .88, respectively.

**Nature reserve task:** The nature reserve task has been successfully used in past research to measure children's avoidance preferences for animals (Field & Storksén-Coulson, 2007) and was adapted for this experiment. Children were told that a green triangular board (60 cm x 60 cm x 60 cm) represented a nature reserve where the animals lived. Photos of each of the three animals were positioned at each of the three corners of the board by the experimenter. Children were asked to imagine they were visiting the reserve and to place a Playmobil figure (a boy for boys and a girl for girls) representing themselves onto the board in the location where they would most like to be. The distance from where the child placed their figure to each animal photo was measured, indicating children's approach or avoidance preference for the three animals.

**Vicarious learning task:** The vicarious learning procedure was computerised using a Microsoft Windows compatible application (Field, 2010) written in Visual Basic.net with ExacTicks 1.1 (Ryle Design, 1997).

**Laptop computer:** For each of the experiments where the computerised vicarious learning procedure was used it was presented via an RM 4300 laptop computer with a 15.6” screen running Microsoft Windows XP SP3.

*2.2.3 Procedure.* Children were randomly allocated into one of four model groups: mother-mother (MM), mother-stranger (MS); stranger-stranger (SS); and stranger-mother (SM). There were two vicarious learning stages; for example, children in the MS group first experienced vicarious learning with their mother (M) as model, and later vicarious learning (counterconditioning) with a stranger (S) model (see figure 1).

The children used a Hewlett Packard laptop to carry out the experiment employing a custom written VisualBasic.net computer program (Field & Price-Evans, 2009). The experimenter briefly explained the instructions to the participants. The children were seated in front of a laptop PC. A window was displayed on the computer screen giving instructions regarding the general nature of the tasks, indicating what the children were expected to do.

Before the initial vicarious learning task the following message was displayed on the computer screen:

“You will now be asked several questions about three animals:

A Cuscus

A Quokka

A Quoll

Each question will appear on the screen and below it, there will be five buttons. Press one of the five buttons to indicate your answer to the question:

No, Not at all

No, Not Really

Don't Know/Neither

Yes, Probably

Yes, Definitely

When you click on a button, another button will appear labeled ‘Sure?’. If you are happy with your answer to the question then press this button; if not select a different answer and then click on the button that says ‘Sure?’”

The children were instructed to click on the “okay” button displayed on screen to start the experiment. On the screen the following message was display:

“In the next few minutes you’ll be shown some animals on the screen, and also pictures of some people’s reactions when they saw those animals.

It is important that you look out for the animals and pay careful attention to how the people reacted when they saw the animal”

Children initially completed the first FBQ, after which the first vicarious learning stage began. Children then saw each of the three animals presented on a computer screen together with a different emotional face (or presented unpaired) in 30 animal-face ‘pairings’: one animal was seen with a scared face 10 times (‘scared-paired’), one animal with happy faces 10 times (happy-paired’) and one animal was presented alone for 10 trials (‘unpaired’). The type of emotion image that a child saw presented with each particular animal was dependent on which of three counterbalancing orders (see Table 1) they had been randomly assigned to.

Table 1

*The counterbalancing of different information across three animal stimuli*

		Animal		
		Quoll	Cuscus	Quokka
Type of Information	Order 1	Positive	Negative	No Information



Order 2	No Information	Positive	Negative
Order 3	Negative	No Information	Positive

---

Furthermore, depending on which of the model groups a child had been assigned to, faces were either of their mother or a stranger. So in the first vicarious learning stage each child in the MM and MS groups saw 20 pictures (10 scared-paired, 10 happy-paired) of their mother’s face. Children in the SS and SM groups were presented with exactly the same faces, but for these children they were stranger faces. Allocation of mother images as strangers to the SS and SM groups was random, but care was taken to ensure that the child did not know the mother. Each trial lasted a total of 2s, and was followed by a randomly determined inter-trial interval of between 2 and 4s. Each scared-paired or happy-paired trial consisted of an animal being presented on the screen for 1s alone and a further 1s together with a face on the opposite side of the screen. Unpaired trials consisted of the animal being presented alone on the screen for 2s. For each trial, the specific animal image, and the side of the screen that it appeared on were randomly determined.

After the initial vicarious learning phase, children completed the FBQ a second time followed by the first of the nature reserve tasks. Following this, the second vicarious learning stage was procedurally identical to the initial but there were two important differences. First, previously happy-paired animals were now presented with scared faces, and previously scared-paired animals were now presented with happy faces (counterconditioning phase). During this phase the animals previously presented unpaired, remained unpaired. Second, children in the MS and SM groups were now presented with a different model: MS group children had seen their mother’s face in the first vicarious learning stage but now saw a stranger’s face; the opposite was the case for the SM group. SS and MM groups saw the same model as in the first vicarious learning phase. Following this, the third FBQ and second

nature reserve task were both administered again. Finally, children were fully debriefed using games and puzzles and correct information about the animals (see appendix B).

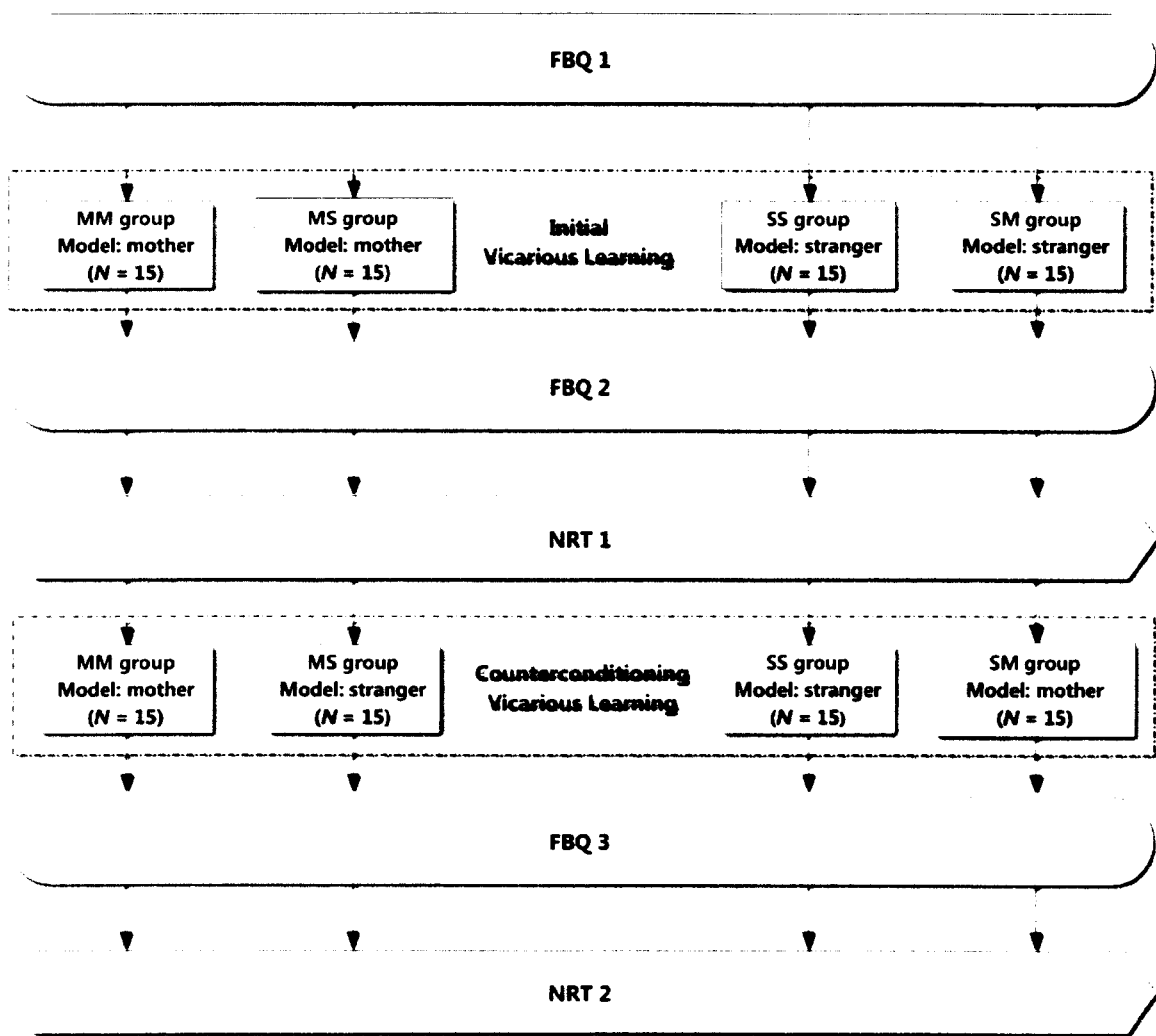


Figure 1. Vicarious learning and counterconditioning procedure comparing the effect on US salience of “relatedness”.

2.3 Results

An alpha level of .05 was used for all statistical tests. Effect sizes are reported as *r* where appropriate, and otherwise as partial eta-squared ( $\eta p^2$ ).

**2.3.1 Fear beliefs.** Table 3 shows the mean fear beliefs before and after vicarious learning and after counterconditioning for each pairing type and each group. Figure 2 shows

mean fear beliefs before and after the vicarious learning procedures for each modelling group.

Table 3

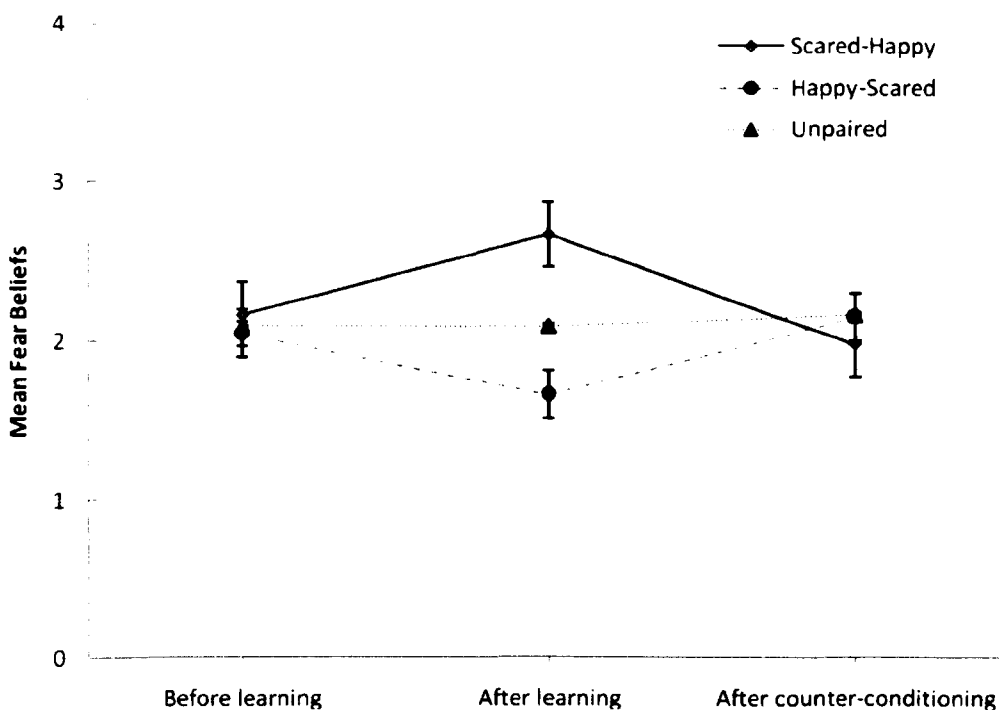
*Mean FBQ Scores Before Learning, After Learning and Counterconditioning (with Standard Deviations in Parentheses)*

Condition	Group	Before learning	After learning	Counterconditioning
Scared	MM	2.30 (0.62)	2.68 (0.68)	2.12 (0.84)
	MS	2.32 (0.83)	2.59 (1.05)	2.28 (1.19)
	SM	1.79 (0.71)	2.54 (0.73)	1.60 (1.06)
	SS	2.27 (0.75)	2.83 (0.88)	1.92 (0.96)
	Total	2.17 (0.74)	2.66 (0.83)	1.98 (1.03)
Happy	MM	1.92 (0.56)	1.70 (0.75)	2.05 (0.76)
	MS	2.17 (0.92)	1.67 (1.07)	2.05 (1.26)
	SM	1.87 (0.80)	1.39 (0.88)	1.89 (0.81)
	SS	2.22 (0.51)	1.87 (0.90)	2.63 (0.89)
	Total	2.05 (0.71)	1.66 (0.90)	2.15 (0.97)
Unpaired	MM	2.13 (0.56)	2.06 (0.86)	2.19 (0.93)
	MS	1.96 (0.87)	1.71 (1.21)	1.76 (1.17)
	SM	1.77 (0.88)	2.13 (0.93)	1.97 (0.53)
	SS	2.51 (0.56)	2.46 (0.73)	2.72 (0.87)
	Total	2.10 (0.77)	2.09 (0.96)	2.16 (0.95)

A three-way 4(model group: MM, MS, SS, and SM) x 3(pairing type: scared-happy, happy-scared and neutral-neutral) x 3(time: baseline, post-learning, and post-counterconditioning) mixed ANOVA with repeated measures on the last two variables was performed on fear belief scores. The important (Greenhouse-Geisser adjusted) time x pairing type interaction was significant,  $F(3.13, 175.05) = 18.55, p < .001, \eta^2p = .25$ , showing that vicarious learning had led to changes in fear beliefs that were different depending on the type

of face presented. Planned comparisons comparing baseline fear beliefs and fear beliefs after the first vicarious learning procedure showed a significant increase after scared-pairing,  $F(1, 56) = 21.58, p < .001, r = .53$ , and decrease after happy-pairing,  $F(1, 56) = 10.12, p = .002, r = .39$ . Comparisons of baseline fear beliefs with those after counterconditioning found no significant differences for happy,  $F(1, 56) = 2.77, p = .10, r = .22$ , or scared,  $F(1, 56) = 0.11, p = .75, r = .04$ , pairings, showing that fear beliefs returned to baseline levels following the vicarious counterconditioning procedure.

There was also a significant main effect of pairing type,  $F(2, 112) = 5.55, p = .005, \eta^2 p = .09$ . All other main effects and interactions were non-significant, including the group x pairing type x time interaction,  $F(9.38, 175.05) = 1.04, p = .41, \eta^2 p = .05$ , indicating that vicariously learnt changes in fear beliefs were no different in all four model groups. The effect size for this interaction was also very small and any effect therefore negligible.



**Figure 2.** Mean (and SE) fear beliefs before and after the two vicarious learning phases: fear conditioning and counterconditioning.

**2.3.2 Avoidance preferences.** Table 4 shows the mean NRT scores before and after vicarious learning and after counterconditioning for each pairing type and each group.

Table 4  
*Mean NRT Scores After Learning and Counterconditioning (with Standard Deviations in Parentheses)*

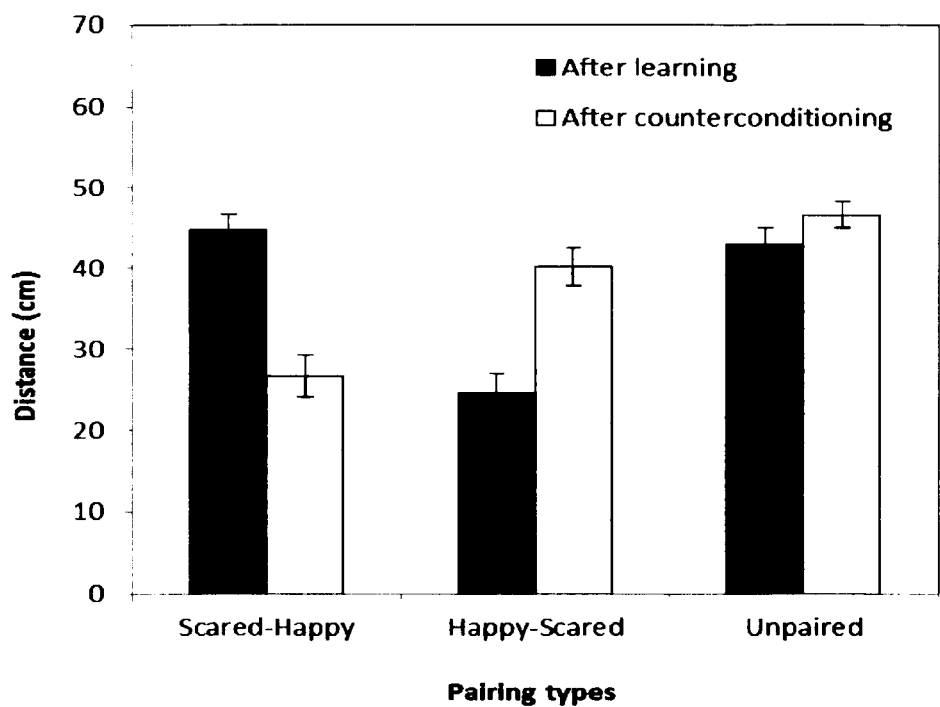
Condition	Group	After learning	Counterconditioning
Scared	MM	43.60 (15.15)	31.73 (19.60)
	MS	48.13 (9.95)	24.73 (19.90)
	SM	42.93 (16.20)	29.80 (20.17)
	SS	44.40 (14.79)	20.17 (19.21)
	Total	44.77 (14.01)	26.61 (19.75)
Happy	MM	26.20 (18.24)	40.33 (16.27)
	MS	21.40 (18.20)	41.47 (18.87)
	SM	29.80 (20.51)	33.33 (20.31)
	SS	20.40 (17.39)	45.53 (16.92)
	Total	24.45 (18.54)	40.17 (18.24)
Unpaired	MM	42.40 (14.46)	40.67 (16.77)
	MS	42.93 (15.51)	48.13 (12.28)
	SM	39.67 (18.33)	49.13 (7.98)
	SS	47.30 (11.88)	48.60 (12.11)
	Total	43.08 (15.09)	46.63 (12.83)

Figure 2 shows mean distances (cm) from the animal to the figures children placed on the board. Two separate analyses were performed at each time point: after the first vicarious learning and after counterconditioning. A two-way 2(model type: mother vs. stranger) x 3(pairing type: scared, happy and none) mixed ANOVA was performed on nature reserve task scores after the first vicarious learning procedure. The Greenhouse-Geisser adjusted effect of pairing type was significant,  $F(1.70, 98.59) = 19.73, p < .001, \eta^2 = .25$ , indicating

vicarious learning affected how far away from animals children placed themselves on the board. Planned comparisons showed no difference in avoidance preferences for animals seen with scared faces compared to the control animal,  $F(1, 58) = 0.38, p = .54, r = .08$ ., but children avoided animals they had seen with happy faces less than the control animal,  $F(1, 58) = 21.20, p < .001, r = .52$ . Thus positive vicarious learning decreased children's avoidance compared to an unpaired animal but negative vicarious learning did not affect avoidance. The main effect of model type,  $F(1, 58) = 0.01, p = .94, \eta^2 < .001$ , and the pairing type x model group interaction,  $F(1.70, 98.59) = 0.14, p = .84, \eta^2 = .002$ , were non-significant. Effect sizes were also extremely small, indicating that type of model, mother or stranger, had no effect on avoidance preferences.

A three-way 4(model group: MM, MS, SS, and SM) x 3(pairing type: scared, happy and none) x 2(time: post-learning vs. post-counterconditioning) mixed ANOVA was performed on nature reserve task distances measured after the counterconditioning phase. The time and first model type variables were also included in this analysis because avoidance scores for each animal may already be elevated or lowered following the first vicarious learning event so avoidance after counterconditioning needs to be considered relative to the first vicarious learning event. The important time x pairing type interaction was significant,  $F(1.71, 95.63) = 26.45, p < .001, \eta^2 = .32$ , indicating that avoidance preferences changed due to vicarious counterconditioning depending on the type of face seen with an animal. Planned comparisons found that avoidance increased for scared-paired (previously happy-paired) animals,  $F(1, 56) = 8.45, p = .005, r = .36$ , and decreased for the happy-paired (previously scared-paired) animal,  $F(1, 56) = 26.44, p < .001, r = .59$ , compared to the control animal. The main effects of time,  $F(1, 56) = 5.52, p = .02, \eta^2 = .09$ , and pairing type were also significant,  $F(2, 112) = 10.30, p < .001, \eta^2 = .16$ . All other effects were non-significant, including the pairing type x time x model group interaction,  $F(5.12, 95.63) = 1.71, p = .14$ ,

$\eta p^2 = .08$ . The effect size for this interaction was also very small, indicating the effect was trivial and that the type of model did not influence avoidance in the nature reserve task.



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

**2.4 Discussion**

The main findings from this experiment demonstrate, as expected, that vicarious learning has an effect on children's self-reported fear beliefs for animals. In summary, findings showed that: (1) self-reported fear beliefs for novel animals increased after children saw them paired with scared faces and conversely decreased after they saw them paired with happy faces; (2) after a vicarious counterconditioning procedure, the vicariously learnt increases and decreases in fear beliefs for novel animals returned to baseline levels; (3) there was an increase in avoidance preferences for scared-paired animals and a decrease for happy-paired animals following counterconditioning; and (4) learning effects were similar for

mothers and strangers: the relatedness of the model to the US did not affect either initial vicarious learning or subsequent counterconditioning.

Overall, these findings provide further support for previous research (Askew & Field, 2001; Askew et al., 2008; Gerull & Rapee, 2002) that shows fear-related vicarious learning increases children's fear beliefs and avoidance for animals. Previous research (e.g. Askew & Field, 2007; Askew et al., 2008; Cook, & Mineka, 1989, 1990) has also indicated that non-relatives can act as models and the results from this experiment confirm this. Some evidence shows that mother models are particularly effective in vicarious learning: for example young infants seek and use information from their mothers when faced with ambiguous situations, but do not seek or use signals from strangers (Zarbatany & Lamb, 1985). The current findings appear to contradict this: comparisons between mother and stranger models found no differences in learnt fear beliefs. This suggests that by the ages of 6 to 10 years children make use of the emotional signals of their mothers to modify their behaviour, but unlike younger infants, they no longer rely principally on these and will make equal use of the emotional signals of adult strangers. Thus a mother's fear does not appear to be a more salient US for children of this age than a stranger's fear.

The ages of the children involved in this experiment offer a possible explanation for the differences in the findings compared to those in previous studies. In the current experiment the children were all older (aged 6-10 years) than is the norm in social referencing studies (e.g. aged 13-15 months: Zarbatany & Lamb, 1985) or for maternal fear-modelling studies (e.g. aged 15-20 months: Gerull & Rapee, 2002). So the differences in findings may be due to a greater acceptance on the part of this older age group for behavioural information from sources outside of their immediate family. The children in this experiment were all school-aged and as a result already adjusted to the idea of being taught by or learning from non-family members.



An alternative explanation is that using mothers does increase US salience but that, unlike direct conditioning, US salience simply is not important for vicarious fear learning. From an evolutionary perspective fear is crucial to survival (Marks & Nesse, 1994); therefore in Darwinian terms it may be unimportant who the fear is learnt from. In terms of survival, given the high cost of failure, when a threat arises it is more important that the potential danger be perceived quickly rather than with absolute certainty, i.e. it is safer to be overcautious, so any information about threat is important.

Another of the findings in this experiment was that vicariously acquired fear beliefs can be reversed using a similar procedure. Kelly et al. (2009) demonstrated that positive information and modelling could effectively reduce learnt fear beliefs and behavioural avoidance. In their experiment positive information proved to be more effective than modelling. However the acquisition phase in their experiment consisted of verbal information only and so the modelled unlearning phase (where the researcher modelled a non-anxious response while placing their hand inside a box the children were *told* contained the animal) was using a different pathway to the acquisition phase. It is possible that such pathway combinations or the specific modelling procedure (where no visual presentation of the animal was used) may be less effective. In the current experiment the acquisition phase consisted of a vicarious learning task and the subsequent unlearning was also achieved by using a vicarious counterconditioning procedure. In this procedure children saw the previously scared-paired animal again with happy faces, or the previously happy-paired animal with scared faces. Using this vicarious unlearning procedure fear beliefs acquired through a vicarious learning procedure were successfully returned to baseline. In accord with the results from the initial learning phase, counterconditioning effects were similar for both mothers and strangers, with no discernible differences between them being detected. Significantly, this was the case even where the initial learning was from the mother and the counterconditioning

or unlearning was via a stranger. This contradicted expectations that any changes in fear-related beliefs learnt from mothers might be more robust (due to greater US salience), and thus more resistant to modification by stranger models. Again, this may be because threat-relevant information is no more salient from mothers than from strangers for children in this age group: children view this observed information as equally important whatever the source. Or, alternatively, salience may be less important in vicarious learning than it is for direct conditioning.

The findings are important because they suggest that timely positive modelling from anyone, whether closely related or complete strangers, can be effective in reversing vicariously acquired fear responses for children in this age group. This has important implications for parents, primary carers, and those who work with school-aged children because it means their intervention has the potential to prevent or reverse fear developing if they recognise a child is involved in a fear-related vicarious learning event.

## **2.5 Chapter Summary**

This experiment confirms that vicarious learning can increase children's fear beliefs for novel animals and shows that for 6 to 10 year olds the relatedness of the model does not appear to affect vicarious fear learning: children vicariously learn fear-related responses for novel stimuli from mothers or strangers equally and the type of model does not affect the size or robustness of the fear response. A second finding was that vicariously acquired fear responses can also be reversed using a vicarious counterconditioning procedure and again this is not affected by whether the model is the observer's mother or a stranger. Thus the salience of the US (the model's fear response) does not appear to affect vicarious fear learning when salience is manipulated by increasing the relatedness of the model to the observer. The most likely explanation is that salience is not affected by the relatedness of the model to the observer during threat-related vicarious learning in this age group. Hence US salience may

still be important but may need to be manipulated in a different way if effects of changes in salience are to be detected. In a general sense the findings may be said to reflect children's increasing willingness as they mature to learn from the responses of strangers as well as family members.

## **Chapter 3.**

### **Vicarious Learning and Salience of the US:**

#### **Effects of Age of Model on Vicarious Learning and Unlearning**

##### **3.1 Introduction**

Rachman (1977) argued that fear beliefs could be acquired in childhood from a variety of sources, including being learnt from adults and peers. Having found no evidence that relatedness of the model to the observer affects vicarious learning via US salience, Experiment 2 investigates another possible influencing factor: the age of the model relative to the observer. Peers are persons of the same age maturing or developing at a similar rate. Peers who mature and develop together from a very young age tend to have similar skill-sets and interests. It comes as no surprise then that children tend to view peers as desirable companions and persons to play with, often, preferring them over family members as they mature (Ladd, 2008). For many children, beginning school is the first time that they have sustained contact with peers. As schools normally have more children than caregivers, children spend more time interacting with their peers than with adults. Thus peers become the daily companions of children in the activities and experiences that comprise their formative years (Ladd, 2008).

That children learn successfully from their peers is well-established. Early research pointed to the important role played by peers in learning; for example Bandura (1977) believed that children learned attitudes, values, and behaviours through social interaction with their peers. More recently, Gifford-Smith, Dodge, Dishion, and McCord (2005) looked specifically at deviant peer influence and concluded that children can exert an extremely potent influence over the thoughts and behaviour of others in their peer group. The term peer-mediated intervention (PMI) is generally used to describe all social, academic and

behavioural strategies that employ children's peers rather than adults to engender change and these have proved extremely effective in achieving a number of outcomes such as improving academic performance, promoting active engagement, and improving interaction with other peers (Hoff & Robinson, 2002). PMIs involve students working in pairs or as part of small cooperative groups. PMI strategies have been shown to improve writing (Yarrow & Topping, 2001), maths (Franca, Kerr, Reitz, & Lambert, 1990), science (Rosenthal, 1994), art (Thurston, 1994) and physical education (Block, Oberweiser, & Bain, 1995). The success of these strategies suggests therefore that children are particularly receptive to learning important information from their peers.

Strategies to improve learning, such as class-wide peer tutoring (CWPT) have been successfully employed by educators for many decades. In CWPT, students are typically instructed first by their teachers, then the class is organised into tutor-student pairs, with the tutor teaching their under-performing peers (Greenwood, Maheady, & Delquadri, 2002). A considerable number of studies have demonstrated that when it comes to improving the academic achievements of pupils, CWPT is far more effective than the more conventional forms of teacher-led classes (see Greenwood, Arreaga-Mayer, Utley, Gavin, & Terry, 2001). In a 12 year longitudinal study involving 416 students from nine schools, researchers found that CWPT increased students' active engagement during instruction through grades one to three (6 to 10 years old); improved student's academic achievement at grades two, three, four, and six, (ages 7 to 13 years old); and reduced the number of students who dropped out by the end of High school (age 17 to 18 years old) (Greenwood, Delquadri, & Hall, 1989; Greenwood & Delquadri, 1995).

While there is clearly evidence for the effectiveness of peer learning, the conditions that promote such learning are less certain (Field, Argyris, & Knowles, 2001). There is also evidence to suggest that younger children are more receptive of such learning if a person of

perceived greater competence is delivering the information. For example, French (1984) reported that children between the age of 6 and 9 years old prefer to seek guidance from an older child than one of the same age. However, while the results of this self-report study may reflect children's true beliefs, they may merely show what children believed would be the expected correct answers to the questions they were asked. For a given scenario, they were asked who they would prefer to enter into a relationship with: someone younger, same age or older? Children responded, for example, that they would prefer friends their own age, to be taught by people older than them, and to teach children younger than them. While this may be good evidence of children's expectations, it does not provide real evidence of a preferential learning effect.

Field et al. (2001) found that fear-related information provided by adults, but not peers, led to increases in fear beliefs for novel animals. They presented 45 children aged 7 to 9 with verbal information about two novel toy creatures ("monster" dolls) in the form of two stories about the dolls: a positive story about one doll and a negative story about the other. They also varied the person who gave children the information across three groups, using a teacher, stranger and a peer. Fear-related beliefs for the dolls significantly increased following negative verbal information, but the effect was only found when information was delivered by an adult. However, more recently Broeren, Lester, Muris, and Field (2011) looked at the effects of vicarious learning on children (8 to 10 years) and found that same age peer models were effective at changing children's fear-related beliefs towards animals. This study looked at the effect of filmed peer modelling on children's fear learning for novel guinea pigs. They found that after positive fear modelling, fear beliefs for both the modelled and non-modelled animals decreased significantly along with avoidance behaviour. This result for the non-modelled animal was attributed by the researchers to an apparent generalization effect of the positive modelling. After negative peer-modelling, fear beliefs for

the negatively modelled animal increased, while there was no increase for the control animal (an absence of any generalization effect). Avoidance preferences did not change for the negatively modelled animal but decreased for the control animal. Broeren et al. attributed this to a possible comparison effect with the non-modelled animal being compared more favourably with the negatively modelled animal.

Thus peer modelling is effective in vicarious fear learning (Broeren et al., 2011), but peers are not an effective source of threat-related verbal information (Field et al., 2001). Unlike Field et al.'s (2001) study of verbal information though, Broeren et al.'s (2011) experiment did not tell us whether peers or adults are more effective models in vicarious fear learning. Consequently, Experiment 2 compared vicarious learning for same age peer and adult stranger models. The basic methodology was identical to Experiment 1 except that models were either adult strangers or children of a similar-age to participants. Once again this experiment also examined the effect US salience has on the unlearning of vicariously acquired fear-related responses during vicarious counter-conditioning because, given previous literature, it was thought that either adult or peer models could prove to be more salient for children: evidence from the classroom suggests peers might be more effective, but laboratory verbal information studies suggest adults are more influential. As in Experiment 1 it was expected that children would show increased fear-related beliefs and avoidance preferences for animals presented with images of scared adults and a reduction when images of happy adults were used. Given the contradictions of previous peer learning studies, no specific predictions could be made about whether adults or peers would be more effective models here.

## 3.2 Method

### 3.2.1 *Participants.*

Sixty children (24 boys, 36 girls) aged between 6 and 10 years ( $M = 8.86$  years,  $SD = 0.98$  years) took part in this experiment. In this experiment the required sample sizes were estimated on the basis of 4 groups and 3 measurements in a mixed ANOVA analysis. A G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) sample size calculation determined that 60 participants would be necessary to detect a moderate effect size of an  $\alpha = .05$  with power of .95.

Children were recruited via schools in south-east England, UK.

### 3.2.2 *Materials.*

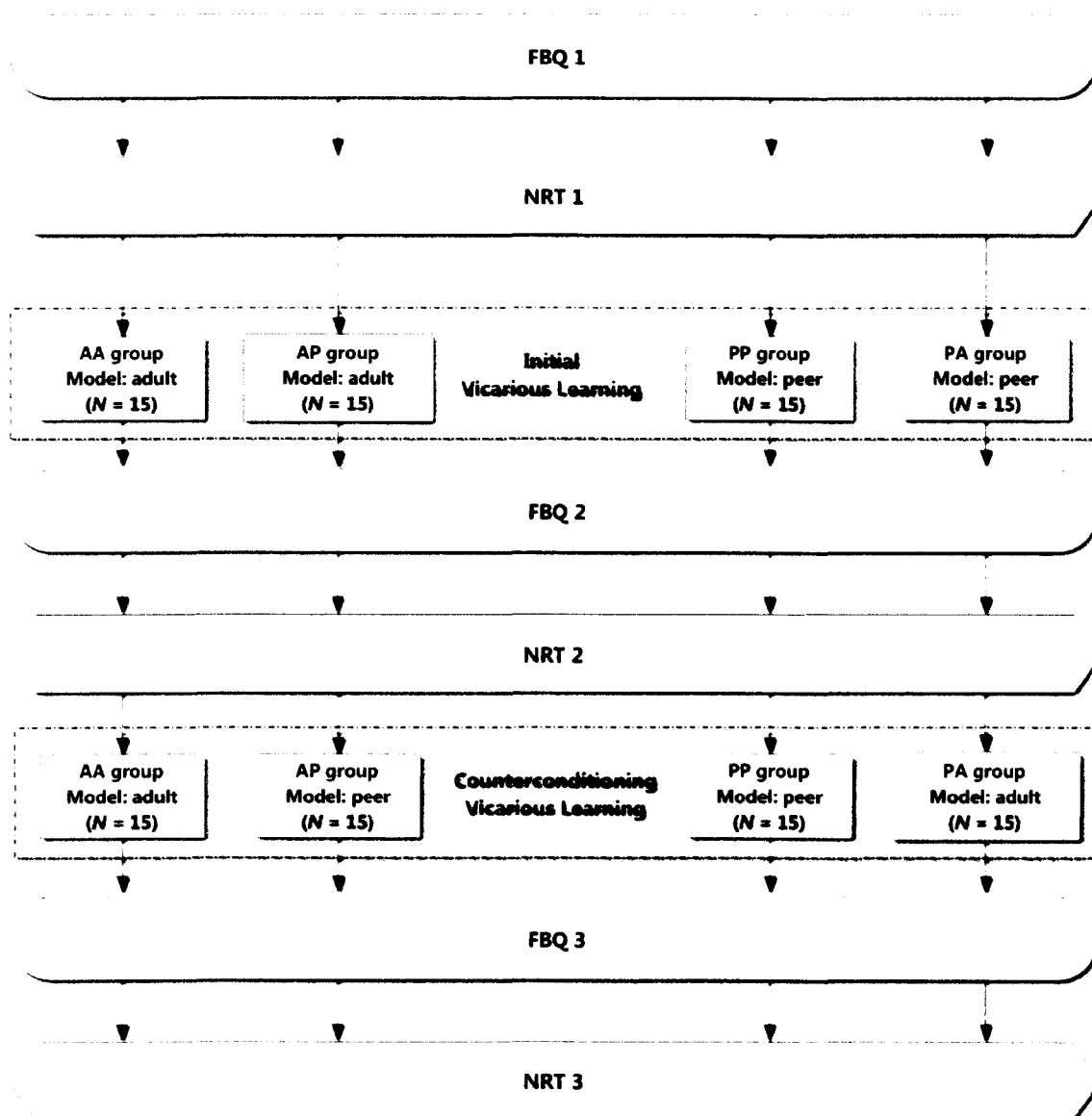
The materials used in this experiment were identical to those used in the first experiment with the exception of the face images. As no male images were used in the first experiment an additional set of male images, and also a further two sets of images of two children (a boy aged 10 and a girl aged 9) were created. None of the models were known to the participants in the experiment. As with the first experiment, the models were taught how to pose for the happy and fearful images. This experiment therefore utilised the images of two adults (male and female) and two children (male and female) who each provided three fearful and three happy colour portrait images (300 x 400 pixels), making 24 images in total. FBQ scale reliabilities before vicarious learning were good: Cronbach's  $\alpha = .71$  (Cuscus subscale), .81 (Quokka subscale), .73 (Quoll subscale). After vicarious learning they were .80, .81, .84 respectively, all of which were above Kline's (1999) recommended .70 threshold.

### 3.2.3 *Procedure.*

The procedure was almost identical to the first experiment but mother and stranger model USs were substituted with adult and peer USs. Thus in this experiment children were randomly allocated to one of four model groups: Adult-Adult (AA), Adult-Peer (AP); Peer-Peer (PP); and Peer-Adult (PA) (see figure 4). As with the first experiment there were two vicarious learning stages; so for example children in the AP group first experienced vicarious



learning with an adult (A) model, then vicarious counterconditioning with a peer (P) model. An additional pre-vicarious learning nature reserve task was also used to measure changes in avoidance preferences during each learning phase. After the first FBQ and NRT had been completed, the first vicarious learning stage began and children were presented with exactly the same animal-face pairing procedure as the first experiment. For this experiment, however, faces were either of adults or children depending on which model group children had been assigned to. Following the initial vicarious learning phase, FBQ and NRT measures were taken. Next, children took part in the vicarious counterconditioning phase, which was subsequently followed by the third FBQ and second NRT measures, and debrief.



*Figure 4.* Procedure used in Experiment 2 to compare the effect of peer and adult models on vicarious fear learning and unlearning.

3.3 Results

3.3.1 Fear beliefs.

Figure 5 shows mean fear beliefs before and after the vicarious learning procedures for each modelling group.

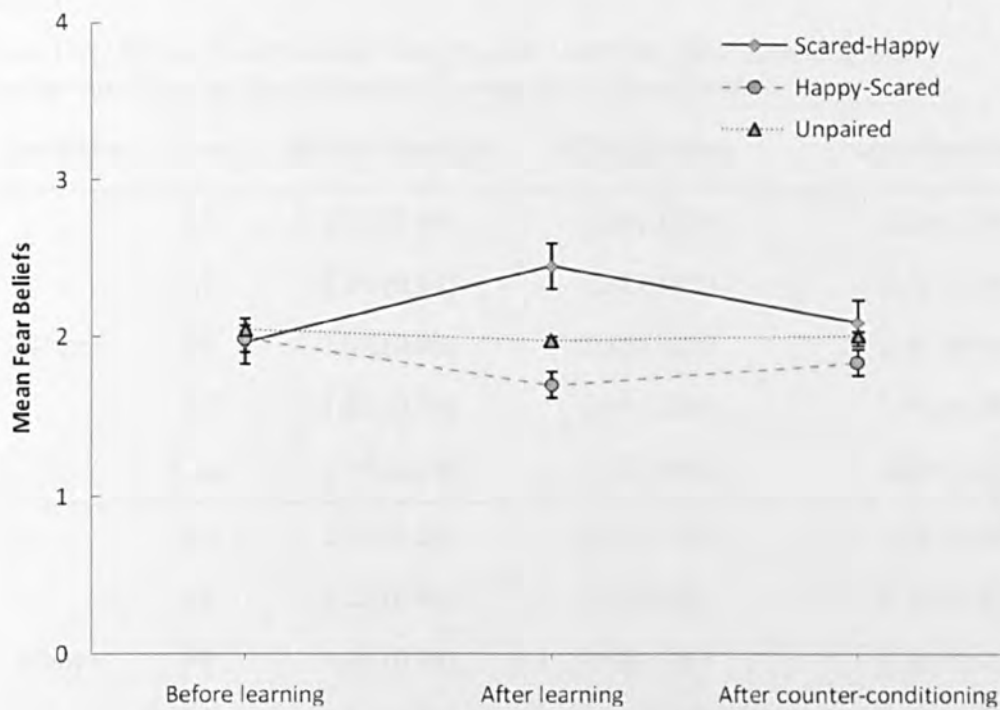


Figure 5. Mean fear beliefs (and SE) for the scared, happy, and unpaired (control) conditions, pre- and post- vicarious learning and post-counterconditioning (unlearning process).

FBQ scores were compared pre- and post-vicarious learning and post counter-conditioning. A three-way 3(time: baseline, post-learning, and post-counterconditioning) x 3(pairing type: scared, happy and none) x 4(model group: AA, AP, PP, and PA) mixed ANOVA with repeated measures on the first two variables was performed on fear belief scores. There was significant main effect of pairing type  $F(2, 112) = 10.16, p < .001, \eta^2p = .15$ , but the main effect of time was non-significant,  $F(1.78, 99.45) = .47, p = .61, \eta^2p = .01$ . The important (Greenhouse-Geisser adjusted) time x pairing type interaction was significant,  $F(2.68, 150.09) = 5.41, p = .002, \eta^2p = .09$ , showing that vicarious learning had led to changes in fear beliefs that were different depending on the type of face (happy or scared)

presented. All other main effects and interactions were non-significant (see Table 7), including the group x pairing type x time interaction,  $F(12, 224) = 0.72, p = .74, \eta^2p = .09$ , indicating that changes in fear beliefs due to vicarious learning were similar in all four model groups.

Table 7  
*Mean FBQ Scores for Adult and Peer, Before Learning, After Learning and Counterconditioning (with Standard Deviations in Parentheses)*

Condition	Group	Before learning	After learning	Counterconditioning
Scared	AA	2.07 (0.59)	2.38 (0.87)	2.30 (1.20)
	AP	2.10 (0.81)	2.52 (0.92)	2.16 (1.06)
	PP	1.91 (0.99)	2.52 (1.21)	1.91 (0.98)
	PA	1.82 (0.71)	2.35 (0.83)	1.98 (1.29)
	Total	1.97 (0.78)	2.45 (0.95)	2.09 (1.12)
Happy	AA	2.01 (0.86)	1.75 (0.89)	1.78 (0.80)
	AP	2.21 (0.86)	1.78 (0.93)	1.86 (0.82)
	PP	1.90 (0.80)	1.50 (0.67)	1.84 (1.01)
	PA	1.86 (0.82)	1.75 (1.04)	1.90 (0.97)
	Total	1.99 (0.83)	1.70 (0.88)	1.84 (0.88)
Unpaired	AA	1.98 (0.80)	2.23 (0.77)	2.31 (0.70)
	AP	2.23 (0.84)	2.10 (0.86)	2.04 (0.75)
	PP	1.97 (0.71)	1.40 (0.86)	1.63 (0.89)
	PA	2.03 (0.72)	2.17 (1.08)	2.06 (0.95)
	Total	2.05 (0.76)	1.98 (0.94)	2.01 (0.84)

Planned comparisons for the time x pairing type interaction comparing baseline fear beliefs and fear beliefs after the first vicarious learning procedure showed a significant increase after scared-pairing,  $F(1, 56) = 20.09, p < .001, r = .51$ , and decrease after happy-pairing,  $F(1, 56) = 2.05, p = .15, r = .04$ . Comparisons of baseline fear beliefs with those after

counterconditioning found no significant differences for happy,  $F(1, 56) = 0.48, p = .49, r = .01$ , or scared,  $F(1, 56) = 0.93, p = .34, r = .02$ , pairings, showing that fear beliefs returned to baseline levels following the vicarious counterconditioning procedure.

3.3.2 Avoidance preferences.

Figure 6 shows mean distances (cm) from the animal to the figures children placed on the board in the nature reserve task.

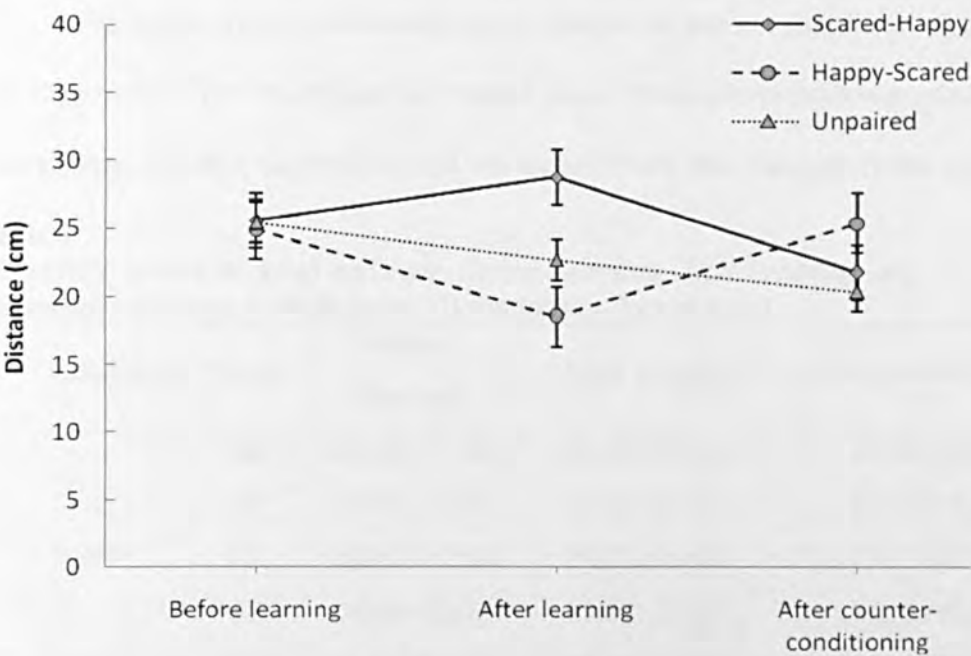


Figure 6. Mean (and SE) distance (cm) between animals and children's figures in the nature reserve tasks.

A three-way 4(conditioning group: AP, AA, PA, PP) x 3(pairing type: scared, happy and none) x 3(time: pre-learning, post-learning and post-counterconditioning) mixed ANOVA, with repeated measures on the second and third variables, was performed on nature reserve task distances. The significant pairing type x time interaction showed that avoidance preferences changed over time depending on the type of face children saw animals with,  $F(3.60, 201.57) = 7.45, p < .001, \eta^2p = .12$ . Planned comparisons comparing avoidance preferences at baseline and post-vicarious learning showed a significant increase in avoidance

preferences for scared-paired animals compared to unpaired animals,  $F(1, 56) = 4.76, p = .033, r = .28$ , but avoidance preferences were no different from baseline levels following counterconditioning,  $F(1, 56) = 0.27, p = .61, r = .07$ . There was no significant decrease in avoidance preferences for happy-paired animals compared to unpaired animals following vicarious learning,  $F(1, 56) = 2.54, p = .12, r = .21$ , but avoidance preferences were significantly higher than baseline, compared to unpaired animals, following counterconditioning,  $F(1, 56) = 4.33, p = .042, r = .27$ .

The type x time x conditioning group interaction was not significant,  $F(10.80, 201.57) = 0.62, p = .81, \eta^2p = .03$ , indicating changes in avoidance preferences were similar in the four groups. All other main effects and interactions were also non-significant (see Table 8).

Table 8  
*Mean NRT Scores for Adult and Peer, Before Learning, After Learning and Counterconditioning (with Standard Deviations in Parentheses)*

Condition	Group	Before learning	After learning	Counterconditioning
Scared	AA	29.47 (13.56)	30.07 (17.03)	25.20 (16.94)
	AP	25.93 (12.64)	31.73 (20.77)	27.07 (18.30)
	PA	26.33 (13.11)	25.33 (15.58)	17.13 (12.92)
	PP	20.60 (9.47)	27.67 (15.46)	17.73 (10.65)
	Total	25.58 (12.41)	28.70 (17.07)	21.78 (15.29)
Happy	AA	27.07 (11.49)	20.27 (14.56)	27.73 (17.02)
	AP	24.93 (13.31)	21.27 (17.26)	27.87 (16.27)
	PA	25.33 (14.85)	18.00 (10.34)	27.00 (20.91)
	PP	22.27 (9.52)	14.60 (9.36)	18.87 (13.16)
	Total	24.90 (12.26)	18.53 (13.18)	25.37 (17.06)
Unpaired	AA	25.33 (11.82)	25.27 (13.87)	27.47 (12.51)
	AP	24.93 (16.77)	23.93 (12.46)	21.20 (13.19)
	PA	28.73 (17.32)	24.93 (16.18)	19.93 (12.08)
	PP	22.67 (14.48)	16.53 (11.78)	12.73 (8.92)
	Total	25.42 (15.02)	22.67 (13.80)	20.33 (12.64)

### 3.4 Discussion

Children in this experiment randomly viewed images of three novel Australian marsupials (CSs) paired with counterbalanced images of negative or positive facial expressions (USs), posed by an adult or a same-age peer, or left unpaired (control). Fear-related beliefs and avoidance preferences were assessed before and after vicarious learning and again after vicarious counterconditioning. The results once again confirmed previous findings (e.g. Askew & Field, 2007) that vicarious CS-US pairings affect children's self-reported fear-related responses for novel animals: scared-pairing increased fear beliefs and avoidance preferences and happy-pairing decreased fear beliefs. As in Experiment 1, the results showed that vicariously learned increases and decreases in fear beliefs for animals had returned to baseline levels post-counterconditioning (unlearning). It also provides further evidence for the effectiveness of same-age child peer models in negative fear-modelling as demonstrated by Broeren et al. (2011). One further finding was that only fear-related vicarious learning affected avoidance preferences: it increased avoidance preferences above baseline levels both during vicarious learning and counterconditioning. Positive vicarious learning on the other hand did not decrease avoidance preferences from baseline levels, but did return previously elevated avoidance to baseline during counter-conditioning.

The manipulation in this experiment involved children being presented with an adult US or a same-age peer US to determine the effect age of model would have on the salience of the US and consequently on the magnitude of the learnt response. Previous evidence has suggested that learning via peers can generally be very effective (e.g. Greenwood et al., 2001), but that fear-related information is more effective when delivered by adults (e.g. Field et al., 2001). Broeren et al. (2011), however, showed that fear-related modelling by same-age peers could also be effective but did not compare it to learning via adult models. The current results also showed that vicarious learning from peer models is no different from learning

from adult models. This result contrasts with the findings of Field et al. (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. It is not immediately clear why this would be but there are a number of factors to consider. It might be important that the experiments took place in a school environment. Context may be important because when children are at school it is very clear to them that they are there to learn, ostensibly at least, from adult teachers. With the verbal scenarios in Field et al.'s research involving a head teacher plus an adult stranger (a possible substitute teacher in children's eyes), the children may have felt that they were being instructed in how to behave and responded accordingly when tested. The same-age peer models, employed by Field et al., were known classmates of the participants and because of this it is possible that the children may have doubted the reality of the scenario presented. The child story-readers are unlikely to have been as confident or have delivered with the same degree of conviction as the teacher/adults. Children may not have felt the same compulsion to learn from children they knew as they would from a teacher, and perhaps felt less under pressure to respond "correctly".

The findings in the current study suggest that either age does not affect the salience of the US for children during vicarious fear-learning, or US salience is not an influential factor in vicarious fear-learning. As mentioned in Chapter 2, it is possible that for vicarious fear-learning in childhood, purely in terms of survival, the salience of the US is less important than the potential danger signalled. This would be a logical response 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 it makes sense from an evolutionary perspective for threat-related learning to occur even when US salience is low. Together with Experiment 1, the current results appear to support this as children learned about threat to a similar degree from their peers as from adults. Moreover, this explanation is also supported to some degree by the



fact that avoidance preferences in the current study were only affected by fear-related modelling, and not positive modelling.

### **3.5 Chapter Summary**

The results of this experiment show that children (aged 6 to 10 years) form associations between the emotional responses of adults or children (USs) and novel animals (CSs). Furthermore, the results indicate that the age of the model has no bearing on vicarious fear-learning or un-learning: children of this age vicariously learn fear-related responses from peer-aged or adult strangers equally and there was no significant difference in either the size of the fear response or its robustness during counterconditioning. Thus the findings suggest that children can not only learn fear from their peers as successfully as from adults, but this learning can also be unlearned from peer models just as successfully as from adults. Finally, the evidence suggests that for vicarious fear-learning in this age group, either the age characteristic of the model does not affect US salience, or US salience factors are simply not an important influence on learning. Given what we know about associative literature more generally the first of these explanations seems most likely.

## **Chapter 4.**

### **Vicarious Learning and Salience of the US:**

#### **Effect of Motion on Vicarious Learning**

##### **4.1 Introduction**

In the final of three studies looking at US salience, Experiment 3 examines whether US salience is enhanced and therefore vicarious learning is greater when children observe moving models in films compared to models in still images. The way in which children develop their social and emotional skills is a highly complex multi-faceted one. In order to integrate and participate fully in society they must learn the cultural values, rules, and norms of behaviour. The ability to recognise, understand and react to the emotions of others is vital in acquiring the skills necessary to integrate with society (Halberstaadt, Denham, & Dunsmore, 2001). It is likely that children acquire most of their knowledge about emotions and relationships from their family, friends and teachers. However, the observed event need not be a “real” event, children can also learn about society’s values and common standards of behaviour through events presented in film on television, computer screen or other visual media, from the observation of actors, and may also vicariously experience emotional and social events this way (Wilson, 2008).

Gentile and Walsh (2002) found that 62% of parents of children aged of 2 to 17 years believed their child had at some time feared something they had observed on television might happen to them in real life. Harrison and Cantor (1999) interviewed university students and found that 90% could describe a movie or television program that they had viewed (the majority in their young childhood or adolescence) that had affected them in a long-term way. Of these, 52% reported disturbed sleep or eating habits, 36% reported changes in behaviour

to avoid real-life events similar to those that they had observed, 22% reported still being obsessed with the content they viewed and 17% actively avoided similar programs or movies. This supported earlier research that found a link between self-reported anxieties and depression with heavy television viewing (Singer et al., 1998), and supports the argument that fear induced in children via television and films could potentially have severe and possibly long-term effects.

Empathy may be crucial for vicarious fear learning and Wilson and Cantor (1985) found evidence suggesting that empathy is a developmentally acquired skill. Two groups of children (3 to 5 years and 9 to 11 years) observed a film showing either a threatening stimulus or a person's fearful response to a threatening stimulus that was not visible itself. Children in the younger group were found to be less physiologically aroused and reported being less frightened by the person's fearful expression than by observation of the threatening stimulus. However, the older group produced a similar emotional response to both versions of the film. While the younger group recognised the fear emotion presented by the person in the film in the same way as the older group, they were less likely to enter into role-taking with the observed person – a skill that is understood to develop around eight years of age (Kurdek, 1977). The study indicates that people's filmed fearful responses to stimuli can evoke fear responses in older children (9 to 11 years) who have a more developed sense of empathy.

In a series of experiments, researchers presented lab-reared monkeys with movies of wild monkeys behaving fearfully with various fear-relevant and fear-irrelevant stimuli such as snakes and flowers (e.g. Mineka, 1985; Cook & Mineka, 1990, 1989). These experiments demonstrated that naïve lab-reared monkeys had acquired fear of snakes, but not flowers, after observing video presentations of model monkeys behaving fearfully with them. As discussed in chapter one, the results from these experiments also showed that the processes underpinning the observers' responses to the models' fearful responses, and the fear-learning

derived from it, are similar to the CS-US processes observed in classical fear conditioning (Cook & Mineka, 1990; Mineka & Cook, 1993). Cook and Mineka (1990) also noted that the results obtained with videotaped models were largely similar to those obtained previously with live model monkeys and argued that video-taped models provide a potent source of emotional learning for primates. By extension, they suggested that media in general may be an important source of fear and phobia learning in humans.

Broeren, Lester, Muris, and Field (2011) tested this by presenting children (8 to 10 years old) with video films of same-age (unknown) peers fearfully or happily approaching a box they believed contained an unfamiliar animal. Children's fear beliefs and avoidance tendencies were found to have decreased for the positive and un-modelled animals. In contrast, children's fear beliefs increased for the fearfully modelled animal compared to the non-modelled animal, though negative modelling did not affect avoidance tendencies. This study clearly demonstrated then that films of fearful peer models can influence children's fear-related cognitions for animals.

Previous studies have shown that children with anxiety disorders demonstrate information processing biases similar to adults (Hadwin & Field, 2010; Muris & Field, 2008). One common type of dysfunctional information processing is attentional bias, which is particularly marked for stimuli perceived as threatening (Garner, 2010; Heim-Dreger, Kohlmann, Eschenbeck, & Burkhardt, 2006). One means of investigating attentional bias is to use a dot probe task. This procedure was developed by MacLeod et al. (1986) to measure how attention is allocated when the observer is presented with competing stimuli. In the original procedure two words, one threat-related and one neutral, were presented for a short period of time and then disappeared. A dot replaced the threatening word in some trials and the neutral word in others, and participants were asked to indicate the location of the dot on the screen as quickly as possible. MacLeod et al. (1986) found that participants were quicker

to respond to dots appearing at a location previously occupied by a threat-associated word than a one occupied by neutral word, indicating an attentional bias for threat. Mogg and Bradley (2002) adapted the procedure using pictures of either a threatening or happy emotion alongside a neutral one, instead of threatening and neutral words. Their results demonstrated attentional bias towards the area on the screen where a threatening face appeared.

It is thought that such biases may have a causal or maintenance role in the development of anxiety disorders and recent research suggests that anxiety may be reduced simply by mediating attention away from the threat stimuli (Amir, Beard, Burns, & Bomyea, 2009; Schmidt, Richey, Buckner, & Timpano, 2009). How these attentional biases develop in the first place is still unclear; however, it is believed that they originate in early childhood (Field & Lester, 2010; Vasey & MacLeod, 2001). In one example of this using a dot probe task, Field (2006) found that children show a left visual field attentional bias for pictures of animals they are given threat-related verbal information about. Another possibility is that attentional biases are also the product of threat-related vicarious learning events during childhood (Muris & Field, 2008).

Therefore the current study sought to investigate the effect of vicarious fear learning on children's attentional bias for animals. Although using static images offers some advantages (e.g. it is possible to clearly, systematically and distinctly manipulate exposure to the CS and US), films might be expected to be more ecologically valid. It was thought that this factor along with the richer information in films would increase US salience compared to still images. Broeren et al. (2011) used children's peers as models in film with mixed results. Given that Experiment 2 of this thesis found no difference in effect between peers and strangers as models though, it was decided that for this experiment strangers would be used as the models, as this scenario would be more similar to the television type experiences that children might be exposed to (e.g. Gentile & Walsh, 2002; Kurdek, 1977). Thus children in

Experiment 3 were randomly assigned to two groups: threat-relevant vicarious learning film or neutral vicarious learning film. Changes in children's fear beliefs and avoidance preferences for two animals were measured before and after the films. To investigate whether an attentional bias for the animals was present following the threat-relevant film, children were also asked to take part in a dot probe task (MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 2002). It was expected that children would demonstrate a significant increase in fear-beliefs for the animals presented in the threat-related film compared to those in the neutral film or no film group.

## **4.2 Method**

### ***4.2.1 Participants.***

Forty-eight children (24 male and 24 female) aged between 7 and 9 years ( $M = 9.03$  years,  $SD = .66$  years) took part in the study. In this experiment the required sample sizes were estimated on the basis of 2 groups and 4 measurements in a mixed ANOVA analysis. A G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) sample size calculation determined that 36 participants would be necessary to detect a moderate effect size of an  $\alpha = .05$  with power of .95. All were recruited from local schools in the south London area.

### ***4.2.2 Materials.***

#### ***State-Trait Anxiety Inventory for Children (STAIC; Spielberg et al., 1973)***

As there is a link between attentional biases and general anxiety levels (Cisler & Koster, 2010), the 20-statement "State-Trait Anxiety Inventory for Children" (STAIC; Spielberg, Gorsuch, Lushene, Vagg, & Jacobs, 1983) self-report measure of anxiety was used to assess children's trait anxiety. This measure consists of 20 statements to assess trait anxiety, i.e. how anxious children generally feel (STAIC-T anxiety), or how anxious they feel at a specific moment in time (STAIC-S anxiety). All statements are scored on a 3-point Likert-scale with a score of 1, 2, or 3 assigned for the three alternative choices. Scores on

both the STAIC S-Anxiety and T-Anxiety subscales therefore range from a minimum score of 20 to a maximum of 60. The STAIC is a reliable scale for use with children: Spielberger et al. (1970) report test-retest correlations of .54 (state) and .86 (trait).

### ***Fear Beliefs Questionnaire (FBQ)***

The FBQ (Field & Lawson, 2003) was again used in this experiment. Before vicarious learning, scale reliabilities were Cronbach's  $\alpha = .79$  (quokka subscale), .75 (quoll subscale). After vicarious learning they were .83 and .80 respectively all of which were above Kline's (1999) recommended threshold value of .70.

### ***Nature reserve task (Field & Storksen-Coulson, 2007)***

As in Experiment 1 and Experiment 2, the nature reserve task was used to measure children's approach-avoidance intentions for animals; however, unlike the earlier experiments the board was rectangular, not triangular because there were only two animals. The procedure was otherwise similar to previous experiments with children asked to imagine that the green board (45 cm x 60 cm) was a nature reserve and invited to place a Playmobil figure representing themselves onto the board in the location where they would most like to be. Unlike previous experiments though, instead of all the animals being presented simultaneously on the board, children saw just one animal on the board at any one time. An image of one of the animals children had seen during the vicarious learning task was placed at one end of the rectangular board. This was then repeated for the second animal. The reason for this was that it was decided that measurements for each animal should ideally be independent from each other, i.e. being farther away from one animal should not automatically mean being nearer to the other animal as it does when all animals are on the board at the same time. The distance from the child's figure to each animal photo was again measured as an indication of children's approach-avoidance preference for the animals.

***Dot-Probe Task (MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 2002)***

A dot-probe task was used to compare attention for animals seen in the fearful and neutral modelling films. In each trial a probe appeared immediately after presentation of two animal images on the left and right of a computer screen (one image of a quokka and one of a quoll). Children were required to identify whether the probe was either a “:” (colon) or a “..” (ellipsis) as quickly as possible. First a fixation cross appeared on the screen for 500ms followed by the animal pictures for 500ms and this was immediately followed by the probe. Children first completed 20 practice trials; followed by 32 actual trials in which response times (RTs) were recorded. In 16 of the 32 trials the probe appeared on the left side of the screen and in 16 trials on the right side. In half of each of these (i.e. 8 trials in each case) the quoll appeared on the left side of the screen and quokka on the right, and in the other half of the trials this positioning was reversed. Finally, in half of each of these the probe was a colon and half an ellipsis. Children responded on a Cedrus RB-830 response pad.

As is recommended when calculating RTs, all errors and outliers were eliminated (see Ratcliff, 1993). This was done because when working with children’s RTs it is possible to get very large outliers where for example a child has lost concentration or become distracted and does not press a key as quickly as possible. As one large unrepresentative data point can skew the mean of the RTs this was adjusted for by deleting scores of 2.5 SDs above and below the mean as they were unlikely to be “real” scores (i.e. they are likely to be because the child has not been concentrating or was distracted, etc). Scores of 2.5 were chosen because in a normal distribution 98.72% of scores fall 2.5 SDs above and below the mean, so scores outside of this range would generally be expected to be outliers. After outliers had been excluded, a new adjusted mean was calculated to provide a more accurate measure of the children’s performances.



Four films were used in the experiment. There were two films for each of the animals, i.e. for each animal there was one film with modelled neutral behaviour and one film with modelled scared behaviour. In the threat-related film children were shown a location where one of the animals was to be found. An actor was then shown approaching this area and upon noticing the animal the actor appeared frightened and ran away. In the neutral film the scenario presented was the same but when the actor found the animal he remained neutral (i.e. made no expression of fear) and then walked away.

**4.2.3 Procedure.** Children were randomly allocated into one of two model groups indicating the type of vicarious learning they would receive: negative (threat-related) film or neutral film (see Figure 7).

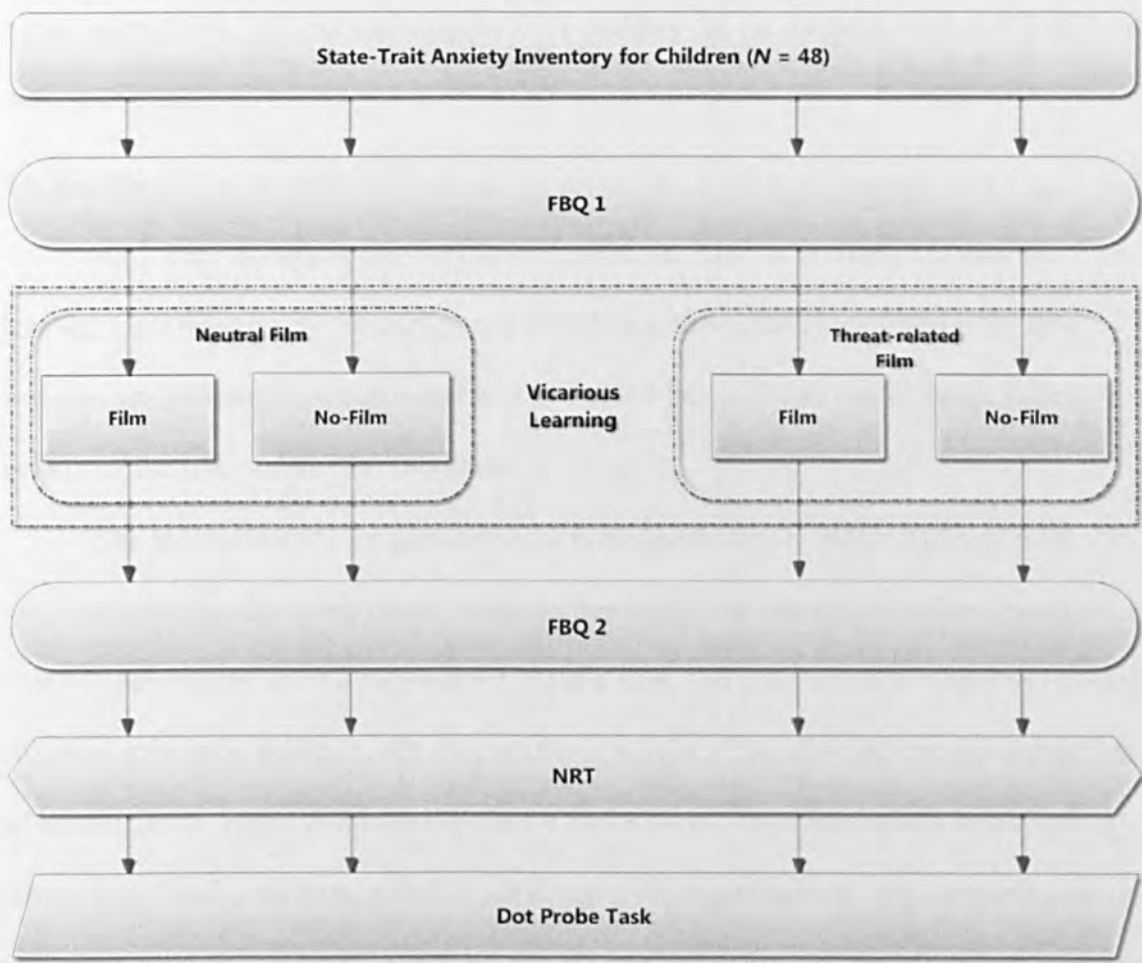


Figure 7. Procedure used in Experiment 3 to compare the effect of moving and still models (US) on vicarious fear learning.

Within each of these groups there were two film conditions: each child saw one of the animals in a film and one not. The type of animal (quoll or quokka) children saw in the film was counterbalanced in each group. Children first completed the State-Trait Anxiety Inventory to determine general levels of anxiety. They then completed a fear beliefs questionnaire (FBQ 1) about the two animals in the experiment: one they would see in the subsequent film and one they would not see in a film. After this the children watched the vicarious learning films. Depending on the group that they were in each child saw a film that presented a person acting in a negative (scared) or neutral (calm) manner when encountering the animal.

Following vicarious learning, children completed the FBQ a second time and then the nature reserve task. After completing the NRT children did the dot probe task and then were fully debriefed.

### **4.3 Results**

**4.3.1 Fear beliefs.** A two-way 2(film condition: film vs. no film) x 2(vicarious learning type: negative vs. neutral) mixed ANOVA with repeated measures on the first variable was performed on fear belief scores. Table 5 below shows mean change in fear beliefs for the film and no film conditions.

The main effect of film condition was non-significant  $F(1, 46) = 0.003, p = .95, r = .01$ , indicating that there was no difference in fear beliefs for the animal children saw in a film compared to the animal they did not see in a film. The main effect of vicarious learning type was also non-significant,  $F(1, 46) = 0.07, p = .79, r = .04$ , showing that the fear beliefs of children in the negative film group did not differ overall from fear beliefs in the neutral film group. Finally, the important film condition x vicarious learning type interaction was non-significant,  $F(1, 46) = 0.22, p = .64, r = .07$ , indicating that fear beliefs did not change as a result of negative vicarious learning compared to neutral or no vicarious learning.

Table 5  
*Mean increases in fear beliefs in each vicarious learning condition.*

Vicarious learning type	Condition	Change in fear beliefs	
		<i>M</i>	<i>SD</i>
Neutral	Film	0.08	0.37
	No-Film	0.02	0.53
Negative	Film	0.66	0.81
	No-Film	0.11	0.63

**4.3.2 Avoidance preferences (NRT).** A 2(film condition: film vs. no film) x 2(VL type: negative vs. neutral) mixed ANOVA, with repeated measures on the first variable, was performed on the nature reserve task scores. The main effect of film condition was non-significant,  $F(1, 46) = 1.72, p = .10, r = .04$ , indicating that whether animals were seen in the film or not seen in the film did not change children’s avoidance preference for them. The main effect of VL type was also non-significant,  $F(1, 46) = 0.50, p = .45, r = .01$ , indicating that animal seen in scared or neutral in the film did not change children’s avoidance preference for animals. The pairing type x VL film type interaction was also non-significant,  $F(1, 46) = 0.17, p = .68, r = .004$ , indicating that vicarious learning had no effect on the distance that the children placed the figure representing themselves from the animal stimuli on the board (see Table 6).

Table 6  
*Mean distances (cm) from the animal to children's figures in the nature reserve task*

Vicarious learning type	Condition	Change in fear beliefs	
		<i>M</i>	<i>SD</i>
Neutral	Film	20.96	12.58
	No-Film	19.17	12.54
Negative	Film	24.58	16.73
	No-Film	21.13	15.02

**4.3.3 Attentional Bias.** An initial two-way 2(film condition: film vs. no film) x 2(VL type: negative vs. neutral) mixed ANCOVA was conducted on adjusted reaction times, with trait anxiety as a covariate. The covariate was included in the analysis because high trait anxiety is known to be related to attentional bias and the ‘pure’ effect of vicarious learning on attention was sought. However, trait anxiety did not prove to be a significant predictor of RTs here, therefore the analysis was subsequently re-run as a 2 x 2 mixed ANOVA without the covariate. The adjusted main effect of trial type was non-significant,  $F(1, 46) = 1.01, p = .32, r = .02$ , indicating that children’s reaction times for animals they saw in the film did not differ from those they did not see in the film. The adjusted main effect of vicarious learning film was also non-significant,  $F(1, 46) = 3.53, p = .067, r = .07$ , indicating that there was no difference in RTs for animals seen in negative and neutral films. Finally, the trial type x vicarious learning film type interaction, which is the critical effect to show whether vicarious learning led to attentional bias, was non-significant,  $F(1, 46) = 0.13, p = .72, r = .003$ .

**4.4 Discussion**

In the current experiment moving models in films were used instead of static images as it was thought that such models would offer more US salience than still images. Contrary to expectations, the threat-related film did not produce significant increases in fear beliefs or

avoidance preferences compared to controls. Hence the use of moving images in this experiment was not as effective as the still images used in the other experiments in this thesis in producing a change in children's fear beliefs. Given changes in fear beliefs were not observed, it is unsurprising that no evidence that vicarious learning can lead to attention bias was found either.

The findings appear *prima facie* to suggest that moving stimuli in films are not effective at facilitating vicarious learning. However, given the considerable amount of data to the contrary (e.g. Broeren et al., 2011; Genile & Walsh, 2002; Harrison & Cantor, 1999; Singer et al., 1998), this conclusion seems unlikely. Alternative explanations of the results should therefore be considered. First, it is possible that the specific films used in this experiment did not constitute an effective medium with which to change children's fear beliefs. This could be because children failed to believe the scenario in the film was real; or while accepting the reality of it, that they did not believe it represented a threatening enough scenario. They may not have been convinced by the model's attempt to convey an impression of fear in the threat-related film. Or alternatively they might simply have considered that the model's response was unwarranted given that the animal was not behaving in a threatening manner.

An additional explanation might be that the moving images provide children with more information about the behaviour of the animals than the still images, and given the animals were not acting in an inherently threatening manner, this additional neutral information was sufficient to override the fearful expression offered by the model. The static images of novel animals provide little information on their own for children to determine what that particular animal might be like, whereas the moving image may reduce some of the uncertainty or unpredictability that could otherwise be associated with the animal. There is some evidence to suggest that unpredictability, closely related to uncertainty, plays a

significant role in the genesis and maintenance of fear (Zvolensky, Eifert, Lejuez, Hopko, & Forsyth, 2000). Unpredictability and uncertainty both share a sense that there is a lack of information about the stimulus perhaps in regards to how it will behave, what it is, or what its intentions are, etc. The relationship between both of these variables and anxiety and fear has been demonstrated in a number of studies (e.g. Booth-Butterfield, Booth-Butterfield, & Koester, 1988; Craske, Zarate, Burton, & Barlow; 1993; Foa, Steketee, & Rothbaum, 1989; Roberts, 1993). What is clear from this literature is that, when dealing with animals, an important feature of the unpredictability variable appears to relate to movement. For example when phobic individuals believe that the movement of a fear-relevant animal is unpredictable they demonstrate significantly higher levels of both cognitive and physiological fear than phobics who believed that the movements of the animal would be predictable (Lick, Candiotte, & Unger, 1978). Thus it is conceivable that there was enough information in what children could observe of the animals in the film to counter the fearful expression of the model and therefore negate any fear-learning effect.

With any future experiments, it is suggested that comparable static images and films be used, both in terms of the CS and the US, and that all images and films be rated prior to use to measure how good the threat-related films or fearful images are at conveying fear. This would serve to counter any question that might be raised over the model's conveyance of an emotion of fear; or the potential effect that might be obtained by viewing the animal in motion with regards to predictability or uncertainty.

#### **4.5 Chapter summary**

Experiment 3 found no evidence of increases in fear beliefs, avoidance preferences or attentional bias for animals seen in threat-related vicarious learning films. It seems likely that US salience was not increased in this experiment compared to Experiments 1 and 2. It is possible that this may be because the media used was not as effective at influencing

children's fear beliefs as previously assumed. Alternatively, the lack of effect may be due to the general ineffectiveness of the scenario in the film rather than the actual media or type of US used (i.e. film). It is possible that the children in the experiment did not consider the stranger in the film clip to be a suitable model or that the scenario presented was simply not perceived as real; however, these possibilities were not directly investigated. It is also possible that the additional information derived by the children from observing the animal presented in the film may have been sufficient to counter the fearful expression of the model.

## **Chapter 5.**

### **Vicarious Learning and CS Fear-Relevance:**

#### **Speed of Acquisition and Persistence of Learning**

##### **5.1 Introduction**

Evidence, including studies in this thesis, suggests that children can acquire fear of a stimulus vicariously by observing other people responding fearfully to that stimulus (e.g. Askew & Field, 2007; Gerull & Rapee, 2002). Studies involving monkeys, however, appear to indicate that vicarious fear learning only occurs for fear-relevant stimuli (Cook & Mineka, 1989). The second group of experiments discussed here concentrate on characteristics of the conditioned stimulus (CS) that influence fear acquisition during vicarious learning in childhood.

Seligman argued that the acquisition of fears is not simply predicated on arbitrary associations, but is more commonly observed in relation to stimuli that would have presented a threat to pre-technology humans (Seligman, 1971). The crux of Seligman's preparedness theory was that 'selective associations' are formed for certain sets of stimuli. These 'prepared', or 'fear-relevant', stimuli (CSs) form associations more easily with fear- or threat-related outcomes (USs) than other stimuli, where association is difficult, or may even be impossible to form (LoLordo, 1979). It has been argued that selective associations for fear-relevant stimuli can be demonstrated in the laboratory when there is evidence that the learning observed: a) occurs more rapidly (i.e. happens in fewer trials); b) is greater in magnitude (i.e. produces a larger conditioned response); and c) is more robust (i.e. persist longer or demonstrate superior resistance to extinction) (e.g. Mineka & Öhman, 2002; Lovibond, Siddle, & Bond, 1993). Using an adaptation of Askew and Field's (2007)



vicarious learning procedure, Askew et al. (2013) tested the first of these propositions. In their experiment 64 children (aged 6-11 years) were presented with images of frightened adult faces together with images of stimuli with differing levels of fear-relevance (marsupials, flowers, caterpillars, worms and snakes) to investigate whether learning would be greater in magnitude for stimuli with higher fear-relevance. In common with previous studies, children's fear beliefs and avoidance preferences increased for stimuli seen with scared faces compared to the control animal. However, similar changes in fear-related responses were found for all stimuli, irrespective of fear-relevance. During the study, the experiment was repeated for stimuli of varying fear-relevance (caterpillars, worms and snakes) with generally consistent results. The results were unexpected and contrary to the theories of authors such as Seligman (1971) and Öhman and Mineka (2001).

Thus Askew et al.'s findings demonstrate that fear-relevance does not affect the magnitude of the vicariously learned fear response (CR) in children of this age. The current chapter investigates the effect of CS fear-relevance on vicarious fear learning further. It describes an experiment examining the remaining two suggested characteristics: whether vicarious fear-learning is more rapid for stimuli of greater fear-relevance, and whether learned responses persist longer when more fear-relevant stimuli are used.

## **5.2 Fear-Relevance of CS: Ease of Acquisition and Persistence of Learning Effects**

There is evidence that conditioned fear responses can develop with a relatively small number of exposures to conditioning events. For example, Rescorla (1980) reported conditioned responses after eight trials, while Sahley, Gelperin, and Rudy (1981) reported single trial conditioning with slugs (*Limax maximus*) using an aversive solution (quindine sulphate). Exposure to a single traumatic event has also been shown to be sufficient for the development of conditioned fear in humans: Yule, Udwin, and Murdoch (1990) reported that the survivors from the sinking of a cruise ship subsequently demonstrated excessive fears in

relation to water, swimming, and travel by water. In general studies suggest that learning should be faster for fear relevant stimuli (Öhman & Mineka, 2001; Öhman, Flykt, & Esteves, 2001), though using shock as the US, Öhman, Eriksson, and Olofsson (1975) demonstrated learning with a single trial for both fear-relevant snake picture CSs and fear-irrelevant house picture CSs.

Experiment 4 examined the speed of vicarious fear learning in children for two stimuli of differing fear relevance. Images of animals (higher fear-relevance) and flowers (lower fear-relevance) were used as CSs and the number of CS-US pairings was manipulated (1, 10 or 30 trials). The main aim was to determine whether the rate of acquisition would be more rapid (i.e., in fewer trials) for stimuli of greater fear-relevance. A secondary interest was whether an increased number of exposures to pairings would lead to a corresponding increase in fear beliefs and avoidance preferences for fear-relevant stimuli. Based on Askew et al.'s (2013) findings, it was predicted that there would be an increase in children's fear beliefs both for scared-paired animals and scared-paired flowers. However, it was expected that this learning might occur in fewer trials for animal stimuli because of their superior fear-relevance compared to flowers. In addition, follow-up measures were taken one week later to investigate whether learning was more robust for stimuli with higher fear-relevance, and whether learning over a greater number of trials would be more robust than learning in fewer trials.

### **5.3 Method**

**5.3.1 Design.** Children were allocated to one of two groups: animal and flower. Both groups saw an identical pairing procedure except that CSs were animals in one group and flowers in the other. So for example, children in the animal group were presented with an image of one animal paired with a scared adult face, one animal with a happy face and the final animal on its own as an unpaired control. Similar conditions were established for the

flower stimuli. The type of facial expression associated with each type of animal or flower was counter-balanced across three counterbalancing groups (see chapter 4 Table 1 for animals and Table 2 below for flowers).

Table 2  
*The counterbalancing of different information across three flowers*

		Flower		
		Red Avens	Willow Gentian	Dotted Loosestrife
Type of Information	Order 1	Positive	Negative	No Information
	Order 2	No Information	Positive	Negative
	Order 3	Negative	No Information	Positive

Thus the design was a 3(pairing type: negative, positive, none) × 3(time: before vicarious learning, post-vicarious learning, and one week post-vicarious learning) × 2(stimulus group: animals vs. flowers) × 3(trial group: 1 trial, 10 trials, 30 trials) mixed design with repeated measures on the first two variables. Dependent variables were mean self-reported fear beliefs and avoidance preferences for CSs.

**5.3.2 Participants.** Participants were 140 children (53 male, 87 female) aged 6–10 years ( $M = 8.86$  years,  $SD = 1.29$  years). In this experiment the required sample sizes were estimated on the basis of 6 groups and 3 measurements in a mixed ANOVA analysis. A G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) sample size calculation determined that 72 participants would be necessary to detect a moderate effect size of an  $\alpha = .05$  with power of .95. Children were recruited from a school in southwest London, UK.

**5.3.3 Materials.** Two different types of emotional face images (scared and happy) or no faces were presented together with images of novel animals or flowers. There were three different images of each of the three animals (a quoll, quokka and cuscus) and three flowers (Red Avens, a Willow Gentian and a Dotted Loosestrife, see appendix F). The flower stimuli

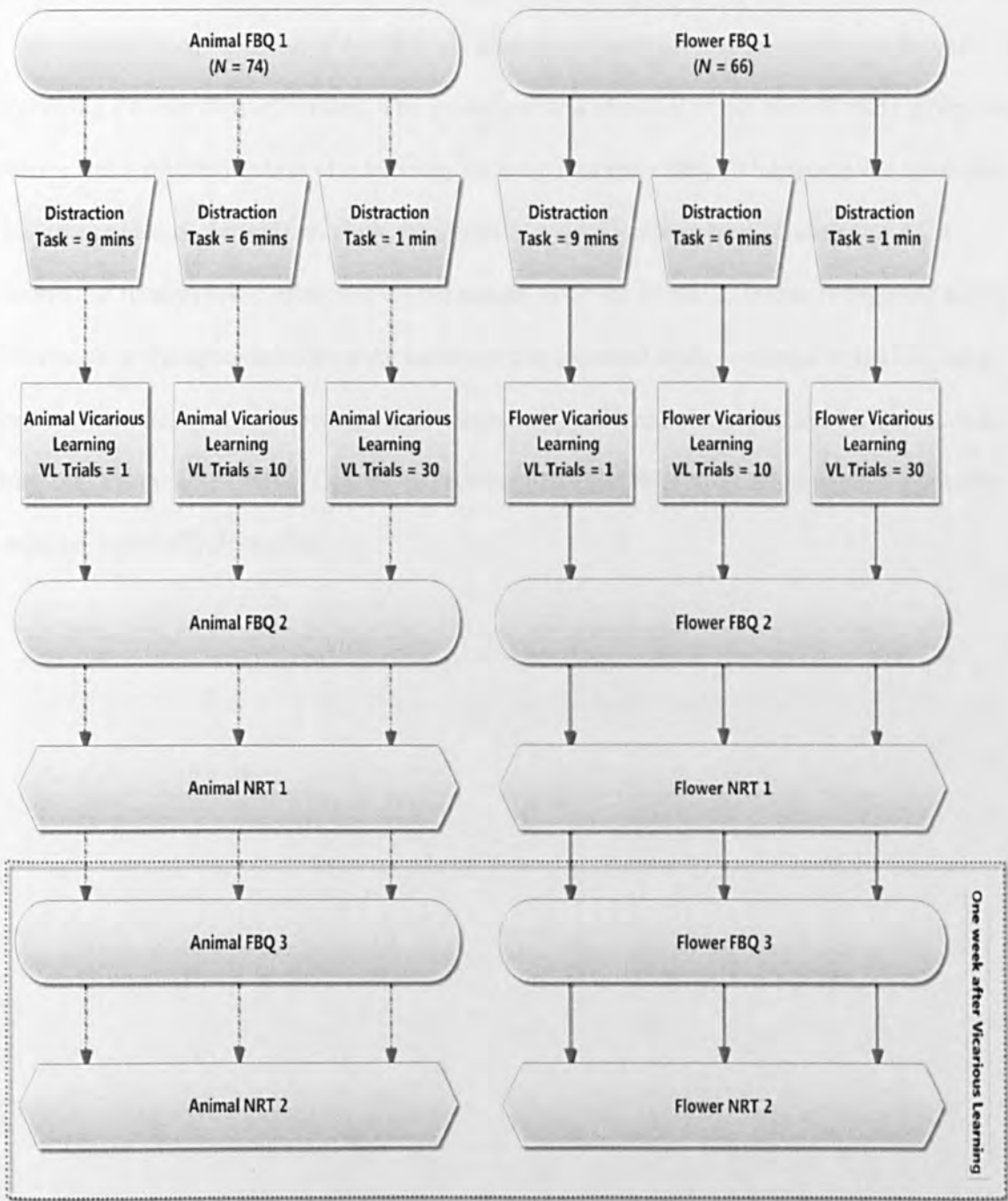
were chosen because UK children typically have no prior experience of them and two (Red Avens and Dotted Loosestrife) had already been used successfully by Askew et al. (2013). An additional nine colour pictures were used in total for the flower stimuli; three different pictures each of three flowers, Red Avens, Willow Gentian, and Dotted Loosestrife (each measuring 400 x 300 pixels). The images were obtained from [www.Copyright-free-photos.org.uk](http://www.Copyright-free-photos.org.uk). Otherwise materials used in this experiment were the same as those used in Experiments 1 and 2 with three exceptions. First, images of 10 female adults were used from the pool created for Experiment 1 because no child was shown their mother's face, so more than one face could be used in all conditions. There were three fearful and three happy colour portraits, making 60 images in total. Second, the nature reserve task used in this experiment was the green rectangular board created for Experiment 3. Finally, a distraction task was also used.

**Fear Beliefs Questionnaire:** FBQ scale reliabilities were all above Kline's (1999) recommended .70 threshold: prior to vicarious learning, Cronbach's  $\alpha = .82$  for Cuscus subscale, .75 for Quokka subscale, .81 for Quoll subscale, .72 for Red Avens subscale, .80 for Dotted Loosestrife subscale, and .68 for Willow Gentian subscale. After vicarious learning  $\alpha$ 's were: .91, .88, and .89 for the animals, and .87, .90, and .84 for the flowers respectively.

**Distraction Task:** A simple custom-written Microsoft PowerPoint based multi-level maze game (by Can Dunne) was used as a distraction task. In this task children had to navigate the mouse untouched through a series of obstacles to gain access to the next level of the game. A stopwatch was used to ensure the distraction task was performed for the correct period of time and to make sure that the time between FBQ 1 and FBQ 2 was consistent across the groups.

**5.3.4 Procedure.** Children were randomly allocated into one of two stimulus groups: animals or flowers (see Figure 8). Within each group they were further allocated to one of

three trial groups: 1 trial, 10 trials and 30 trials, making six groups in all. Children first completed FBQ 1 for their particular stimulus type. As the number of trials varied between groups, children undertook a distraction task to ensure that all groups had the same time interval length between undertaking FBQ 1 and FBQ 2. The length of time spent on the distraction task depended on the trial group children were assigned to (see figure 8): 9 mins for the 1 trial groups; 6 mins for the 10 trials groups; and 1 min for the 30 trials group.



*Figure 8.* Vicarious learning procedure for Experiment 4: stimulus group (Animal or Flower) was manipulated as well as the number of CS-US trials (1, 10 or 30 trials).

For example, children in the ‘Animal: 1 trial group’ were given a 9 min distraction task and then presented with each of the three animals for a single trial only; one animal was seen once with a happy face, one animal was seen once with a scared face, and one animal was seen once unpaired (control). The ‘Flower: 1 trial group’ had the same procedure but with flower CSs instead of animals. The 10 trials groups’ procedure was identical to previous experiments except that one of the 10 trials groups saw animals and the other saw flowers, following a 6 min distraction task. The procedure was identical in the two 30 trials groups but after a 1 min distraction task children saw 30 scared-paired trials, 30 happy-paired trials and 30 unpaired trials. As with previous experiments a single pairing trial consisted of a CS (animal or flower) being presented on the screen alone for 1s and a further 1s together with a US (face) on the opposite side of the screen, while unpaired trials consisted of the CS being presented alone for 2s. Following vicarious learning, children completed the FBQ a second time and then the first NRT. One week later the FBQ and NRT were administered again and children were fully debriefed.

5.4 Results

5.4.1 Fear beliefs. Figure 9 shows mean fear beliefs at each time point for each pairing condition.

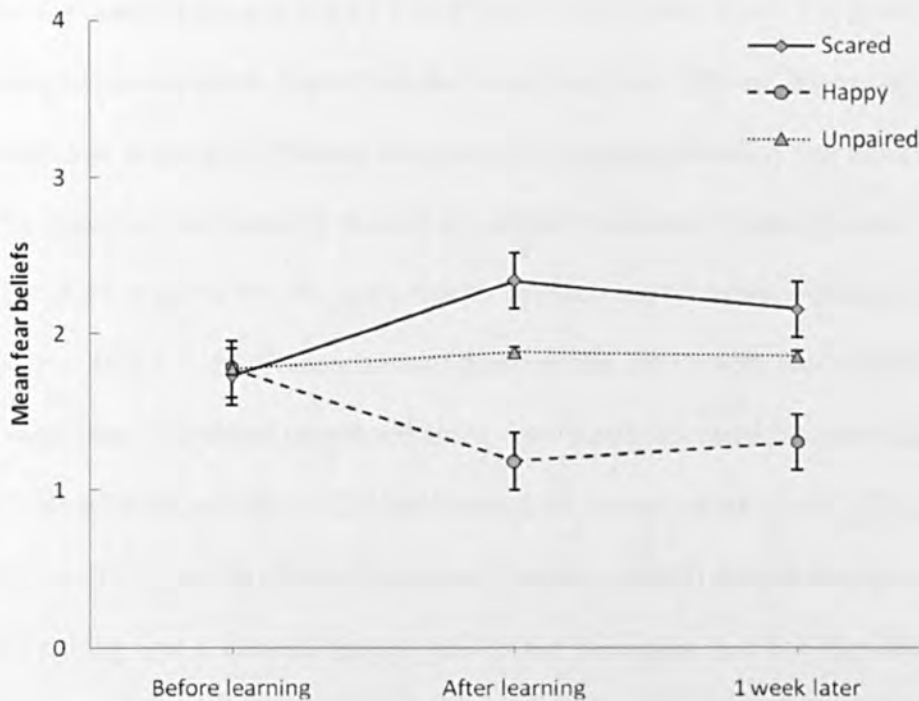


Figure 9. Mean fear beliefs (and SE) for scared, happy, and unpaired (control) conditions, pre-learning, post-learning and one week later.

FBQ scores were compared pre- and post-vicarious learning and one week after the procedure. Mean fear beliefs for scared-paired stimuli were greater post-learning ( $M = 2.34$ ,  $SD = 1.30$ ) than pre-learning ( $M = 1.72$ ,  $SD = 0.99$ ) and remained higher one week later ( $M = 2.15$ ,  $SD = 1.18$ ). Fear beliefs for happy-paired stimuli decreased post-learning ( $M = 1.18$ ,  $SD = 1.03$ ) compared to baseline ( $M = 1.77$ ,  $SD = 1.12$ ) and were still lower one week later ( $M = 1.30$ ,  $SD = 1.18$ ). Unpaired fear beliefs remained similar across all time points: pre-learning ( $M = 1.77$ ,  $SD = 1.05$ ); post-learning ( $M = 1.88$ ,  $SD = 1.12$ ); and one week later ( $M = 1.85$ ,  $SD = 1.13$ ) (see Table 9). A four-way 3(time: pre-learning, post-learning, one week) x 3(pairing type: scared, happy, none) x 2(stimulus group: animals vs. flowers) x 3(trial group:

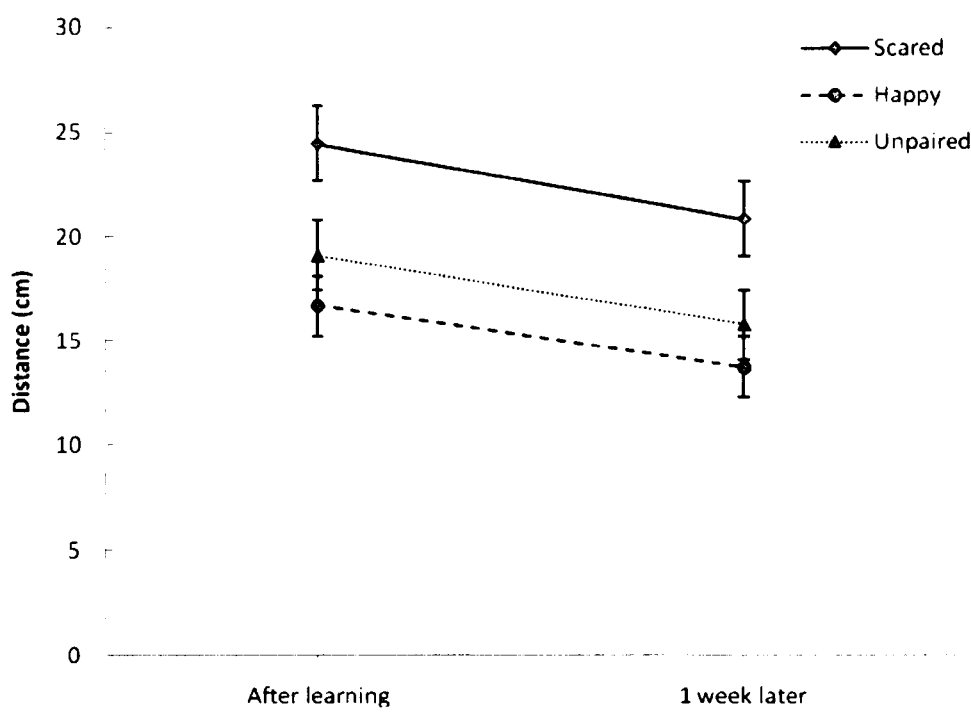
1, 10, 30) mixed ANOVA with repeated measures on the first two variables was performed on fear belief scores. There was a significant main effect of pairing type,  $F(2, 268) = 33.25, p < .001, \eta^2 p = .20$ . The important (Greenhouse-Geisser adjusted) time x pairing type interaction was significant,  $F(3.42, 457.87) = 27.76, p < .001, \eta^2 p = .17$ , indicating vicarious learning led to changes in fear beliefs for stimuli that was different depending on the type of face children saw it with. Planned comparisons comparing baseline fear beliefs and fear beliefs after vicarious learning showed a significant increase following scared-pairing,  $F(1, 134) = 22.34, p < .001, r = .38$ , and a significant decrease after happy-pairing,  $F(1, 134) = 38.04, p < .001, r = .47$ . Comparisons of baseline fear beliefs with those after the second visit, one week later, found fear beliefs remained significantly elevated for scared-paired stimuli,  $F(1, 134) = 10.66, p < .01, r = .27$  and lowered for happy-paired stimuli,  $F(1, 134) = 20.64, p < .001, r = .37$ . Thus the effect of vicarious learning was still present one week later. The time x pairing type x stimulus group x trial group interaction was non-significant,  $F(8, 536) = 0.70, p = .69, \eta^2 p = .01$ . All other main effects and interactions were also non-significant, including the time x pairing type x trial group interaction,  $F(6.83, 457.87) = 0.94, p = .48, \eta^2 p = .01$  and the time x pairing type x stimulus group interaction,  $F(3.42, 457.87) = 1.94, p = .11, \eta^2 p = .01$ , showing that the fear relevance of the stimulus (animal or flower) and the number of CS-US pairing trials (1, 10, and 30) children saw had no effect on the magnitude of vicarious learning.



**Table 9**  
**Mean FBQ Scores for 1, 10, and 30 Trials Before Learning, After Learning, and after 1 week**  
**(with Standard Deviations in Parentheses)**

Condition	Group	No of pairings	Before learning	After learning	1 week later
Scared	Animal	1	1.79 (1.02)	2.07 (1.20)	1.85 (1.03)
		10	1.88 (0.83)	2.30 (1.27)	2.42 (1.15)
		30	1.82 (0.59)	2.47 (0.95)	2.11 (1.03)
		Total	1.83 (0.82)	2.28 (1.14)	2.12 (1.08)
	Flower	1	1.55 (1.10)	2.09 (1.38)	2.00 (1.11)
		10	2.00 (1.14)	2.81 (1.36)	2.29 (1.38)
		30	1.30 (1.11)	2.30 (1.58)	2.26 (1.39)
		Total	1.61 (1.14)	2.39 (1.46)	2.18 (1.29)
Happy	Animal	1	1.81 (0.99)	1.44 (0.85)	1.64 (0.99)
		10	1.84 (0.90)	1.45 (1.09)	1.63 (1.16)
		30	1.86 (0.63)	1.11 (0.70)	1.29 (0.79)
		Total	1.84 (0.84)	1.33 (0.89)	1.52 (0.99)
	Flower	1	1.55 (1.41)	1.00 (1.15)	1.00 (0.87)
		10	2.05 (1.36)	1.24 (1.14)	1.33 (1.28)
		30	1.52 (1.34)	0.83 (1.15)	0.87 (1.18)
		Total	1.70 (1.37)	1.02 (1.14)	1.06 (1.12)
Unpaired	Animal	1	2.07 (0.75)	2.15 (0.90)	1.94 (0.83)
		10	1.89 (0.99)	1.96 (0.99)	2.07 (1.04)
		30	1.78 (0.65)	2.09 (0.84)	2.09 (0.97)
		Total	1.92 (0.80)	2.07 (0.90)	2.03 (0.94)
	Flower	1	1.64 (1.29)	1.59 (1.30)	1.68 (1.21)
		10	1.71 (1.19)	1.86 (1.11)	1.62 (1.16)
		30	1.48 (1.31)	1.57 (1.47)	1.65 (1.53)
		Total	1.61 (1.25)	1.67 (1.29)	1.65 (1.29)

**5.4.2 Avoidance preferences.** Figure 10 shows mean distances (cm) from the animal and flower CSs to the figures children placed on the board. Table 10 shows the Mean and standard deviation of the scores for 1, 10, and 30 Trials, after learning and one week later.



**Figure 10.** Mean (and SE) distance between stimuli and children’s figures in the nature reserve tasks.

Two separate analyses were performed at each time point: post-vicarious learning and at one week. A three-way 3(pairing type: scared, happy and none) x 2(stimulus group: animals vs. flowers) x 3(trial group: 1, 10, 30) mixed ANOVA was performed on post-vicarious learning NRT scores. There was a significant main effect of pairing type,  $F(1.89, 252.95) = 11.88, p < .001, \eta^2p = .09$ , indicating vicarious learning affected how far away from the stimuli CSs on the board children placed themselves. Planned comparisons showed children placed themselves further away from scared-paired stimuli compared to control stimuli,  $F(1, 134) = 12.09, p = .001, r = .08$ . But there was no effect for happy-paired stimuli,  $F(1, 134) = 2.04, p = .16, r = .01$ .

Table 10  
*Mean NRT Scores, 1, 10, and 30 Trials, after learning and one week later (with Standard Deviations in Parentheses)*

Condition	Group	No of pairings	After learning	1 week later
Scared	Animal	1	21.79 (15.08)	16.88 (11.91)
		10	26.64 (19.03)	23.88 (17.60)
		30	24.88 (14.64)	23.23 (17.71)
		Total	24.48 (16.26)	21.41 (16.14)
	Flower	1	23.50 (16.52)	20.23 (17.51)
		10	22.76 (18.07)	19.90 (16.51)
		30	25.18 (19.72)	21.05 (16.08)
		Total	23.83 (17.90)	20.40 (16.46)
Happy	Animal	1	18.13 (12.11)	15.00 (11.52)
		10	17.64 (16.60)	13.36 (11.21)
		30	14.38 (12.48)	12.96 (10.12)
		Total	16.67 (13.80)	13.75 (10.83)
	Flower	1	16.91 (17.20)	15.00 (11.52)
		10	14.62 (15.81)	13.36 (11.21)
		30	18.23 (18.31)	12.96 (10.12)
		Total	16.62 (16.95)	13.75 (10.83)
Unpaired	Animal	1	22.71 (12.71)	16.58 (13.79)
		10	20.44 (14.96)	18.64 (14.70)
		30	22.54 (15.46)	19.73 (15.77)
		Total	21.89 (14.30)	18.36 (14.66)
	Flower	1	15.45 (13.57)	13.91 (10.83)
		10	16.76 (15.03)	14.00 (13.84)
		30	14.18 (15.73)	11.09 (11.98)
		Total	15.45 (14.61)	12.98 (12.14)

All other main effects and interactions were non-significant, including the pairing type x stimulus group interaction,  $F(1.89, 252.95) = 2.44, p = .089, \eta^2p = .02$ , pairing type x trial group interaction,  $F(3.78, 252.95) = 0.31, p = .87, \eta^2p = .004$ , and pairing type x trial group x stimulus group interaction,  $F(3.78, 252.95) = 137.32, p = .54, \eta^2p = .01$ , indicating that the number of trials or the type of CS did not affect children's avoidance preferences for animals or flowers.

Analysis of the NRT data at one week (Greenhouse-Geisser adjusted) revealed a significant main effect of pairing type,  $F(1.92, 256.64) = 15.84, p < .001, \eta^2p = .11$ . Planned comparisons showed significant greater avoidance for scared-paired stimuli compared to unpaired stimuli at one week,  $F(1, 134) = 12.69, p = .001, r = .29$ , but not for happy paired stimuli compared to control stimuli,  $F(1, 134) = 2.62, p = .11, r = .14$ . All other main effects and interactions were non-significant, including the pairing type x stimulus group interaction,  $F(1.92, 256.64) = 2.11, p = .13, \eta^2p = .02$ , the pairing type x trial group interaction,  $F(3.83, 256.64) = 1.04, p = .387, \eta^2p = .02$  and the pairing type x trial group x stimulus group interaction,  $F(3.83, 256.64) = 0.93, p = .45, \eta^2p = .01$ . This showed that the number of trials and type of CS had no effect on children's avoidance preferences for CSs.

## 5.5 Discussion

The results showed that: (1) vicarious fear learning increased children's fear beliefs and avoidance preferences for animal and flower stimuli to a similar degree. Thus there was no significant difference in learning between the higher fear-relevant and lower fear-relevant stimuli; (2) overall, the number of CS-US association trials did not affect the speed of fear acquisition or its robustness; (3) there was no significant interaction between fear-relevance of a stimulus and number of pairings children saw, so that learning did not occur in less trials for

fear relevant stimuli; and (4) increased fear beliefs and avoidance preferences remained elevated one week later irrespective of the type of stimulus or number of pairings.

As with the previous experiments, the findings demonstrated overall changes in children's fear beliefs as a result of vicarious learning. The results also confirmed Askew et al.'s (2013) finding that increases in children's fear beliefs are similar for scared-paired animals and scared-paired flowers: no enhanced fear learning effect was observed for the animals, which were assumed to have higher fear-relevance than flowers. Thus the results are somewhat at odds with evidence from classical conditioning procedures (see Öhman & Mineka, 2001) that suggest fear-relevance facilitates the development of faster and more robust CS-US associations.

Children's fear beliefs and avoidance preferences, as measured via questionnaire and the nature reserve task, increased or decreased depending on the type of face presented. The number of pairing trials participants were exposed to had no observed impact on fear acquisition for either stimulus type, indicating that learning was not faster (i.e., in less trials) for higher fear-relevant stimuli (animals) than lower fear-relevant stimuli (flowers). In the follow-up test one week later, fear beliefs and avoidance preferences were still found to be elevated compared to baseline levels for all stimulus types and irrespective of number of pairing trials children saw.

In this experiment then, the magnitude, speed and persistence of vicarious fear learning was found to be no different regardless of the level of the fear-relevance of a stimulus. Askew et al. (2013) suggest that stimulus preparedness may be bypassed in vicarious learning with children in this age group, so that fear-relevance is not important in the development of CS-US associations in vicarious learning, and the current findings support this. An alternative explanation might be that the non-prepared stimuli (flowers) in this experiment may have somehow benefitted from attentional bias (Davey, 1995). The

suggestion is that the children may have derived this bias from socially transmitted information prior to the experiment (e.g. flowers can be poisonous). This bias would have to be of a degree that would more commonly be expected with biologically prepared stimuli in order to achieve the results observed. Children having already acquired a bias for the stimulus from others would then be more prepared for learning and thus fear belief acquisition. An assumption of Seligman (1971) is that stimuli are biologically prepared. However, Davey, (1995, 1997) argues that similar learning effects to preparedness can simply be due to what he calls 'expectancy evaluations', i.e. because associations between a CS and a fear-related US are learnt more easily when the learner already expects that the outcome of learning will be threatening or fear-related. Consequently, it might be that flowers were just as 'prepared' as the animals.

Unfortunately, we cannot be absolutely sure whether the animals used in the experiment were more fear-relevant than the flowers, or how fear-relevant each stimulus actually was, because fear-relevance is typically ascribed post-hoc to stimuli that individuals are already commonly afraid of (e.g. spiders and snakes) or that show selective associations. However, as Askew et al. (2013) point out, there are good reasons for not using established fear-relevant stimuli in vicarious fear learning experiments because children of this age may already have experience of them and have formed established fear-related beliefs. Moreover, their findings with stimuli of varying fear-relevance suggested that vicarious fear learning in young children is not affected by the fear-relevance of the stimuli: they found no difference in increases in fear beliefs for marsupials, caterpillars, snakes and flowers. Askew et al. observed that the findings could be interpreted as evidence that young children do not exhibit a preference during vicarious learning for typical fear-relevant stimuli over other types of stimuli.

Similar findings with toddlers from Dubi et al. (2008) may indicate that prepared-type selective associations develop from experience rather than being the product of evolutionary processes, that is to say young children do not exhibit selective associations for typical fear-relevant stimuli during vicarious learning because they have not yet developed (or learnt) sufficient threat-related expectancies about an encounter with them. This would explain the inconsistency between the current findings and findings with adults, which show superior learning for fear-relevant stimuli (e.g., Mineka & Öhman, 2002). Alternatively, it is possible that young children essentially show similar selective learning for all stimuli, until they later learn which stimuli are non-threatening. This may make sense from an evolutionary perspective because it would aid survival until more knowledge about stimuli has been learnt. This is supported by evidence that learning was rapid and robust for all stimuli in the experiment.

## **5.6 Chapter Summary**

This experiment provides further support for the effectiveness of vicarious learning fear learning in children. It also provides support for previous findings (Askew et al., 2013) that such fear-learning is similar for stimuli of varying levels of fear-relevance. Contrary to expectations, there were no superior effects observed for higher fear-relevant stimuli over lower fear-relevant stimuli: learning was not greater, faster or more persistent. The results also showed that the number of CS-US trials does not seem to affect learning generally: fairly robust learning can occur after a single learning trial and is not greater after 30 trials. This may be because stimulus preparedness is not important for vicarious fear-learning with children in this age group.

## **Chapter 6.**

### **Vicarious Learning and CS Fear Relevance:**

#### **Resistance to Extinction**

##### **6.1 Introduction**

The experiment discussed in Chapter 5 found no evidence that learnt responses persisted longer for stimuli of higher fear-relevance. The final experiment looked once again at CS fear-relevance and how robust learning would be for stimuli of greater or lesser fear-relevance. It has been suggested that learning for fear-relevant stimuli should be evidenced by a marked resistance to extinction. Extinction is the phenomenon describing the gradual weakening of a previously established conditioned response by repeated presentation of the CS alone, leading to the behaviour reducing or disappearing. Resistance to extinction is demonstrated when there is no reduction in conditioned response to the CS following CS-alone presentations. In associative learning terms, it had originally been thought that an observed reduction in conditioned responses post extinction was due to the CS-US association being erased. Today, the most generally accepted explanation of extinction is that the processes that underpin extinction represent a form of inhibitory learning procedure. It is suggested that rather than simply attempting to erase the pre-existing CS-US association from memory this procedure involves the learning of a new association—a CS-*no* US association—which then competes with the previously learnt CS-US association (e.g., Bouton, 1993).

As discussed in chapter 1, Seligman (1971) argued that the processes involved in associative learning were subject to phylogenetic influences. The suggestion is that human beings are genetically pre-disposed to associate fear and avoidance with certain prepared or fear-relevant stimuli. Such preparedness provides an attractive explanation for the



irrationality often associated with phobias. Being prepared, these fear responses would bypass the normal cognitive mediation process, i.e. it explains why people with phobias can understand that their fear is excessive or unwarranted but regardless of this they are unable to control their avoidance behaviour (Öhman & Mineka, 2001). In human research comparing aversive learning for fear-relevant/prepared stimuli (such as snakes and spiders) with stimuli that were considered neutral (such as flowers and mushrooms) the most persistent effect observed is resistance to extinction (e.g. Davey, 1992; Cook, Hodes, & Lang, 1986; Fredrikson & Öhman, 1979). For example, Öhman, Fredrikson, Hugdahl, and Rimmö (1976) found that, compared to learning for fear-irrelevant stimuli (flowers and mushrooms), conditioned fear for fear-relevant stimuli (snakes or spiders) was resistant to extinction. They also noted that this resistance was only selective for associations with an aversive US. On the other hand, McNally and Foa (1986) and others (e.g. Merckelbach, van der Molen, & van den Hout, 1987) could find no evidence of superior resistance to extinction for fear-relevant over fear-irrelevant stimuli. This has been attributed by Öhman and Mineka (2001) generally to methodological differences and an overall inability to demonstrate conditioning effects for either stimulus type during experiments.

Chapter 5 findings provided no support for the suggestion that learning for fear-relevant stimuli is more persistent than for fear-irrelevant stimuli. However, this was merely a measure of persistence over time, and did not investigate resistance to extinction. Thus the experiment discussed in this chapter (experiment 5) again examined vicarious learning for stimuli high (animals) or low (flowers) in fear-relevance but in particular whether greater resistance to extinction would be shown for stimuli of higher fear-relevance. At one week intervals following vicarious learning children were exposed to three extinction procedures consisting of presentations of the conditioned stimulus (animals or flowers) in the absence of the unconditioned stimulus (emotional faces). Changes in children's fear beliefs and avoidance

preferences for animals or flowers were measured by FBQ and nature reserve task. Based on previous research, children were predicted to show a marked increase in fear-related beliefs and avoidance preferences for animals and flowers seen together with pictures of adults displaying fear. Specifically, it was expected that superior resistance to extinction should be observed for the high fear-relevance stimuli (animals) compared to the lower fear-relevance stimuli (flowers).

## **6.2 Method**

### ***6.2.1 Participants***

Participants were 66 children (23 male, 43 female) aged 6-10 years ( $M = 8.81$  years,  $SD = 1.01$  years). In this experiment the required sample sizes were estimated on the basis of 2 groups and 5 measurements in a mixed ANOVA analysis. A G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) sample size calculation determined that 32 participants would be necessary to detect a moderate effect size of an  $\alpha = .05$  with power of .95. Children were recruited from local schools in southwest London, UK.

### ***6.2.2 Materials***

All materials were also used in previous experiments. All nine colour images of the three Australian marsupials and nine colour pictures of the three flowers were used as novel stimuli. Adult face images were the full set of 30 individual adult females introduced in Experiment 1. Internal consistencies for the FBQ were once again found to be acceptable: before vicarious learning, scale reliabilities were Cronbach's  $\alpha = .73$  Cuscus subscale, .66 Quokka subscale, .71 Quoll subscale, .66 Red Avens subscale, .79 Dotted Loosestrife subscale, and .74 Willow Gentian subscale. Post vicarious learning they were: .80, .75, and .82 for the animals, and .93, .93, and .87 for the flowers respectively. The rectangular green nature reserve board used in Experiments 3 and 4 was used for the NRT.

### ***6.2.3 Procedure.***

The procedure was similar to that used in Experiment 4 in that children were divided into two groups and completed a FBQ for either the three animals or the three flowers, depending on the group they had been assigned to. In this experiment children were also asked to do a pre-vicarious learning NRT (see figure 11). After the initial measures were taken, depending on the group they were in, children were shown pictures of either the three animals or the three flowers paired with pictures of scared or happy faces, or alone (no face). Each animal or flower was paired with a different type of face (or alone). Unlike Experiment 4 (Chapter 5), all children saw the same number of animal-face or flower-face pairings: 10 pairings with scared faces, 10 with happy faces and 10 with no faces. After completing the vicarious learning procedure, children completed the FBQ and NRT a second time, to ascertain whether fear-related beliefs and avoidance preferences for animals or flowers had changed due to vicarious learning. One week later, children took part in the first extinction procedure: depending on their stimuli group they were shown all the images of the animals or flowers again but this time alone, without any accompanying face (i.e. all of the CSs were presented again in the absence of any of the USs). They then completed the FBQ and NRT for a third time to ascertain any reduction in fear-related beliefs or avoidance preferences towards animals or flowers due to the extinction procedure. A second extinction procedure was performed 2 weeks after the initial vicarious learning task and FBQ and NRT measures taken again. A third and final extinction procedure was repeated at 3 weeks. Children were fully debriefed following extinction procedure 3.

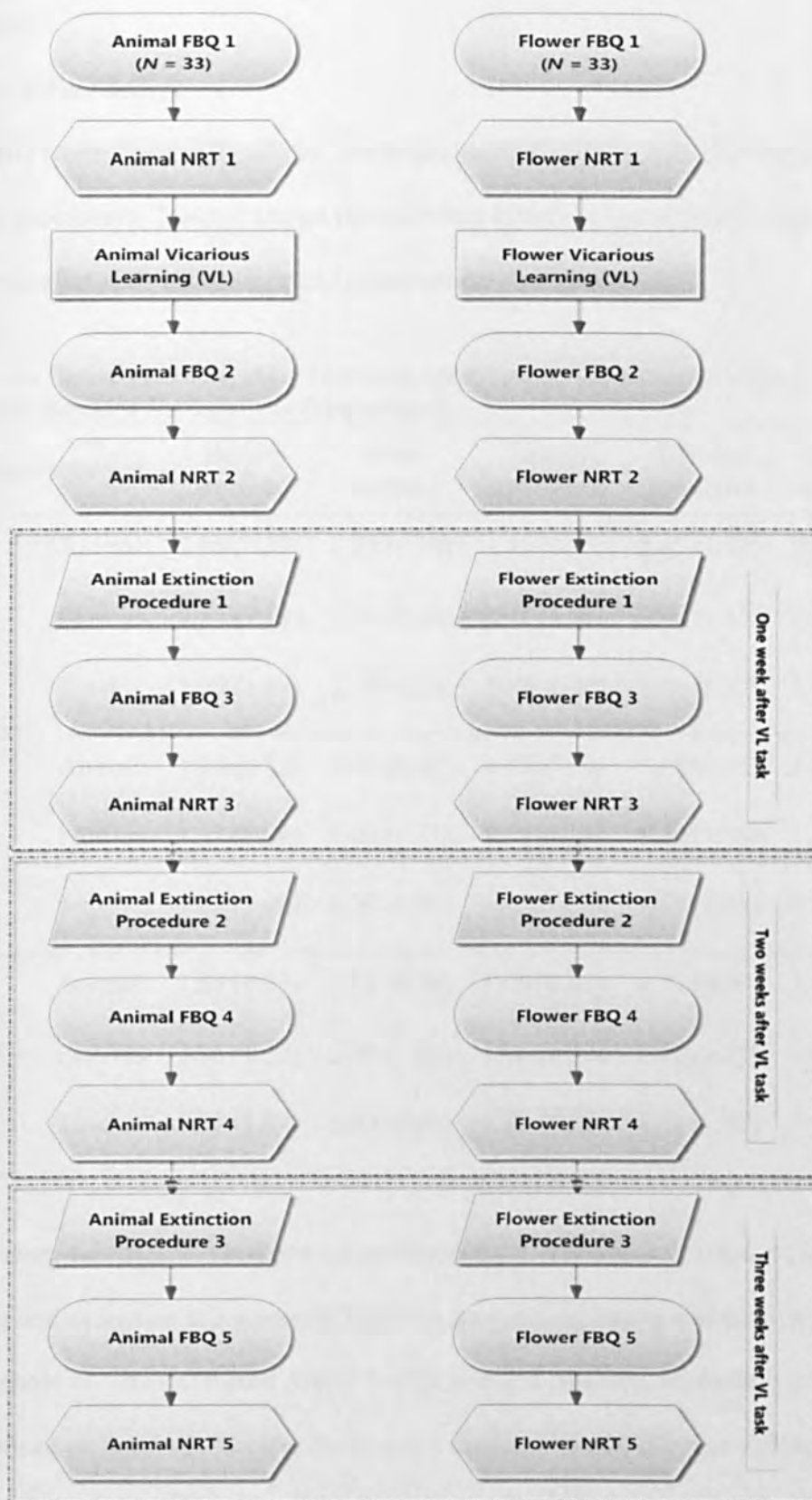


Figure 11. Procedure used in Experiment 5 to compare the effect of animals and flowers stimuli on vicarious fear learning and extinction.

6.3 Results

6.3.1 Fear beliefs.

FBQ scores were analysed pre- and post-vicarious learning and following the extinction procedures. Table 11 shows the mean fear beliefs before and after vicarious learning and after each extinction trial for each pairing type and group.

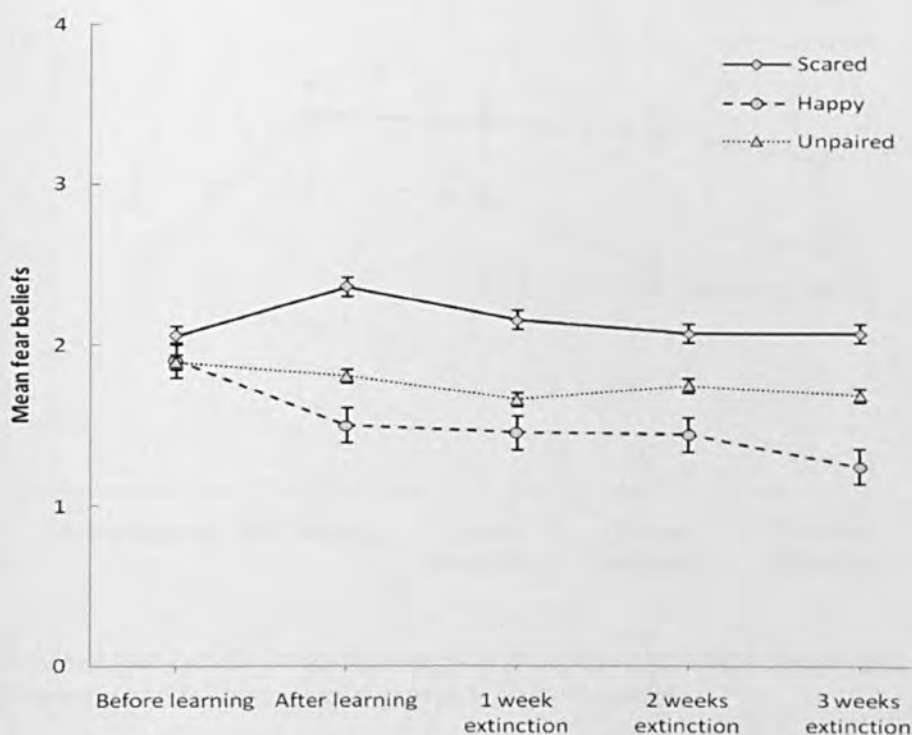
Table 11  
*Mean Scores Before Learning, After Learning, after 1 week, 2 week and 3 week Extinction Trials (with Standard Deviations in Parentheses)*

Condition	Group	Before learning	After learning	1 week extinction	2 weeks extinction	3 weeks extinction
Scared	Animals	2.06 (0.77)	2.36 (0.94)	2.15 (0.97)	2.07 (1.10)	2.07 (1.03)
	Flowers	1.50 (1.19)	2.53 (1.44)	2.44 (1.41)	2.41 (1.43)	2.19 (1.40)
	Total	1.79 (1.03)	2.44 (1.20)	2.29 (1.20)	2.23 (1.27)	2.13 (1.22)
Happy	Animals	1.90 (0.82)	1.50 (0.87)	1.45 (0.93)	1.44 (1.05)	1.24 (1.05)
	Flowers	1.31 (1.09)	1.09 (1.12)	1.41 (1.39)	1.38 (1.26)	1.34 (1.23)
	Total	1.62 (1.00)	1.30 (1.01)	1.43 (1.17)	1.41 (1.15)	1.29 (1.14)
Unpaired	Animals	1.89 (0.77)	1.81 (0.76)	1.66 (0.85)	1.74 (0.90)	1.68 (0.84)
	Flowers	2.06 (1.32)	2.06 (1.34)	1.94 (1.39)	1.47 (1.32)	1.69 (1.45)
	Total	1.97 (1.07)	1.93 (1.08)	1.79 (1.15)	1.61 (1.12)	1.69 (1.160)

A three-way 5(time: pre-learning, post-learning, extinction at 1 week, extinction at two weeks and extinction at 3 weeks) x 3(pairing type: scared, happy and none) x 2(stimulus group: animals vs. flowers) mixed ANOVA with repeated measures on the first two variables was performed on fear belief scores. There was a significant main effect of pairing type,  $F(2, 128) = 22.15, p < .001, \eta^2p = .26$ , and the time x group interaction was borderline significant,  $F(2.99, 191.18) = 2.59, p = .055, \eta^2p = .04$ . The more important (Greenhouse-Geisser

adjusted) time x pairing type interaction was significant,  $F(6.25, 400.16) = 5.26, p < .001, \eta^2p = .08$ , indicating vicarious learning had led to differing changes in fear beliefs depending on the type of face presented. The three-way group x pairing type x time interaction was significant,  $F(6.25, 400.16) = 2.43, p = .014, \eta^2p = .04$ , indicating that changes in fear beliefs due to vicarious learning were different for flowers and animals. In order to analyse this effect further, separate pairing type x time analyses were conducted on animal and flower fear belief scores.

**Animals.** For animals, there were significant main effects of pairing type,  $F(1.65, 54.28) = 12.17, p < .001, \eta^2p = .27$ , and time  $F(2.67, 87.95) = 3.90, p = .015, \eta^2p = .11$ . The crucial (Greenhouse-Geisser adjusted) time x pairing type interaction was significant,  $F(5.70, 188.24) = 2.45, p = .029, \eta^2p = .07$ , indicating vicarious learning led to changes in fear beliefs that differed depending on the type of face children saw with the animal.



*Figure 12.* Mean fear beliefs for scared, happy and unpaired (control) animals at pre- and post-vicarious learning and following extinction at 1, 2 and 3 weeks.

Follow-up tests indicated that fear beliefs increased after scared-paired vicarious learning,  $F(1, 33) = 5.82, p = .022, r = .15$ , remained elevated (borderline significant) after extinction at 1 week,  $F(1, 33) = 4.14, p = .050, r = .11$ , but returned to baseline levels at week 2,  $F(1, 33) = 0.81, p = .37, r = .02$ , and remained at baseline levels at week 3,  $F(1, 33) = 1.19, p = .28, r = .03$  (see figure 12). In contrast, there was no change in fear beliefs for happy-paired animals after vicarious learning  $F(1, 33) = 2.39, p = .132, r = .07$ , and fear beliefs did not differ after 1 week,  $F(1, 33) = 1.29, p = .27, r = .04$ , at week 2,  $F(1, 33) = 2.03, p = .16, r = .06$ , and still remained unchanged at week 3,  $F(1, 33) = 3.93, p = .056, r = .11$ .

**Flowers.** The type x time analysis for flowers showed a significant main effect of pairing type  $F(2, 62) = 33.23, p < .001, \eta^2 p = .26$ .

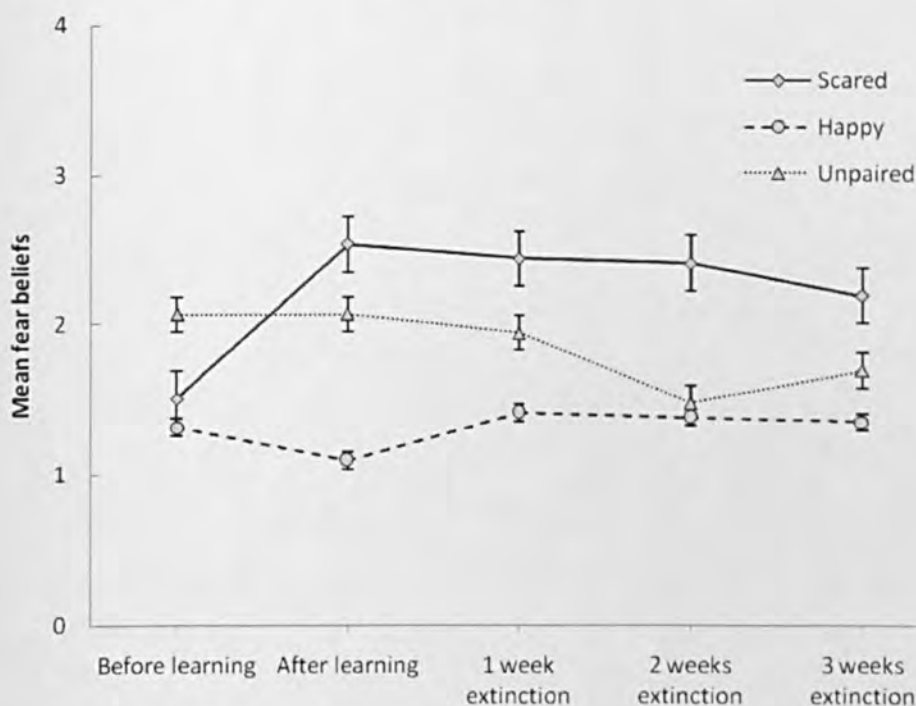


Figure 13. Mean fear beliefs for scared, happy and unpaired (control) flowers pre- and post-vicarious learning and following extinction at 1, 2 and 3 weeks.

The important (Greenhouse-Geisser adjusted) time x pairing type interaction was also significant,  $F(5.68, 176.07) = 4.19, p = .001, \eta^2 p = .12$ , indicating vicarious learning had led to differing changes in fear beliefs depending on the type of face flowers were presented

with. Fear beliefs increased after scared-paired vicarious learning  $F(1, 31) = 6.17, p = .019, r = .17$ , and remained elevated after extinction at 1 week,  $F(1, 31) = 8.37, p = .007, r = .21$ , 2 weeks,  $F(1, 31) = 20.67, p < .001, r = .40$ , and were still significantly elevated after 3 weeks,  $F(1, 31) = 11.68, p = .002, r = .27$  (see figure 13) for happy-paired animals. There was no change in fear beliefs for happy-paired flowers after vicarious learning,  $F(1, 31) = 0.53, p = .47, r = .02$ , after one week,  $F(1, 31) = 0.36, p = .559, r = .01$ , 2 weeks,  $F(1, 31) = 3.84, p = .059, r = .11$ , or 3 weeks,  $F(1, 31) = 1.28, p = .266, r = .04$ .



### 6.3.2 Avoidance preferences.

Figure 14 shows mean distances (cm) from the animal stimuli to the figures children placed on the board.

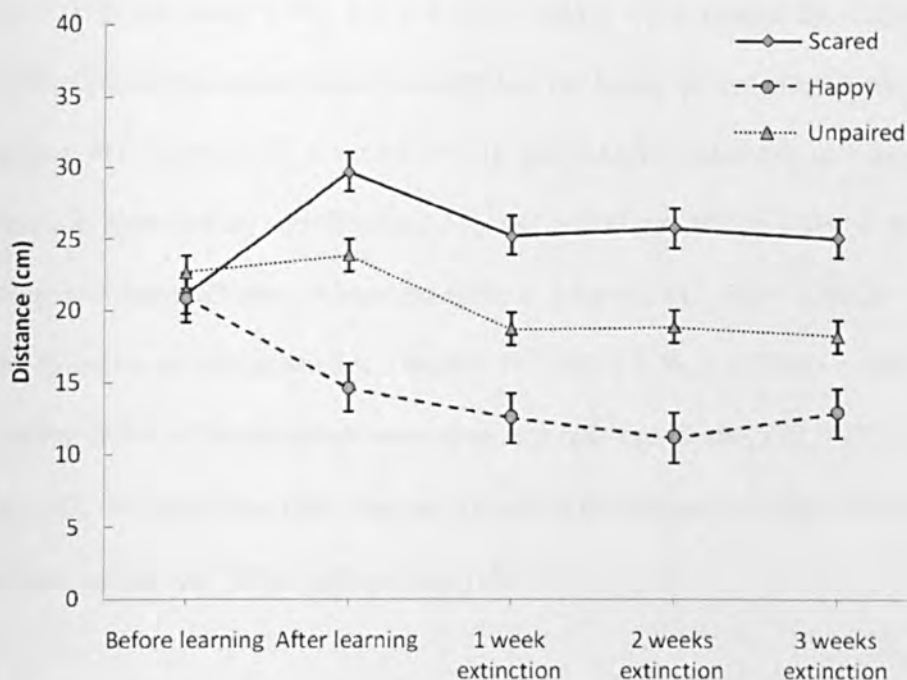


Figure 14. Mean (and SE) distance between animals and children's figures in the nature reserve task pre- and post-vicarious learning and following extinction at 1, 2 and 3 weeks.

A three-way 5(time: pre-learning, post-learning, extinction at 1 week, extinction at two weeks and extinction at 3 weeks) x 3(pairing type: scared, happy and none) x 2(stimulus group: animals vs. flowers) mixed ANOVA was performed on NRT scores. The (Greenhouse-Geisser adjusted) main effects of pairing type,  $F(1.78, 113.59) = 34.04$ ,  $p < .001$ ,  $\eta^2 p = .35$ , and time,  $F(3.05, 195.09) = 4.59$ ,  $p = .004$ ,  $\eta^2 p = .07$ , were significant. The important (Greenhouse-Geisser adjusted) time x pairing type interaction was significant,  $F(6.05, 387.33) = 6.29$ ,  $p < .001$ ,  $\eta^2 p = .09$ , indicating vicarious learning led to changes in avoidance preferences for CSs that were different depending on the type of face presented with them. Planned comparisons showed that avoidance preferences increased for scared-

paired CSs following vicarious learning,  $F(1, 64) = 8.59, p = .05, r = .12$ , and were still significant at 1 week,  $F(1, 64) = 11.66, p = .001, r = .15$ . Increased avoidance of scared-paired stimuli was still demonstrated compared to baseline at week 2,  $F(1, 64) = 12.55, p = .001, r = .16$ , and week 3,  $F(1, 64) = 8.14, p = .006, r = .11$ , despite the extinction procedures. Children placed themselves significantly closer to happy-paired stimuli after vicarious learning,  $F(1, 64) = 11.75, p = .001, r = .16$ , but not after extinction at 1 week (though this effect was approaching significance),  $F(1, 64) = 3.09, p = .083, r = .05$ . Avoidance preferences were different to baseline again at 2 weeks,  $F(1, 64) = 6.50, p = .013, r = .09$ , but were found to be extinguished at 3 weeks,  $F(1, 64) = 1.76, p = .189, r = .03$ . Finally, the time x pairing type x stimulus group interaction was non-significant,  $F(8, 512) = 1.25, p = .27, \eta^2 = .02$ , indicating that there was no difference in changes in avoidance preferences between animal and flower groups (see Table 12).

Table 12

*Mean NRT Scores Before Learning, After Learning, after 1 week, 2 week and 3 week extinction trials (with Standard Deviations in Parentheses)*

Condition	Group	Before learning	After learning	1 week extinction	2 week extinction	3 week extinction
Scared	Animals	27.30 (17.88)	30.82 (19.31)	25.79 (20.09)	25.64 (17.34)	26.33 (18.61)
	Flowers	14.97 (12.97)	28.48 (17.16)	24.64 (17.72)	25.88 (18.83)	23.82 (20.03)
	Total	21.14 (16.70)	29.65 (18.16)	25.21 (18.80)	25.76 (17.96)	25.08 (19.22)
Happy	Animals	25.42 (15.40)	18.91 (17.20)	14.55 (13.07)	13.03 (13.69)	13.61 (14.72)
	Flowers	16.27 (10.09)	10.27 (10.72)	10.45 (11.37)	9.27 (8.55)	12.12 (14.30)
	Total	20.85 (13.72)	14.59 (14.87)	12.50 (12.33)	11.15 (11.48)	12.86 (14.42)
Unpaired	Animals	25.18 (14.70)	25.61 (18.93)	20.09 (17.03)	20.58 (17.89)	20.85 (18.86)
	Flowers	20.09 (13.78)	22.03 (14.22)	17.24 (13.36)	17.15 (13.99)	15.58 (11.46)
	Total	22.64 (14.37)	23.82 (16.71)	18.67 (15.25)	18.86 (16.02)	18.21 (15.71)

## 6.4 Discussion

This experiment again demonstrated significant changes in children's fear-related beliefs and avoidance preferences for animals and flowers depending on the type of emotional face the stimuli were presented together with. Findings showed: (1) children's fear beliefs and avoidance preferences for animal and flower stimuli increased following the vicarious learning phase and remained elevated after extinction 1 week later. As with the previous experiment (chapter 5) there were no significant differences in learning between stimuli of differing fear-relevance; (2) fear beliefs for animal CSs were extinguished from 2 weeks onwards, but there was no significant extinction effect for flower CSs following the extinction phase at 3 weeks; and (3) there was no significant extinction effect observed for avoidance preferences for either

CS type, with children still demonstrating avoidance for both animal and flower stimuli even after the final extinction procedure at 3 weeks.

Previous research indicates that learning for fear-relevant stimuli will be greater in magnitude, faster, and more robust than for fear-irrelevant stimuli (Mineka & Öhman, 2002). Cook and Mineka (1990, 1989) provided support for preparedness in vicarious learning with evidence of superior conditioning for fear-relevant but not fear-irrelevant stimuli in monkeys. In some direct conditioning studies, similar fear acquisition for fear-relevant (e.g. snakes, spiders, angry faces) and fear-irrelevant stimuli (e.g. flowers, mushrooms, happy faces) has been reported, but with significantly greater resistance to extinction for fear-relevant stimuli (Öhman, Fredrikson, Hugdahl, & Rimmö, 1976; Öhman & Dimberg, 1978). In the current vicarious learning experiment children's fear beliefs increased after they saw animals and flowers in a vicarious fear learning procedure, but as in chapter 5 and Askew et al. (2013), there was no difference in learning for these two stimuli of differing fear-relevance. The uniformity of the learning effects for animals and flowers in the acquisition phase of these experiments suggests that the vicarious transmission of threat-related visual information by adults to children may in some way facilitate a reduction in the significance of, or relegation of the role of stimulus preparedness. In other words, observation by a child of a fearful response in an adult may for some reason override the fear-relevance of the CS or render it less important. Certainly, these findings and those from chapter 5 appear to contradict a preparedness theory explanation of vicarious learning in children of this age group.

There was a significant and unexpected difference in the results obtained for the two CSs during the extinction phase. At one week there was no extinction of fear beliefs for either stimulus. However, while extinction trials with animals (higher fear-relevance) produced elevated fear beliefs followed by an extinction effect, no significant extinction of fear beliefs was found for (less fear-relevant) flower stimuli. This is the opposite of what preparedness-

related theories predict. In experiment 4 (chapter 5), persistence was only measured once 1 week after the initial vicarious learning task, and this may not have been enough to record a change in the fear-belief or avoidance responses. In the current experiment an extinction procedure was performed 1, 2 and 3 weeks after the vicarious learning task. The robustness demonstrated for fear beliefs acquired for the less fear-relevant flower stimuli cannot be easily explained. One possibility is that some other characteristic of the flower stimuli, for example colour, may affect the salience of this CS and be responsible for the robustness of the association. Alternatively, and contrary to Pavlovian conditioning procedures, the stark incongruity of the CS-US pairing may operate in vicarious learning as an aid to learning.

It is worth noting the markedly different results obtained for extinction here and with counterconditioning in chapters 2 and 3 (experiments 1 and 2). In both of those experiments changes in fear beliefs for animals were successfully returned to baseline after the counterconditioning phase. In the current experiment there was a resistance to extinction for both stimuli at one week, and a significant extinction effect at 2 weeks for animals but not flowers. This suggests that extinction and counterconditioning, despite the similarity attributed to them by some researchers (e.g. Wilson & Davidson, 1971), may be underpinned by different associative mechanisms. The learning and counterconditioning phases of these experiments consisted of vicarious procedures that produced broadly similar effects. In terms of differences in findings, it is perhaps significant that one important difference between extinction and counterconditioning is that extinction is by definition not a vicarious procedure in that it does not involve a model's response (US).

As mentioned previously, it is generally accepted today that some form of inhibitory learning processes underpin extinction whereby the original CS-US association effectively competes with a CS *no*-US association. More recent associative learning theory elaborates on the concept of counterconditioning by predicting that positive experiences with the feared CS

will actually weaken previously established CS-US associations involving the aversive US. This association is then eventually replaced with a new CS-US association involving the positive US (Kelly et al., 2009). In the current experiment the vicarious learning phase introduced an unexpected association between the less fear-relevant flower CSs and the fearful adult USs. The unexpectedness and success of this association may be deduced from the initial effect size for the flower CSs and the robustness of the effect. It is possible that the novelty of this association has contributed to its robustness such that this association needs to be actively weakened and replaced with another CS-US association involving a positive US (as was demonstrated in the counterconditioning experiments in chapters 2 and 3). Therefore the extinction procedure, if it is not actively replacing the previous CS-US association is simply not strong enough to effect a change for the novel association.

Results for avoidance preferences were also somewhat unexpected. While the more fear-relevant animal CSs demonstrated an expected resistance to extinction, this resistance was also equally observed for the less fear-relevant flower CSs. As with the measure for fear beliefs, it is possible that the novelty of the flower-fearful face association contributed to the robust response. However, given that the animal CSs in the current experiment demonstrated a significant extinction effect for fear-beliefs it is unclear why levels of avoidance preferences remained elevated. One explanation could be that the nature reserve task is a less cognitive, more behavioural measure of children's feelings for animals than the fear beliefs questionnaire. This may make it is a more direct and instinctive measure of how children would actually respond to the animals than the fear beliefs questionnaire.

## **6.5 Chapter Summary**

In common with Askew et al. (2013) and findings from chapter 5, the current study demonstrated that children's fear beliefs increased similarly for two stimuli (animals and flowers) of differing fear relevance. In contrast to results from direct conditioning studies,

differences in learning for fear-relevant stimuli—faster learning, greater CR, more robust/extinction-resistant learning—were not found in this or the previous chapter (Experiment 4). Effects of vicarious learning on fear-related measures were no greater for stimuli assumed to have greater fear-relevance than less fear-relevant stimuli. In fact in the current experiment the less fear-relevant stimuli elicited a more robust learning response (greater resistance to extinction) than the assumed fear-relevant stimuli. In a general sense, the findings suggest that, unlike in direct conditioning, vicarious learning in children of this age is not influenced by the fear-relevance of the stimuli involved. Although preparedness effects are found with monkeys and in direct human conditioning, it may make sense in terms of survival and evolution for children of this age to vicariously learn to fear all types of stimuli, regardless of fear-relevancy, from adults who know more about dangers in the immediate environment. Further, the fear relevance of stimuli may not, as assumed, be transmitted genetically, but may instead be transmitted socially via learning processes (see e.g. Davey, 1995). Thus, in terms of vicarious learning, there may not yet be a distinction between fear relevance and fear irrelevance for children in this age group: all stimuli may effectively be fear-relevant (but see for example, Lobue & DeLoache, 2008, for evidence contradicting this in younger children). Alternatively, novelty may have a more important role to play in the robustness displayed for learning for less fear-relevant CSs here, which is susceptible to counterconditioning but not extinction. Finally, there may simply be some other unknown characteristic or combination of characteristics of the less fear-relevant stimuli used in this experiment, such as colour, or an incongruity in the CS-US association that, enhanced effects and robustness of vicarious fear learning.

## **Chapter 7.**

### **General Discussion**

#### **7.1 Aims and Objectives of this Thesis**

This thesis investigates the development of fear in childhood. More specifically, it looked at vicarious learning of fear in children and the processes underlying this type of learning. Given that previous literature has shown that vicarious learning is a form of associative learning in which a CS becomes associated with a US (Askew & Field, 2007; Mineka & Cook, 1993), established principles of associative learning should apply to it. Therefore the thesis looked at the effect of manipulating CS and US characteristics on vicarious fear-learning in children. This was investigated using the prospective paradigm originally developed by Askew and Field (2007), as this methodological framework overcomes the limitations of previous retrospective human vicarious learning research. The thesis had two primary objectives, to: (a) investigate the effects of increasing US salience on vicarious learning by manipulating the age, relatedness, and motion (in a filmed scenario) of the model; and (b) investigate the effects of CS fear-relevance on the speed, magnitude and robustness of vicarious learning. These objectives will be evaluated and there will follow a brief discussion of the implications of the findings, limitations of the research, and implications for future work.

#### **7.2 What Effect does US Salience have on Vicarious Learning?**

##### ***7.2.1 Does increasing US salience increase vicarious fear learning?***

The associative learning literature shows that the salience of the US is critical for learning. Salience may be described as a measure of the effectiveness of the US and the salience of a stimulus may be derived from emotional, motivational cognitive or other factors. According to the Rescorla-Wagner model (1972), given a conditioning trial with a



single CS, the associative strength of the CS should be a function of the salience of both the CS and the US; so if the US is more salient, learning should be more effective. However, the experiments described in chapters 2, 3 and 4 found no evidence that the salience of the US affected vicarious fear-learning in children of this age.

Chapter 2 looked at how the relatedness of the model to the observer might affect US salience and fear-learning. It was assumed that the more related the model was to the observer, the more salient the US would be, and consequently lead to more superior fear learning. As predicted, the results showed that children's fear responses for animals increased following fear-related vicarious learning and decreased following positive vicarious learning. However, contrary to expectations, there were no differences in changes in children's fear beliefs between mother and stranger models. Previous studies with infants and younger children would suggest a mother model, being more closely related to the observer, would be a more potent model (e.g., Zabatany & Lamb, 1985), but this did not prove to be the case here. The reason for this lack of effect is not immediately obvious, but it could be a natural consequence of childhood development. Children in the current experiment were older than is typical for social referencing (e.g., aged 13–15 months: Zabatany & Lamb, 1985) and maternal fear-modelling studies (e.g., aged 12–21 months: Egliston & Rapee, 2007; Gerull & Rapee, 2002). The guardian and mentor role of the mother for a naive and vulnerable young child is gradually rendered redundant as the child develops. Through the development process the child acquires experiences of its own and develops other equally valuable sources of information. It is possible therefore that the lack of superior effect when using mother models may be attributable to the advanced development of the children involved in this experiment. It is conceivable that the importance of relatedness as a characteristic of US salience may diminish over time or alternatively that the relative importance of other sources increases with experience. As the child grows older and gains more personal experience and

experience with others, the effect relatedness has on the salience of the US may weaken as the child comes to place value on information acquired from sources outside the family.

The second of the US salience experiments (chapter 3) looked at another factor assumed to influence US salience, i.e., the age of the model relative to the observer. Peer-mediated intervention strategies provide much evidence for the effectiveness of peer influence over adult in learning and effecting change in children (Hoff & Robinson, 2002). However, there is also evidence that superior effects may be obtained with adult models in changing fear-related beliefs (e.g., Field et al., 2001). This experiment looked at whether peer modelling or adult modelling would be more salient and therefore more effective in changing children's fear-related beliefs. The results were similar to the first experiment with the expected increases in fear responses following fear-related learning and reduction following positive learning for peer and adult models. However, no significant difference in the effectiveness of peer compared to adult models was observed. As with chapter 2, the findings suggest that the age of the source may not affect US salience during vicarious fear-learning in children of this age. Alternatively, US salience may simply be unimportant for this age group. The distinction between these two interpretations is subtle and not distinguished by the current study, and either way the effect on children's fear in real learning situations will be the same.

The final experiment to look at US salience, Experiment 3 (chapter 4), used the more ecologically-valid scenario of models in motion (in filmed scenarios) to examine the effect the richness of this information source might have on US salience and consequently on vicarious learning. This experiment also looked at whether threat-related attentional biases, frequently seen in anxiety disorders, are created during vicarious fear-learning. No significant effect of fear-related vicarious learning films on children's fear cognitions was found. Given the effects found using still images, the lack of effect with moving images is difficult to

explain. One possible explanation might be that the children did not empathise with the model presented in the film. This might be due to the fact that the film simply did not appear to be “real” enough to the children: they may not have been convinced that the model in the film was genuinely expressing fear. However, considering the significant effect obtained in the other experiments with static images, it is unclear how significant the realism of the presentation actually needs to be to effect a change in fear cognitions.

The video film used in this experiment provided threat-related visual information in a fairly subtle way: the videos were not designed to convey shock or to demand and hold the observer’s attention. It is possible that today’s media-savvy children, exposed as they are to a continuous stream of information from various media sources such as television and the internet, via computers, smart phones, and tablets, are less influenced by filmed presentations of relatively low strength. Ironically, the information being conveyed in such presentations may appear less real and consequently be less effective than originally thought owing to a gradual desensitisation of children to images presented in the media. For example, studies indicate that one of the effects of increased exposure to television (and in particular aggressive behaviour) is that children may be less affected by the anxiety and suffering of others (National Institute of Mental Health, 1982). The sheer weight of information now presented to children in this way may mean that information conveyed in such media presentations have little or no effect on the salience of the US.

To summarise, social referencing studies have generally focussed on behaviour (Zarbatany & Lamb, 1985) or fear-learning (Egliston & Rapee, 2007; Gerull & Rapee, 2002) in very young infants. The studies reported here focussed on school age (6-10 years) children at an age when fears associated with animals typically develop (Field & Davey, 2001) and represent the first vicarious learning experiments to examine the effect of relatedness and age

of model on acquisition of fear. Findings show that strangers and same age peers are equally as effective as fear models as children's mothers during vicarious fear learning.

### ***7.2.2 Effect of US salience on counterconditioning.***

Kelly et al. (2009) found that fear beliefs inflated via verbal information could be unlearned using positive modelling (counterconditioning). Chapter 2 and 3 of this thesis showed that fear responses acquired through vicarious fear-learning can also be unlearned via positive vicarious learning, i.e., counterconditioning. As with the initial fear learning there was no discernible difference in counterconditioning effects between mother and stranger models, or between peers and adults. This represents the first evidence that vicariously acquired fears can be successfully unlearned from a variety of models and is important when one considers that vicariously learned fears are likely to be learned from close family members such as parents or siblings. Thus, these studies not only indicate that fears learned in the family or from peers are no more intense than fears acquired from others, but also that fears acquired in this way can be just as effectively unlearned via stranger models. For example, where fear-beliefs were originally acquired via observation of a parent's fear responses, it appears that a stranger is just as effective for children of this age as a parent for unlearning the beliefs again.

### ***7.2.3 Implications for US salience***

The results of the US salience experiments could be construed as casting doubt on the significance of the role of US salience in vicarious fear-learning, or perhaps the importance of the particular variables assessed in these experiments for salience. It seems likely from these results that the salience of the US is not affected by increasing the relatedness of the model to the observer, by the age of the model, or whether models are animated. Specifically, in the case of vicarious fear-learning in children of this age, manipulating these characteristics may simply not be effective at altering the salience of the US.

An alternative explanation is also not ruled out by the findings though. It is possible that US salience itself does not have any significant effect on vicarious learning. Given that vicarious learning is a form of associative learning, this conclusion may initially seem unlikely. However, by its very nature vicarious learning involves the observer placing significant reliance on the interpretation of another's reaction which is assumed to be a true reflection of the other's experiences. It may be that because of this reliance on the other's experience that the "noise" associated with interpreting the salience of the US is sacrificed to accelerate acquisition of threat-related information. From a functional point of view there is no difference between these two explanations and a distinction between them could only be made if studies either exhaustively demonstrated that US salience could be increased without affecting learning, or conversely by showing that manipulating US salience in a specific manner affected vicarious learning. Nonetheless, and importantly, the evidence presented here consistently suggests that children can learn fear vicariously via a range of model types.

### **7.3 What Effect does Fear Relevance have on Vicarious Learning?**

The second group of experiments in this thesis looked at characteristics of the CS and how they affect fear learning. Research with adults suggests that for fear-relevant CSs, fear learning is generally shown to be: greater in magnitude (producing a larger conditioned response); more rapid (requiring fewer trials); and more robust (demonstrating a superior resistance to extinction) than for fear-irrelevant CSs (see e.g., Öhman & Mineka, 2001). However, Askew et al. (2013) showed that vicariously acquired fear responses in children (6 to 11 years) were no larger for fear-relevant stimuli than for fear-irrelevant stimuli. The final two experiments discussed in this part of the thesis compared the speed and robustness of vicariously learned responses for stimuli of differing fear-relevance.

#### ***7.3.1 Speed of learning.***

Previous work suggests that learning should be faster (occur in fewer trials) for fear-relevant stimuli as opposed to fear-irrelevant stimuli. In chapter 5, images of animals and flowers (established fear-irrelevant stimuli) were used with varying numbers of CS-US pairings (1, 10 or 30) to see whether learning occurred at different speeds for CSs of greater or lesser fear-relevance. The experiment found no interaction between fear-relevance and number of pairings. Children acquired fear for the (fear-irrelevant) flowers at the same rate as they did for the (more fear-relevant) animals. This indicated that the fear-relevance of the CS appeared to have no effect on vicarious fear-learning. This finding appears to contradict predictions of preparedness theory (and see e.g., Öhman & Mineka, 2001).

### ***7.3.2 Robustness of learning.***

Experiments using classical conditioning procedures in which the fear-relevance of the CS has been manipulated have successfully and repeatedly demonstrated resistance to extinction for fear-relevant stimuli (see McNally, 1987, for reviews; Öhman & Mineka, 2001). The inference from such studies is that due to an automatic response facilitated by an evolutionary fear-learning module, resistance to extinction will be observed when the CS is phylogenetically fear-relevant and not when it is fear-irrelevant (Öhman & Mineka, 2001). Both CS fear-relevance experiments in chapters 5 and 6 looked at how robust learning would be for stimuli of differing fear-relevance. Experiment 4 looked at the persistence of learnt fear responses over time and found that children's fear beliefs were still elevated for animals and flowers at follow-up at one week. Experiment 5 examined whether animals would show lower rates of extinction of learnt fear-related responses compared to flowers. However, while no significant extinction was found at 1 week for either stimulus, there was a significant extinction effect for animals from 2 weeks onwards, but no extinction at either 1, 2 or 3 weeks for flowers.

What is surprising about this is that persistence was at least as strong for the fear-irrelevant flower stimuli as it was for the more fear-relevant animal stimuli. The evidence from these experiments appears to suggest that CS-US incongruity has more of an effect on fear-beliefs for less fear-relevant stimuli. In chapter 7 there was an unexpectedly clear resistance to extinction effect demonstrated for flowers paired with scared faces while the more fear-relevant animals paired with scared faces demonstrated a more conventional extinction effect. It is possible that the incongruity of the pairing may have contributed to the superior resistance to extinction observed (discussed in more detail below in 7.3.4).

### ***7.3.3 Magnitude of learning (size of CR).***

Previous research (Askew et al., 2013) with 6 to 10 year olds suggested that vicariously learnt fear responses for fear-relevant stimuli were not significantly different from those obtained for less fear-relevant stimuli (stimuli used were marsupials, flowers, caterpillars, worms and snakes). The results obtained were unexpected and contrary to the theories of authors such as Seligman (1971) and Öhman and Mineka (2001). Findings from chapters 5 and 6 support those of Askew et al. Neither of these experiments provided evidence that there was any difference in the magnitude of fear learning for animals compared to flowers during vicarious learning trials. This also corroborates earlier research carried out with toddlers by Dubi et al. (2008) (although it should be noted that neither fear beliefs nor avoidance persisted longer than 1 minute for either the fear-relevant or fear-irrelevant stimuli in that study). Furthermore, chapter 5 demonstrated that increasing or decreasing the number of pairing trials during the vicarious learning phase does not significantly affect the magnitude of the CR regardless of CS fear-relevance.

### ***7.3.4 Implications of CS Fear-Relevance Findings.***

In common with the earlier studies looking at the salience of the US, this group of experiments also demonstrated that vicarious learning procedures can be successfully used to

significantly alter children's fear-related beliefs and avoidance of novel animals. These studies are the first to test predictions that fear relevance of stimuli influences the speed and robustness of vicarious learning in children. It also provided further evidence that children of this age learn fear equally from animal and flower stimuli. In addition these are the first studies to date showing that the strength of learning is not generally influenced by the number of vicarious learning trials that children are exposed to (either 1, 10 or 30 trials). This appears to suggest differences in the way associative learning processes work in vicarious fear learning in children compared to classical fear-conditioning procedures with adults.

Thus, findings appear to demonstrate that vicarious fear-learning operates independently of stimulus fear-relevance for children in this age group. Vicarious learning involves the learning of fear based on the reaction or consequences demonstrated by a third party, rather than direct experience. What is paramount for survival is the recognition and avoidance of threat. Vicarious learning offers the possibility of acquiring this vital survival information "at arm's length". It is not unreasonable therefore to assume that during this process greater immediacy is placed on the acquisition of the threat-related message being conveyed, rather than on analysis of the CS involved in learning. Information received about the CS may ultimately be misleading (for example a friendly-looking small pet dog that suddenly turns and bites someone who reaches out to stroke it) and thus discounted in the vicarious learning process. Purely in terms of survival, this allows for a rapid response and evasion, rather than unnecessary and potentially dangerous delay. This however contradicts Öhman and Mineka's (2001) concept of a fear module that they suggest exists to accelerate the learning of associations for certain evolutionarily significant stimuli. It is not easy to reconcile the two arguments. However, it may be that in vicarious learning it is more expedient for younger children to quickly adopt the behaviours of experienced adult models



and thus learn of potentially threatening situations independent of stimuli characteristics. This “overriding” behaviour may therefore be age and/or context specific.

The findings might also be interpreted as offering support for Davey’s (1995) expectancy bias model. This model suggests that increased expectancy that a traumatic outcome will follow the occurrence of a CS can cause selective associations and may be derived from culturally or socially transmitted information (Davey, 1995; 1997; Field & Davey, 2001). “Preparedness” effects leading to selective learning may not be due to genetic transmission then, but social learning processes (e.g. verbal information or vicarious learning) during childhood. Thus selective associations may not have been found here because children are still young and may not yet have learnt that animals are likely to be more threatening than flowers. Effectively then both stimuli may have been fear-irrelevant, though the speed of learning (in one pairing) and relative robustness of effects suggests rather that both stimuli may have been regarded as fear-relevant. In addition, Askew et al. (2013) have recently shown that vicarious learning for these animals and flowers is no different to learning for established fear-relevant stimuli (snakes) in terms of size of the CR.

Given the overtly benign and fear-irrelevant nature of the CSs (flowers) in these experiments, one might expect to find little fear learning. A more plausible explanation than expectancy bias might be deduced from looking at other specific characteristics of the CS and how these might influence learning. The importance of colour for example might deserve further consideration. Wilson (1966) found that viewing the colour red led to an increase in physiological arousal (measured by conductance level and galvanic skin response). The importance of this is that arousal has been shown to increase memory performance (Roosendaal, 2002). Therefore certain colours may through arousal increase memory performance and hence learning. Wichmann, Sharpe, and Gegenfurtner (2002) found that colour scenes were encoded better than black and white scenes improving retrieval

performance, thus they suggest that colour played a significant role in enhancing memory performance. Greene, Bell, and Boyer, (1983) also found that “warm” colours (e.g. red, orange and yellow) were particularly effective at increasing arousal when compared with “cool” colours (e.g. blue, brown and grey). Two of the three flower types used in these experiments belong to this category of warm colours; the Red Avenas (red) and the Dotted Loosestrife (yellow); while all of the animal stimuli could be classified as “cool” being predominantly brown in colour. It is possible therefore, that the vivid colours of the flower stimuli used in these experiments facilitated association learning in the vicarious learning procedure better than the “cool” browns of the animal stimuli. Therefore problematic stimulus preparedness with the animal CSs combined with the memory enhancing effect of the colours from the flower CSs could offer an explanation for the superior performance observed for the less fear-relevant stimuli in these experiments. Future studies might consider using fear-relevant and-irrelevant stimuli that are matched for colour.

More generally there may be some characteristic of the CS-US association in these experiments that contributes to superior learning for the less fear-irrelevant stimuli. It may be that the incongruous association of flowers with fearful expressions actually enhances learning—as it is unexpected it could be better remembered as a potential threat. Research has demonstrated a mnemonic advantage for events that are perceived to be distinctive or out of the ordinary. This advantage could also be due to additional processing and consequently, better encoding for stimuli of this type (Michelon, Snyder, Buckner, McAvoy, & Zacks, 2003). There are generally considered to be two types of distinctiveness: primary distinctiveness derives from the degree to which an object contrasts with its environment; i.e., the chances of it being remembered improve in inverse proportion to its similarity with its contextual neighbours; but secondary distinctiveness is brought about by a violation of expectations regarding the environment; i.e., something out of the ordinary is perceived, or

something new experienced (Schmidt, 2012). This phenomenon is commonly referred to as the *bizarreness effect*. It is unclear whether distinctiveness confers an advantage in the encoding or retrieval of information, although it is likely that both play a role. From an encoding viewpoint, encoding is superior if an object is presented in a way that brings attention to its bizarre characteristics rather than the ordinary. It is these bizarre characteristics of the stimuli that make the memory more distinctive (McDaniel, Dornburg, & Gynn, 2005).

On the other hand, from a retrieval viewpoint, the distinctiveness of an object or event offers an advantage in the retrieval of information rather than the initial encoding as the retrieval set will also be distinct from the ordinary (Hunt & McDaniel, 1993). In applying this to the current findings, the flower stimuli would possibly not fit into the primary distinctiveness category, being largely indistinct from many other flowers. However, the association of these flower stimuli with a fearful response could fall into the category of secondary distinctiveness, with the CS-US association itself, i.e., adults behaving fearfully towards flowers, being considered bizarre and thus more memorable. The mechanics of distinctiveness remain complex and controversial, and lie outside of the scope of this thesis. Nevertheless, given that the phenomenon has real effect, it is possible, and suggested here, that the anomalous pairing of benign flower CSs with fearful adult USs may have been sufficiently bizarre to confer a mnemonic advantage in the learning of an association.

#### **7.4 Clinical Implications**

Modelling has been a successful part of the arsenal used in the treatment of fears for some time (e.g. Bandura, 1969; Lindsay & Powell, 1994; 1989). This technique is not, however, something that was targeted for specific investigation in these experiments. Consistent reductions in fear-beliefs for children in the experiments were observed post “happy” pairings, but it should be noted that these children were not from a clinical

population and did not have any pre-existing fear-beliefs regarding the stimuli presented. Therefore, while this finding was convincing, its clinical importance must be considered speculative. Furthermore, the vicarious unlearning procedure utilized here was measured against fear-beliefs acquired via this pathway only and may not be as effective, or effective at all, for fears acquired via other means such as verbal information or direct traumatic experience. Nevertheless the findings do highlight how the experimental procedure might be used in the future to develop early intervention and fear prevention strategies. To avoid creating actual fears in children, vicarious fear-learning has typically previously been studied retrospectively in children or adults with existing fears (see Askew & Field, 2008, for a review). The current procedure offers an advantage in that it represents a harmless laboratory model of what actually happens in the real world, and as such could be important in developing and testing new fear prevention and intervention strategies in non-fearful children.

The results of these experiments point to a number of ways in which it may be possible to moderate the development of fear in children, particularly where the fear may have been acquired through a vicarious learning event. First, at a very general level, these results show that parents, carers and anyone who works with children needs to be aware that their behaviour in a given situation, or towards an animal or object, can have a very real effect on children's fear beliefs for that animal, object or situation.. The findings suggest that such behaviour can lead to an increase in fear-beliefs in children. This is particularly important to bear in mind in cases where a model displays a fearful response to something that to others represents no threat. As has been seen in these experiments, children appear particularly sensitive to the acquisition of fear beliefs when vicarious processes are invoked. This occurs regardless of the fear-relevance of the CS involved. So all fearful responses observed by children should be treated as potentially inducing similar fear beliefs in the child

regardless of how irrational the response appears to an adult observer. Conversely, the findings also suggest that fears acquired via vicarious learning can be successfully unlearned in the same way, i.e., through vicarious means. In addition, any vicarious counterconditioning (unlearning) will be just as successful from a model who was not the source of the original vicarious learning episode as the original model. So for example, teachers or peers might be able to prevent a child developing phobic levels of fear by modelling positive responses to the stimulus the child has recently observed a parent or sibling expressing fear of. However, the time interval is still an unknown factor here because all counterconditioning in this thesis was performed directly after the original learning event and it is unclear whether it would still be successful at a later point in time.

### **7.5 Limitations and Future Work**

Some of the advantages afforded by the vicarious learning paradigm employed in these experiments impose limits on the extent of the conclusions that may be drawn from it. The nature of the vicarious learning manipulation means that it is appropriate to use with children: it is mild and involves relatively small changes in fear beliefs and avoidance preferences. Most importantly, “actual” fear is not created or investigated in this procedure. With such limitations, however, it might also be argued that the model would not extrapolate to real-world conclusions. But mild as the procedure may be, it still nevertheless facilitates change in two of the three emotional fear-response systems identified by Lang’s (1978) fear model: subjective experience (measured by self-report) and avoidance behaviour (measured by the nature reserve task).

For each of the experiments described here, the self-reported fear beliefs of the participants were shown to increase for the scared-pairing of animals relative to unpaired animals. A common criticism of self-report measures is that by their nature they may be vulnerable to self-presentation strategies; i.e., children may seek to respond in a way that they

think the experimenter would like them to respond. In order to allow for this potential, additional measures of avoidance behaviour were also taken in the form of the nature reserve task. Although this task is also essentially a self-report task, it is assumed to tap more directly into children's behavioural intentions. In support of this, previous studies have shown that avoidance preferences in the nature reserve task correlate significantly both with fear beliefs and actual avoidance when children are presented with the animals (Broeren et al., 2011).

It is widely accepted that inherited behavioural traits work together with learning experiences such as modelling in the development of phobias and anxiety disorders (Craske, 1999; Hudson & Rapee, 2004; Muris & Merckelbach, 2001; Rapee, 2001). It might prove instructive to assess participants' anxiety levels before the vicarious learning task in future research to determine if trait anxious children are more or less susceptible to vicarious learning than non-anxious children. Perhaps more importantly, it would be useful to assess these anxious children post-counterconditioning to determine whether unlearning is as effective as it is for non-anxious children, or whether high trait anxiety predisposes children to more robust increases in fear beliefs or increased resistance to counterconditioning.

While there appears to be a universal connection between facial expressions and emotions, it is still not clear what facet of an emotion a particular expression might relate to. Cultural and social influences can lead to significant differences in the interpretation of emotions derived from facial expressions (Ekman, 1992). As well as interpretation, these differences can also affect the expression of the emotion. It is uncertain to what degree the adults attempting to display negative or positive emotional expressions in the current studies do indeed manage to convey the appropriate non-verbal information to children in a way that might be perceived by them as being realistic. The ratings reported in chapter 2 give confidence that faces were at least conveying the correct emotion, though ratings for how genuine children felt the models to be were not taken. Some acceptance of authenticity is

implied though by the increases in children's fear beliefs for animals they saw with scared faces.

To date, childhood phobias have been treated using a variety or combination of methods such as instructional or behavioural treatments. Clearly it would be beneficial to determine what specific aspects of these treatments are most effective. While Kelly et al. (2009) (see chapter 2) looked at the effectiveness of modelling in counterconditioning fear beliefs, that study was limited in that there was no vicarious acquisition phase. Thus while only one pathway, verbal information, was used in the acquisition phase, two pathways, verbal information and modelling, were used in the counterconditioning phase. Also, as mentioned earlier, the modelling procedure used may not have been as effective as the vicarious procedure described in chapter 6. It would be useful to examine in more detail the relative significance of vicarious information in relation to verbal information, as a pathway of fear reduction for children in this age group (6 to 10 years). Both pathways could be examined at acquisition and unlearning phases, on their own and as a re-enforcement to the other pathway. This would help to determine the relative worth of such parental information combinations from a therapeutic perspective.

Some researchers have suggested that the availability of a father figure may provide children with a feeling of security which of itself may then moderate the development of anxiety in children (Lamb, 1977). It is also unclear whether the influence of either parent is more important at a particular stage of the child's development, for example in terms of fear responses, it may be possible that boys or girls might be influenced to greater effect by a father or a mother at various stages of development. To date, models associated with parental rearing and the development of childhood anxiety disorders have largely been based on the perceived significance of the mother's role, while the importance of the roles played by fathers, and their importance at various developmental stages in childhood and significance

of this on the gender of the child, have been overlooked (Bögels & Phares, 2008). The potential importance of the father in the development of psychopathology is one that has largely been ignored. This could be because of an assumption that fathers are somehow less important and contribute less to a child's development, and consequently mothers who spend more time with children will have more of an effect on their development (Phares, Lopez, Fields, Kamboukos, & Duhig, 2005; Lamb, 2000). It could also in part be because researchers perceive that mothers are easier to involve in research projects and as a consequence may find it more practical to relegate the father's role (Phares & Compas, 1992; Phares, Fields, Kamboukos, & Lopez, 2005). Nevertheless, it is clear that fathers are spending more time bringing up children than ever before (Pleck, 1997). It would therefore be sensible for future research to involve fathers and investigate their significance in the transmission and development of child anxiety disorders, and in particular the effect of father-son moderating (or otherwise) on children's fear beliefs.

Given that the current experiments indicate that vicarious learning is an effective way of unlearning vicariously acquired fears, it might also prove useful to explore whether positive vicarious learning can prevent future negative vicarious learning. Mineka and Cook (1986) successfully demonstrated the "immunizing" effects that prior exposure to fear-relevant stimuli (snakes) with positive models had on monkeys in subsequent vicarious learning events. It would be useful to explore the possibility of potentially immunising humans from negative vicarious learning events. Furthermore, it is acknowledged that the learning pathways described by Rachman (1977) are not mutually exclusive. For example Field and Storksen-Coulson (2007) found that threat-related verbal information and a direct negative learning event produced similar effects on 6 to 8 year olds' fear beliefs, but when the pathways were combined the effect observed was significantly greater. However, Askew, Kessock-Philips, and Field (2008) found little effect of adding verbal information to vicarious



learning. Future research should look more closely at the interaction of pathways with the aim of identifying combinations that provide optimum therapeutic effects. It is self-evident that acquiring a better understanding of the underlying factors and processes of childhood fear acquisition should facilitate improvements in the assessment, treatment, and ultimately in the prevention of anxiety disorders in general and phobias in particular.

## **7.6 Final Summary**

Research to date suggests that US salience is of vital importance in associative learning. Three experiments investigated for the first time the effect of US salience on vicarious fear learning and unlearning in children aged 6 to 10 years old. Three salience factors predicted to be particularly important (model relatedness, age and motion) were shown not to affect vicarious learning or unlearning: vicarious learning was no different irrespective of US salience. These experiments also demonstrated for the first time that vicarious counterconditioning is effective for the unlearning of children's fear-related responses acquired via vicarious learning, suggesting that early intervention may be able to reverse the development of fear. Crucially, irrespective of how the fear was vicariously acquired, this unlearning is unaffected by whether the model is a stranger, the child's mother or another child. Thus it appears that anyone can potentially intervene to prevent a child developing fear following a fear-related vicarious learning event. In addition, two experiments showed vicarious fear-learning is rapid (occurs in one trial) and the speed and magnitude of learning is independent of stimulus fear-relevance for children in this age group. Moreover, vicariously learnt fear beliefs are robust and resistant to extinction even for established fear-irrelevant stimuli. Thus the results suggest that vicarious fear-learning in children of this age may not be directly analogous to direct fear conditioning research with adults. The current findings present then a pivotal step towards understanding how fears are

developed and unlearned during childhood, and have implications for improving the current prevention and early intervention for fearful and anxious children.

## 8 References

- Abbott, B., & Badia, P. (1979). Choice for signaled shock over unsignaled shock as a function of signal length. *Journal of the Experimental Analysis of Behavior*, 32, 409–417.
- Amir, N., Beard, C., Burns, M., & Bomyea, J. (2009). Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology*, 118, 28–33. doi:10.1037/a0012589
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed., text revision)*. Washington, DC: Author.
- Armfield, J.M. (2007). Understanding animal fears: a comparison of the cognitive vulnerability and harm-looming models. *BMC Psychiatry*.doi:10.1186/1471-244X-7-68
- Arntz, A., Lavy, E., van den Berg, G., & van Rijsoort, S. (1993). Negative beliefs of spider phobics: a psychometric evaluation of the spider phobia beliefs questionnaire. *Advances in Behaviour Research and Therapy*, 15, 257–277.
- Askew, C., Dunne, G., Ozdil, A., Reynolds, G. & Field, A.P. (2013). Stimulus fear-relevance and the vicarious learning pathway to childhood fears. *Emotion*, 13, 915-925. doi:10.1037/a0032714.
- Askew, C., & Field, A.P. (2007). Vicarious learning and the development of fears in childhood. *Behaviour Research and Therapy* 45, 2616–2627. doi: 10.1016/j.brat.2007.06.008
- Askew, C., & Field, A. P. (2008). The vicarious learning pathway to fear 40 years on. *Clinical Psychology Review*, 28, 1249–1265. doi: 10.1016/j.cpr.2008.05.003

- Askew, C., Kessock-Philip, H., & Field, A. P. (2008). What Happens When Verbal Threat Information and Vicarious Learning Combine? *Behavioural and Cognitive Psychotherapy*, 36, 491-505. ISSN 1352-4658
- Baeyens, F., Crombez, G., Van den Bergh, O., & Eelen, P. (1988). Once in contact always in contact: Evaluative conditioning is resistant to extinction. *Advances in Behaviour Research and Therapy*, 10, 179-199.
- Baeyens, F., & De Houwer, J. (1995). Evaluative conditioning is a qualitatively distinct form of classical conditioning: A reply to Davey (1994). *Behaviour Research and Therapy*, 33, 825– 831.
- Baeyens, F., Eelen, P., Crombez, G., & Van den Bergh, O. (1992). Human evaluative conditioning: Acquisition trials, presentation schedule, evaluative style and contingency awareness. *Behaviour Research and Therapy*, 30, 133–142.
- Baeyens, F., Eelen, P., & Crombez, G. (1995). Pavlovian associations are forever: On classical conditioning and extinction. *Journal of Psychophysiology*, 9, 127-141.
- Baeyens, F., Eelen, P., Van den Bergh, O., & Crombez, G. (1990). Flavor–flavor and color–flavor conditioning in humans. *Learning and Motivation*, 21, 434 – 455.
- Baeyens, F., Eelen, P., Van den Bergh, O., & Crombez, G. (1989). Acquired affective-evaluative value: Conservative but not unchangeable. *Behaviour Research and Therapy*, 27, 279-287.
- Baeyens, F., Vansteenwegen, D., Hermans, D., & Eelen, P. (2001). Human evaluative flavor-taste conditioning: Conditions of learning and underlying processes. *Psychologica Belgica*, 41, 169-186.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84, 191–215.

- Bandura, A. (1969). *Principles of Behavior Modification*. New York: Holt, Rinehart & Winston.
- Bar-Haim Y, Lamy D, Pergamin L, Bakermans-Kranenburg & van IJzendoorn, M.H. (2007). Threat-related attentional bias in anxious and non-anxious individuals: a meta-analytic study. *Psychological Bulletin*, 133, 1–24.
- Bauer, D.H. (1976). An exploratory study of developmental changes in children's fears. *Journal of Child Psychology and Psychiatry*, 17, 69–74.
- Bennett-Levy, J., & Marteau, T. (1983). Fear of animals: What is prepared? *British Journal of Psychology*, 75, 37–42.
- Berger, S. (1962). Conditioning through vicarious instigation. *Psychological Review*, 69, 450–466.
- Bertenthal, B. I., Campos, J. J., & Barrett, K. C. (1984). Self-produced locomotion: An organizer of emotional, cognitive, and social development in infancy. In R. Emde, & R. Harmon, *Continuities and discontinuities in development*. New York: Plenum Press.
- Bevins, R. A., McPhee, J. E., Rauhut, A. S., & Ayres, J. J. B. (1997). Converging evidence for one-trial context fear conditioning with immediate shock: Importance of shock potency. *Journal of Experimental Psychology: Animal Behavior Processes*, 23, 312–324.
- Block, M. E., Oberweiser, B., & Bain, M. (1995). Using classwide peer tutoring to facilitate inclusions with disabilities in regular physical education. *Physical Educator*, 52, 47–56.
- Boer, F., & Lindhout, I. E. (2001). Family and genetic influences: is anxiety “all in the family”? In W. K. Silverman & P. D. A. Treffers (Eds.). *Anxiety Disorders in*

*Children and Adolescents: Research, Assessment and Intervention* (pp. 235-254).

Cambridge: Cambridge University Press.

Bögels, S. M., & Brechman-Toussaint, M. L. (2006). Family issues in child anxiety:

Attachment, family functioning, parental rearing and beliefs. *Clinical Psychology*

*Review*, 26, 834–856. doi: ology Review, 26, 834–856. doi:10.1016/j.cpr.2005.08.001

Bögels, S. M., & Phares, V. (2008). Fathers' role in the etiology, prevention, and treatment of

child anxiety: A review and new model. *Clinical Psychology Review*, 28, 539-558.

doi:10.1016/j.cpr.2007.07.011

Booth-Butterfield, M., Booth-Butterfield, S., & Koester, J. (1988). The function of

uncertainty reduction in alleviating primary tension in small groups. *Communication*

*Research Reports*, 5, 146-153.

Bouton, M. E. (1993). Context, time, and memory retrieval in the interference paradigms of

Pavlovian learning. *Psychological Bulletin*, 114, 80-99.

Bouton, M. E. (2002). Context, ambiguity, and unlearning: Sources of relapse after

behavioral extinction. *Biological Psychiatry*, 52, 976-986.

Bouton, M. E. (2004). Context and behavioral processes in extinction. *Learning & Memory*,

11, 485-494.

Bouton, M.E., & Bolles, R.C. (1979). Role of conditioned contextual stimuli in reinstatement

of extinguished fear. *Journal of Experimental Psychology: Animal Behavior*

*Processes*, 5, 368-378.

Bouton, M.E., & King, D.A. (1983). Contextual control of the extinction of conditioned fear:

tests for the associative value of the context. *Journal of Experimental Psychology:*

*Animal Behavior Processes*, 9, 248–65.

Bowlby, J. (1973). *Attachment and Loss. Volume 2: Separation Anxiety and Anger*. London:

Hogarth Press.

- Bradley, M. M., Moulder, B., & Lang, P. J. (2005). When good things go bad: The reflex physiology of defense. *Psychological Science*, 16, 468-473.
- Bradshaw, D. L., Goldsmith, H. H., & Campos, J. J. (1987). Attachment, temperament, and social referencing: Interrelations among three domains of infant affective behavior. *Infant Behavior and Development*, 10, 223-231.
- Bregman, E. (1934). An attempt to modify emotional attitudes of infants by the conditioned response technique. *Journal of Genetic Psychology*, 45, 169-196.
- Brewer, W. F. (1988). Memory for randomly sampled autobiographical events. In U. Neisser & E. Winograd (Eds.), *Remembering reconsidered: Ecological and traditional approaches to the study of memory* (pp. 21-90). Cambridge, UK: Cambridge University Press.
- Broeren, S., Lester, K.J., Muris, P., & Field, A.P. (2011). She is afraid of the animal, so therefore I am too: Influence of peer modeling on fear beliefs and approach-avoidance tendencies to novel animals in typically developing children. *Behaviour Research and Therapy*, 49, 50-57.
- Brooks, D.C. & Bouton, M. E. (1993). A retrieval cue for extinction attenuates spontaneous recovery. *Journal of Experimental Psychology: Animal Behavior Processes* 19, 77-89.
- Campos, J., Hiatt, S., Ramsay, D., Henderson, C., & Svejda, M. (1978). The emergence of fear on the visual cliff. In M. Lewis & L. A. Rosenblum (Eds.), *The development of affect*. New York: Plenum Press.
- Campos, J. J., & Stenberg, C. R. (1981). Perception, appraisal, and emotion: The onset of social referencing. In M. Lamb & L. Sherrod (Eds.), *Infant social cognition*. Hillsdale, NJ: Erlbaum.
- Chavira, D.A., Stein, M.B., Bailey, K., & Stein, M.T. (2004). Child anxiety in primary care: prevalent but untreated. *Depression and Anxiety*, 20, 155-164. doi: 10.1002/da.20039

- Childers, P., & Wimmer, M. (1971). The concept of death in early childhood. *Child Development*, 60, 551-561.
- Cisler, J. M., & Koster, E. H. W. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical Psychology Review*, 30, 203-216. doi:10.1016/j.cpr.2009.11.003
- Clarke J. C., & Jackson J. A. (1983). *Hypnosis and Behavior Therapy*. New York: Springer Publishing Company.
- Cook, E. W., Hodes, R. L., & Lang, P. J. (1986). Preparedness and phobia: Effects of stimulus content on human visceral conditioning. *Journal of Abnormal Psychology*, 95, 195-207.
- Cook, M., & Mineka, S. (1987). Second-order conditioning and overshadowing in the observational conditioning of fear in monkeys. *Behavior Research and Therapy*, 25, 349-364.
- Cook, M., & Mineka, S. (1989). Observational conditioning of fear to fear-relevant versus fear-irrelevant stimuli in rhesus monkeys. *Journal of Abnormal Psychology*, 98, 448-459. doi: 10.1037/0021-843X.98.4.448
- Cook M., & Mineka, S. (1990). Selective associations in the observational conditioning of fear in rhesus monkeys. *Journal of Experimental Psychology: Animal Behaviour Processes*, 16, 372-389. doi:10.1037/0097-7403.16.4.372
- Cook, M., Mineka, S., Wolkenstein, B., & Laitsch, K. (1985). Observational conditioning of snake fear in unrelated rhesus monkeys. *Journal of Abnormal Psychology*, 94, 591–610.
- Craig K. J., Brown K. J., & Baum A. (1995). Environmental factors in the etiology of anxiety. In: Bloom FE, Kupfer DJ, eds. *Psychopharmacology: the Fourth Generation of Progress*. New York, NY: Raven Press: 1325–1339.



- Craske, M. G. (1999). *Anxiety disorders: Psychological approaches to theory and treatment*. Boulder, CO: Westview Press.
- Craske, M. G., Zarate, R., Burton, T., & Barlow, D.H. (1993). Specific fears and panic attacks: A survey of clinical and nonclinical samples. *Journal of Anxiety Disorders*, 7, 1-19.
- Darwin, C. (1877). A biographical sketch of an infant, *Mind*, 2, 285-94.
- DaSilva, P., Rachman, S. J., & Seligman, M. E. P. (1977). Prepared phobias and obsessions: Therapeutic outcomes. *Behaviour Research and Therapy*, 15, 210-211.
- Davey, G. C. L. (1989). UCS revaluation and conditioning models of acquired fears. *Behaviour Research and Therapy*, 27, 521-528.
- Davey, G. C. L. (1992). An expectancy model of laboratory preparedness effects. *Journal of Experimental Psychology: General*, 121, 24-40.
- Davey, G. C. L. (1994). Self-reported fears to common indigenous animals in an adult UK population: The role of disgust sensitivity. *British Journal of Psychology*, 85, 541-554.
- Davey, G. C. L. (1994). The 'disgusting' spider: The role of disease and illness in the perpetuation of fear of spiders. *Society and Animals*, 3, 17-24.
- Davey G. C. L. (1995). Preparedness and phobias: Specific evolved associations or a generalized expectancy bias? *Behavioral & Brain Sciences*, 18, 289-325.
- Davey, G. C. L. (1997). A conditioning model of phobias. In G. C. L. Davey (Ed.), *Phobias: A handbook of theory, research and treatment* (pp. 301-322). Chichester: Wiley.
- Davey, G. C. L. (2002). 'Nonspecific' rather than 'nonassociative' pathways to phobias: a commentary on Poulton and Menzies. *Behaviour Research and Therapy*, 40, 151-158.
- Davey, G. C. L. (2008). *Clinical psychology. Topics in applied psychology*. Hodder Education. ISBN 9780340928899

- Davey, G. C. L., Forster, L., & Mayhew, G. (1993). Familial resemblances in disgust sensitivity and animal phobias. *Behaviour Research and Therapy*, 31, 41-50.
- Davis, M. (1974). Sensitization of the rat startle response by noise. *Journal of Comparative and Physiological Psychology*, 87, 571–581.
- Davis, M. (1992). The role of the amygdala in conditioned fear. In: *The amygdala: neurobiological aspects of emotion, memory, and mental dysfunction* (Aggleton J, ed), pp 255–305. New York: Wiley.
- Davison, G. C., & Neale, J. M. (1994). *Abnormal psychology* (6th ed.). New York: Wiley.
- Dawson, M., & Grings, W. (1968). Comparison of classical conditioning and relational learning. *Journal of Experimental Psychology*, 76, 227–231.
- Debiec, J., & LeDoux, J. (2004). Fear and the Brain. *Social Research*, 71, 807-818.
- Declercq, M., & De Houwer, J. (2008). Evidence for the interchangeability of an avoidance behavior and a negative occasion setter. *Learning & Behavior*, 36, 290-300.
- Delprato, D. J. (1980). Hereditary determinants of fears and phobias: A critical review. *Behavior. Therapy*, 11, 79-103.
- De Houwer, J. (2007). A conceptual and theoretical analysis of evaluative conditioning. *Spanish Journal of Psychology*, 10, 230–241.
- De Houwer, J. (2009). The propositional approach to associative learning as an alternative for association formation models. *Learning & Behavior*, 37, 1-20.
- De Houwer, J., Baeyens, F., & Field, A. (2005). Associative learning of likes and dislikes: Some current controversies and possible ways forward. *Cognition & Emotion*, 19, 161–174.
- De Houwer, J., Baeyens, F., Vansteenwegen, D., & Eelen, P. (2000). Evaluative conditioning in the picture-picture paradigm with random assignment of conditioned

- stimuli to unconditioned stimuli. *Journal of Experimental Psychology-Animal Behavior Processes*, 26, 237-242. doi:10.1037/0097-7403.26.2.237
- De Houwer, J., Thomas, S., & Baeyens, F. (2001). Associative learning of likes and dislikes: A review of 25 years of research on human evaluative conditioning. *Psychological Bulletin*, 127, 853–869.
- de Jong, P.J., & Merckelbach, H. (1997). No convincing evidence for a preparedness explanation of phobias. *Behavioral and Brain Sciences*, 20, 362-363.
- de Jong, P. J., Muris, P., & Merckelbach, H. (1996). UCS inflation and human aversive autonomic conditioning. *Biological Psychology*, 43, 227-239.
- De Rosnay, M., Cooper, P. J., Tsigaras N., & Murray, L. (2006). Transmission of social anxiety from mother to infant: an experimental study using a social referencing paradigm. *Behaviour Research and Therapy*, 44, 1165-1175.
- Diaz, E., Ruiz, G., & Baeyens, F. (2005). Resistance to extinction of human evaluative conditioning using a between-subjects design. *Cognition & Emotion*, 19, 245-268.  
doi:10.1080/02699930441000300
- Di Nardo, P. A., Guzy, L. T., & Bak, R. M. (1988). Anxiety response patterns and etiological factors in dog-fearful and non-fearful subjects. *Behaviour Research and Therapy*, 26, 245-251.
- Di Nardo, P. A., Guzy, L. T., Jenkins, J. A., Bak, R. M., Tomasi, S. M., & Copland, M. (1988). Etiology and Maintenance of Dog Fears. *Behaviour Research and Therapy*, 26, 241-244.
- Doogan, S., & Thomas, G. V. (1992). Origins of fear of dogs in adults and children: The role of conditioning processes and prior familiarity with dogs. *Behaviour Research and Therapy*, 30, 387–394.

- Dubi, K., Rapee, R. M., Emerton, J. L., & Schniering, C. A. (2008). Maternal Modeling and the Acquisition of Fear and Avoidance in Toddlers: Influence of Stimulus Preparedness and Child Temperament. *Journal of Abnormal Child Psychology*, 36, 499-512. doi:10.1007/s10802-007-9195-3
- Egliston, K.A., & Rapee, R. M. (2007). Inhibition of fear acquisition in toddlers following positive modelling by their mothers. *Behaviour Research and Therapy*, 45, 1871-1882. doi:10.1016/j.brat.2007.02.007
- Ehlers, A., Osen, A., Wenninger, K., & Gieler, U. (1994). Atopic dermatitis and stress: The possible role of negative communication with significant others. *International Journal of Behavioral Medicine*, 1, 107-121.
- Ekman, P. (1992). An Argument For Basic Emotions. *Cognition and Emotion*, 6, 169-200.
- Ekman, P., & Friesen, W. (1975). *Unmasking the face*. Englewood Cliffs, N J: Prentice-Hall.
- Eley, T. C., & Gregory, A. M. (2004). Behavioral genetics. In T. L. Morris & J. S. March (Eds.), *Anxiety disorders in children and adolescents* (pp. 71–97). New York: Guilford.
- Estes, W.K., & Skinner, B.F. (1941). Some quantitative properties of anxiety. *Journal of Experimental Psychology*, 29, 390-400.
- Etscorn, F., & Stephens, R. (1973). Establishment of conditioned taste aversions with a 24-hour CS-US interval. *Physiological Psychology*, 1, 251-253.
- Eysenck, H. J. (1979). The conditioning model of neurosis. *Behavioral and Brain Sciences*, 3, 155-199.
- Eysenck, H. J. (1981). *General features of the model*. In: *A model for personality*, pp 1–37. Berlin: Springer.
- Eysenck, H. J., & Rachman, S. (1965). *The Causes and Cures of Neurosis*. London: Routledge & Kegan Paul.

- Fanselow, M.S. (1994). Neural organization of the defensive behavior system responsible for fear. *Psychonomic Bulletin and Review*, 1, 429–438.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G\*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149-1160
- Feinman, S. (1992). In the broad valley: an integrative look at social referencing. In S. Feinman (Ed.), *Social referencing and the social construction of reality in infancy* (pp. 3–13). New York: Plenum
- Feinman, S., & Lewis, M. (1983). Social referencing at ten months: A second-order effect on infant's responses to strangers. *Child Development*, 54, 878–887.
- Feinman, S., Roberts, D., Hsieh, K., Sawyer, D., & Swanson, D. (1992). A critical review of social referencing in infancy. In S. Feinman (Ed.), *Social referencing and the social construction of reality in infancy* (pp. 15–54). New York: Plenum
- Field, A. P. (2003). I don't like it because it eats Brussels sprouts: Evaluative conditioning in children. British Psychological Society Annual Conference, Bournemouth (13<sup>th</sup>–15<sup>th</sup> March, 2003)
- Field, A. P. (2006). Is conditioning a useful framework for understanding the development and treatment of phobias? *Clinical Psychology Review*, 26, 857-875.  
doi:10.1016/j.cpr.2005.05.010.
- Field, A. P. (2006). Watch out for the beast: Fear information and attentional bias in children. *Journal of Clinical Child and Adolescent Psychology*, 35, 431–439.
- Field T.M. (1979). Infant behaviors directed toward peers and adults in the presence and absence of mother. *Infant Behavior and Development*, 2, 47-54.

- Field, A. P., Argyris, N. G., & Knowles, K. A. (2001). Who's afraid of the big bad wolf: a prospective paradigm to test Rachman's indirect pathways in children. *Behaviour Research and Therapy*, 39, 1259–1276.
- Field, A. P., & Davey, G. C. L. (1997). Conceptual conditioning: Evidence for an artifactual account of evaluative learning. *Learning and Motivation*, 28, 446–464.
- Field, A. P., & Davey, G. C. L. (1999). Reevaluating evaluative conditioning: A nonassociative explanation of conditioning effects in the visual evaluative conditioning paradigm. *Journal of Experimental Psychology: Animal Behavior Processes*, 25, 211–224.
- Field, A. P., & Davey, G. C. L. (2001). Conditioning models of childhood anxiety. In W. K. Silverman, & P. A. Treffers (Eds.), *Anxiety disorders in children and adolescents: research, assessment and intervention* (pp. 187–211). Cambridge: Cambridge University Press.
- Field, A. P., Hamilton, S. J., Knowles, K. A., & Plews, E. L. (2003). Fear information and social phobic beliefs in children: a prospective paradigm and preliminary results. *Behaviour Research and Therapy*, 41, 113–123.
- Field, A. P., & Lawson, J. (2003). Fear information and the development of fears during childhood: effects on implicit fear responses and behavioural avoidance. *Behaviour Research and Therapy*, 41, 1277–1293. doi:10.1016/S0005-7967(03)00034-2
- Field, A. P., Lawson, J., & Banerjee, R. (2008). The verbal threat information pathway to fear in children: The longitudinal effects on fear cognitions and the immediate effects on avoidance behavior. *Journal of Abnormal Psychology*, 117, 214–224.
- Field, A. P., & Lester, K. J. (2010). Learning of information processing biases in anxious children and adolescents. In J. A. Hadwin & A. P. Field (Eds.), *Information*

- processing biases and anxiety: A developmental perspective* (pp. 253–278).  
Chichester: Wiley-Blackwell.
- Field, A. P., St-Leger, E., & Davey, G. C. L. (2010). Past- and future-based rumination and its effect on catastrophic worry and anxiety. *Journal of Experimental Psychopathology*, 1, 17-36.
- Field, A. P., & Storksen-Coulson, H. (2007). The interaction of pathways to fear in childhood anxiety: a preliminary study. *Behaviour Research and Therapy*, 45, 3051-3059.  
doi:10.1016/j.brat.2007.09.001
- Fiske, S. T., & Taylor, S. E. (1996). *Social cognition* (2nd ed.). New York: McGraw-Hill.
- Flykt, A. (2006). Preparedness for action: Responding to the snake in the grass. *American Journal of Psychology*, 119, 29-44.
- Flykt, A., & Caldara, R. (2006). Tracking fear in snake and spider fearful participants during visual search: A multi-response domain study. *Cognition & Emotion*, 20, 1075-1091.
- Foelix, R. (1996) *Biology of Spiders*. (2nd ed.). Cambridge, MA: Harvard University Press.
- Franca, V.M., Kerr, M.M., Reitz, A.L., & Lambert, D. (1990). Peer tutoring among behaviorally disordered students: Academic and social benefits to tutor and tutee. *Education and Treatment of Children*, 13, 109-128
- Fredrikson, M., & Ohman, A. (1979). Cardiovascular and electrodermal responses during conditioning to fear-relevant stimuli. *Psychophysiology*, 16, 1-7.
- French, D. C. (1984). Children's knowledge of the social functions of younger, older and same-age peers. *Child Development*, 55, 1429–1433.
- Frith, C. D. (2007) *Making up the mind; how the brain creates our mental world*. Oxford, UK: Blackwell.
- Foa, E. B. , Steketee, G., & Rothbaum, B. O. (1989). Behavioral/cognitive conceptualization of post-traumatic stress disorder. *Behavior Therapy*, 20, 155-176.

- Forsyth, J. P., & Chorpita, B. F. (1997). Unearthing the nonassociative origins of fears and phobias: A rejoinder. *Journal of Behavior Therapy and Experimental Psychiatry*, 28, 297-305.
- Fyer, A. J., Mannuzza, S., Chapman, T. F., Martin, L.Y., & Klein, D.F. (1995). Specificity in familial aggregation of phobic disorders. *Archives of General Psychiatry*, 52, 564-573.
- Garcia, J., & Koelling, R. A. (1966). Relation of cue to consequence in avoidance learning. *Psychonomic Science*, 4, 123-124.
- Garner, M. (2010). Assessment of attentional bias using the dot-probe task in anxious children and adolescents. In J. Hadwin & A. P. Field (Eds.), *Information processing biases and anxiety: A developmental perspective*. Chichester: Wiley-Blackwell.
- Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin*, 132, 692–731.
- Gentile, D. A., & Walsh, D. A. (2002). A normative study of family media habits. *Journal of Applied Developmental Psychology*, 23, 157–178.
- Gerdes, A. B. M., Uhl, G., & Alpers, G. W. (2009). Spiders are special: Harmfulness does not explain why they are feared. *Evolution & Human Behavior*, 30, 66-73.
- Gerull, F. C., & Rapee, R.M. (2002). Mother knows best: Effects of maternal modelling on the acquisition of fear and avoidance behaviour in toddlers. *Behaviour Research and Therapy*, 40, 279–287. doi: 10.1016/S0005-7967(01)00013-4
- Gibson, E. J. (1983). The concept of affordances in development: The renascence of functionalism. In W. A. Collins (Ed.), *The concept of development: The Minnesota Symposia on Child Psychology* (Vol.15, pp. 55-81). NJ: Lawrence Erlbaum Associates.



- Gibson, E. J., & Walk, R. D. (1960). The "visual cliff." *Scientific American*, 202, 64-71.
- Gifford-Smith, M., Dodge, K.A., Dishion, T.J., & McCord, J. (2005). Peer influence in children and adolescents: Crossing the bridge from developmental to intervention science. *Journal of Abnormal Child Psychology*, 33, 255–265.
- Golkar, A., & Öhman A. (2012). Fear extinction in humans: Effects of acquisition-extinction delay and masked stimulus presentations. *Biological Psychology*, 91, 292-301
- Goodman, J. E., & McGrath, P. J. (2003). Mothers' modeling influences children's pain during a cold pressor task. *Pain*, 104, 559-565.
- Graham, J., & Gaffan, E. A. (1997). Fear of water in children and adults: etiology and familial effect. *Behaviour Research and Therapy*, 35, 91-108.
- Gray, J.A. (1982). *The Neuropsychology of Anxiety*. New York: Oxford University Press.
- Greene, T. C., Bell, P. A., & Boyer, W. M. (1983). Coloring the environment: Hue, arousal, and boredom. *Bulletin of the Psychonomic Society*, 21, 253-254.
- Greenwood, C.R., Arreaga-Mayer, C., Utle, C.A., Gavin, K.M., & Terry, B.J. (2001). Classwide peer tutoring learning management system: Applications with elementary-level English language learners. *Remedial and Special Education*, 22, 1, 34-47.
- Greenwood, C. R., & Delquadri, J. (1995). ClassWide Peer Tutoring and the prevention of school failure. *Preventing School Failure*, 39, 21-25.
- Greenwood, C.R., Delquadri, J. C., & Hall, R. V. (1989). Longitudinal effects of class-wide peer tutoring. *Journal of Educational Psychology*, 81, 371-383.
- Grillon, C., Baas, J.M.P., Lissek, S., Smith, K., & Milstein, J. (2004). Anxious responses to predictable and unpredictable aversive events. *Behavioral Neuroscience*, 118, 916-924.
- Gullone, E. (2000). The development of normal fear: A century of research. *Clinical Psychology Review*, 20, 429–451.

- Gunnar, M. R., & Stone, C. (1984). The effects of positive maternal affect on infant responses to pleasant, ambiguous, and fear-provoking toys. *Child Development, 55*, 1231–1236.
- Guthrie, E. R. (1935). *The psychology of learning*. England, Harper: Oxford.
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences, 16*, 701–713.
- Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development, 10*, 79-119.
- Hall, G.S. (1897). A study of fears. *American Journal of Psychology, 8*, 147-249.
- Harris, J.A., Jones, M.L., Bailey, G.K., & Westbrook, R.F. (2000). Contextual control over conditioned responding in an extinction paradigm. *Journal of Experimental Psychology: Animal Behavior Processes, 26*, 174–178.
- Harrison, K., & Cantor, J. (1999). Tales from the screen: Enduring fright reactions to scary media. *Media Psychology, 1*, 97-116
- Heim-Dreger, U., Kohlmann, C. W., Eschenbeck, H., & Burkhardt, U. (2006). Attentional biases for threatening faces in children: Vigilant and avoidant processes. *Emotion, 6*, 320–325.
- Hekmat, H. (1987). Origins and development of human fear reactions. *Journal of Anxiety Disorder, 1*, 197-218.
- Hermans, D., Dirikx, T., Vansteenwegen, D., Baeyens, F., Van den Bergh, O., & Eelen, P. (2005). Reinstatement of fear responses in human aversive conditioning. *Behaviour Research and Therapy, 43*, 533–551.

- Heyes, C. M., & Dawson, G. R. (1990). A demonstration of observational learning in rats using a bidirectional control. *The Quarterly Journal of Experimental Psychology*, 42, 59–71. doi:10.1080/14640749008401871
- Himle, J., Crystal, D., Curtis, G.C., & Fluent, T.E. (1991). Mode of onset of simple phobias: further evidence of heterogeneity. *Psychiatry Research*, 36, 37-43.
- Hoff, K. E., & Robinson, S. L. (2002). Best practices in peer-mediated interventions. In A. Thomas, & J. Grimes (Eds.), *Best practices in school psychology IV* (pp. 1555–1567). Bethesda, MD: National Association of School Psychologists.
- Hofmann, W., De Houwer, J., Perugini, M., Baeyens, F., & Crombez, G. (2010). Evaluative conditioning in humans: A meta-analysis. *Psychological Bulletin*, 136, 390-421.
- Hong, E. (1998). Differential stability of individual differences in state and trait anxiety. *Learning and Individual Differences*, 10, 51-69.
- Hudson, J. L., & Rapee, R. M. (2004). From Anxious Temperament to Disorder: An etiological model of Generalized Anxiety Disorder. In R.G. Heimberg, C.L. Turk, & D.S. Mennin (Eds.), *Generalized Anxiety Disorder: Advances in Research and Practice*. New York: Guilford Press.
- Hugdahl, K., & Johnsen, B. H. (1989). Preparedness and electrodermal fear-conditioning: Ontogenetic vs. phylogenetic explanations. *Behaviour Research and Therapy*, 27, 269–278.
- Hugdahl, K., & Kärker, A. C. (1981). Biological vs. experiential factors in phobic conditioning. *Behaviour Research and Therapy*, 19, 109–115.
- Hugdahl, K., & Öhman, A. (1980). Skin conductance conditioning to potentially phobic stimuli as a function of interstimulus interval and delay versus trace paradigm. *Psychophysiology*, 17, 348-355.

- Hunt, R. R., & McDaniel, M. A. (1993). The enigma of organization and distinctiveness. *Journal of Memory and Language*, 32, 421-445.
- Hygge, S., & Ohman, A. (1978). Modeling processes in the acquisition of fears: vicarious electrodermal conditioning to fear-relevant stimuli. *Journal of Personality Social Psychology*, 36, 271-279.
- Hyman, I. E., Jr., Husband, T. H., & Billings, F. J. (1995). False memories of childhood experiences. *Applied Cognitive Psychology*, 9, 181-197.
- Isbell, L. (2006). Snakes as agents of evolutionary change in primate brains. *Journal of Human Evolution*, 51, 1-35
- Izard, C. E. (1971). *The face of emotion*. New York: Plenum Press.
- Janiszewski, C., & Warlop, L. (1993). The Influence of Classical Conditioning Procedures on Subsequent Attention to the Brand. *Journal of Consumer Research*, 20, 171-189.
- John, E. R., Chesler, P., Bartlett, F., & Victor, I. (1968). Observational learning in cats. *Science*, 159, 1489-1491.
- Jones, M. C. (1924). A laboratory study of fear: The case of Peter. *Pedagogical Seminary*, 31, 308-315.
- Jones, T., & Davey, G. C. L. (1990). The effects of cued UCS rehearsal on the retention of differential “fear” conditioning: An experimental analogue of the “worry” process. *Behaviour Research and Therapy*, 28, 159-164.
- Jones, C. R., Russell H. F., & Michael A. O. (2009). Implicit Misattribution as a Mechanism Underlying Evaluative Conditioning, *Journal of Personality and Social Psychology*, 96, 933-948.
- Jones, M. K., & Menzies, R. G. (1995). The etiology of fear of spiders. *Anxiety, Stress and Coping*, 8, 227-234.

- Kamin, L. J. (1969). Predictability, surprise, attention, and conditioning. In: Campbell, B.A., Church, R.M. (Eds.), *Punishment and Aversive Behavior*. Appleton-Century-Crofts, New York, 835 pp. 276–296.
- Kagan, J. (1981). *The second year: The emergence of self awareness*. Cambridge, MA: Harvard University Press.
- Kagan, J., Kearsley, R. B., & Zelazo, P. R. (1975). The emergence of initial apprehension to unfamiliar peers. In M. Lewis, & L. A. Rosenblum, *Friendship and peer relations*. New York: Wiley.
- Kavaliers, M., Choleris, E., & Colwell, D. D. (2001). Brief exposure to female odors “emboldens” male mice by reducing predator-induced behavioral and hormonal responses, *Hormones and Behavior*, 40, 497-509.
- Kelly, V.L., Barker, H., Field, A.P., Wilson, C., & Reynolds, S. (2009). Can Rachman’s indirect pathways be used to un-learn fear? A prospective paradigm to test whether children’s fears can be reduced using positive information and modelling a non-anxious response. *Behaviour Research and Therapy*, 48, 164-170.  
doi:10.1016/j.brat.2009.10.002
- Kheriaty, E., Kleinknecht, R. A., & Hyman, I. E., Jr. (1999). Recall and validation of phobia origins as a function of a structured interview versus the Phobia Origins Questionnaire. *Behavior Modification*, 23, 61-78.
- King, N. J., Gullone, E., & Ollendick, T. H. (1998). Etiology of childhood phobias: Current status of Rachman’s three pathways theory. *Behaviour Research and Therapy*, 36, 297–309.
- Kirkby, K. C., Menzies, R. G., Daniels, B. A., & Smith, K. L. (1995). Aetiology of spider phobia: classificatory differences between two origin instruments. *Behaviour Research and Therapy*, 33, 955-958.

- Klein, R. (1994). Anxiety disorders. In M. Rutter, E. Taylor, & L. Herzov (Eds.). *Child and adolescent psychiatry - Modern approaches* (3rd ed.). London: Blackwell Scientific Publications.
- Kleinknecht, R. A. (1994). Acquisition of blood, injury, and needle fears and phobias. *Behaviour Research and Therapy*, 32, 817–823.
- Kleinknecht, R. A. (2002). Comments on: Non-associative fear acquisition: A review of the evidence from retrospective and longitudinal research. *Behaviour Research and Therapy*, 40, 159-163.
- Kleinknecht, R. A., & Lenz, J. (1989). Blood/injury fear, fainting and avoidance of medically related situations: a family correspondence study. *Behaviour Research and Therapy*, 27, 537–547.
- Kline, P. (1999). *The handbook of psychological testing* (2nd ed). London: Routledge.
- Klennert, M. D. (1984). The regulation of infant behavior by maternal facial expression. *Infant Behavior and Development*, 7, 447-465.
- Klennert, M.D., Campos, J.J., Sorce, J.F., Emde, R.N., & Svejda, M. (1983). Emotions as behavior regulators: social referencing in infancy. In R. Plutchik & H. Kelleman (Eds.), *Emotion: Theory, research and experience: Vol. 2. Emotions in early development* (pp. 57–86). New York: Academic Press.
- Klennert, M. D., Emde, R. N., Butterfield, P., & Campos, J. J. (1986). Social referencing: The infant's use of emotional signals from a friendly adult with mother present. *Developmental Psychology*, 22, 427-432.
- Kriekhaus, E. E., & Wolf, G. (1968). Acquisition of sodium by rats: Interaction of innate mechanisms and latent learning. *Journal of Comparative and Physiological Psychology*, 65, 197-201.

- Kurdek, L. A. (1977). Structural components and intellectual correlates of cognitive perspective-taking in first through fourth-grade children. *Child Development, 48*, 1503–1511.
- Ladd, G. W. (2008). Trends, travails, and turning points in early research on children's peer relationships: Legacies and lessons for our time? *Handbook of peer interactions, relationships, and groups*. Guilford Press.
- Lamb, M. E. (1977). Father–infant and mother–infant interaction in the first year of life. *Child Development, 48*, 167–181.
- Lamb, M. E. (2000). "The History of Research on Father Involvement." *Marriage & Family Review, 29*, 23–42.
- Lang, P. J. (1978). Anxiety: Toward a psychophysiological definition. In H. S. Akiskal & W. L. Webb (Eds.), *Psychiatric diagnosis: Exploration of biological predictors* (pp. 365–389). New York: Spectrum.
- Lapouser, R., & Monk, M. (1959). Fears and worries in a representative sample of children. *American Journal of Orthopsychiatry, 29*, 803–18.
- Lautch, H. (1971). Dental Phobia. *The British Journal of Psychiatry, 119*, 151–158.
- LeDoux, J. E. (1996). *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*. New York: Simon & Schuster.
- LeDoux, J. E., Cicchetti, P., Xagoraris, A., & Romanski, L. M. (1990). The lateral amygdaloid nucleus: sensory interface of the amygdala in fear conditioning. *Journal of Neuroscience, 10*, 1062–1069.
- LeDoux, J. E., Iwata, J., Cicchetti, P., & Reis, D. J. (1988). Different projections of the central amygdaloid nucleus mediate autonomic and behavioral correlates of conditioned fear. *Journal of Neuroscience, 8*, 2517–2529.

- Lejuez, C. W., Eifert, G. H., Zvolensky, M. J., & Richards, J. R. (2000). Preference between onset predictable and unpredictable administrations of carbon dioxide-enriched air: Implications for better understanding the etiology and treatment of panic disorder. *Journal of Experimental Psychology: Applied*, 6, 349-358.
- Levey, A. B., & Martin, I. (1987). Evaluative conditioning: A case for hedonic transfer. In H. J. Eysenck & I. Martin (Eds.), *Theoretical foundations of behavior therapy* (pp. 113–131). New York: Plenum.
- Levis, D.J. (1979). A reconsideration of Eysenck's conditioning model of neurosis. *Behavioral and Brain Sciences*, 2, 172-174.
- Lick, J., Candiotte, M., & Unger, T. (1978). Effects of uncertainty about the behaviour of a phobic stimulus on subjects' fear reactions. *Journal of Consulting and Clinical Psychology*, 46, 1559–1560.
- Liddell, A., & Lyons, M. (1978). Thunderstorm phobias. *Behaviour Research and Therapy*, 16, 306-308.
- Lieberman, D. A. (2000). *Learning behavior and cognition* (3<sup>rd</sup> Ed) USA, Wadsworth.
- Lindsey, D., & Read, J. (1994). Psychotherapy and memories of childhood sexual abuse: A cognitive perspective. *Applied Cognitive Psychology*, 8, 281-338.
- Lindsay, S. J. E., & Powell, G. E. (1989). *An introduction to clinical child psychology*. Aldershot: Gower Publishing. ISBN 0-566-05103-6
- Lindsay, S. J. E., & Powell, G. E. (1994). *Handbook of clinical adult psychology* 2<sup>nd</sup> ed. London: Routledge, ISBN 978-0-415-07215-1
- Lipp, O. V., & Derakshan, N. (2005). Attentional bias to pictures of fear-relevant animals in a dot probe task. *Emotion*, 53, 365-369.



- Lipp, O.V., & Waters, A. M. (2007). When danger lurks in the background: Attentional capture by animal fear-relevant distractors is specific and selectively enhanced by animal fear. *Emotion*, 7, 192-200.
- LoBue, V., & DeLoache, J.S. (2008). Detecting the snake in the grass: Attention to fear-relevant stimuli by adults and young children. *Psychological Science*, 19, 284-289.
- Locke, J. (1975) [1690]. *An Essay Concerning Human Understanding*, ed. P. H. Nidditch. Oxford, UK: Clarendon Press.
- Loftus, E. (1993). Desperately seeking memories of the first few years of childhood: The reality of early memories. *Journal of Experimental Psychology: General*, 122, 274-277.
- Lolordo, V. M. (1979). Selective associations. In A. Dickinson & R. A. Boakes (Eds.), *Mechanisms of learning and motivation: A memorial volume to Jerzy Konorski* (pp. 367-398). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Lovibond, P. F. (2004). Cognitive processes in extinction. *Learning & Memory*, 11, 495-500.
- Lovibond, P. F., Hanna, S. K., Siddle, D. A. T., & Bond, N. W. (1994). Electrodermal and subjective reactions to fear-relevant stimuli under threat of shock. *Australian Journal of Psychology*, 46, 73-80.
- Lovibond, P. F., & Shanks, D. (2002). The role of awareness in Pavlovian conditioning: Empirical evidence and theoretical implications. *Journal of Experimental Psychology: Animal Behavior Processes*, 28, 3-26.
- Lovibond, P. F., Siddle, D. A. T., & Bond, N. W. (1993) Resistance to extinction of fear-relevant stimuli: Preparedness or selective sensitization? *Journal of Experimental Psychology: General*, 122, 449-461.
- MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology*, 95, 15-20.

- Maltzman, I., & Boyd, G. (1984). Stimulus significance and bilateral SCRs to potentially phobic pictures. *Journal of Abnormal Psychology*, 93, 41-46.
- Marks, I. M. (1969). *Fears and phobia*. New York: Academic Press.
- Marks, I. M. (1987). *Fears, phobias, and rituals*. New York: Oxford University Press.
- Marks, I. M., & Nesse, R. M. (1994). Fear and fitness: An evolutionary analysis of anxiety disorders. *Ethology and Sociobiology*, 15, 247-261.
- Manassis, K., Hudson, J. L., Webb, A., & Albano, A. M. (2004). Beyond behavioral inhibition: Etiological factors in childhood anxiety. *Cognitive and Behavioral Practice*, 11, 3-12.
- Mackintosh, N. J. (1983). *Conditioning and Associative Learning*, Clarendon Press. ISBN 0198521014
- Martin, I., & Levey, A. B. (1978). Evaluative conditioning. *Advances in Behavior Research & Therapy*, 1, 57-102.
- Matchett, G., & Davey, G. C. L. (1991). A test of a disease-avoidance model of animal phobias. *Behaviour Research & Therapy*, 29, 91-94.
- Mathis, A., Chivers, D. P., & Smith, R. J. F. (1996). Cultural transmission of predator recognition in fishes: intraspecific and interspecific learning. *Animal Behaviour*, 51, 185-201.
- McAllister, W. R., & McAllister, D. E. (1971). *Behavioral measurement of conditioned fear*. In: *Aversive Conditioning and learning* (Brush F.R,ed). 105-179. New York: Academic.
- McClure, E. B., & Pine, D. S. (2006). *Social anxiety and emotion regulation: a model for developmental psychopathology perspectives on anxiety disorders in Developmental*

*Psychopathology* (eds D. Cicchetti and D.J. Cohen), John Wiley & Sons, Hoboken, NJ, pp. 470-502.

McDaniel, M. A., Dornburg, C. C., & Guynn, M. J. (2005). Disentangling encoding versus retrieval explanations of the bizarreness effect: Implications for distinctiveness.

*Memory & Cognition*, 33, 270-279.

McGaugh, J. L. (2000). Memory-a century of consolidation. *Science*, 287, 248–251.

McLaren, I.P.L., & Mackintosh, N.J. (2000). An elemental model of associative learning: I. Latent inhibition and perceptual learning. *Animal Learning and Behavior*, 28, 211-246.

McNally, R. J. (1986). Pavlovian conditioning and preparedness: Effects of initial fear level. *Behaviour Research and Therapy*, 24, 27-33.

McNally, R. J. (1987). Preparedness and phobias: A review. *Psychological Bulletin*, 101, 283-303.

McNally, R. J., & Foa, E. B. (1986). Preparedness and resistance to extinction to fear-relevant CSs: A failure to replicate. *Behaviour Research and Therapy*, 24, 529- 535.

McNally, R. J., & Reiss, S. (1982). The preparedness theory of phobias and human safety-signal conditioning. *Behaviour Research and Therapy*, 20, 153-159.

McNally, R. J., & Steketee, G. S. (1985). The etiology and maintenance of severe animal phobias. *Behaviour Research and Therapy*, 23, 431-435.

Meadowcroft, J. M., & Reeves, B. (1989). Influence of story schema development on children's attention to television. *Communication Research*, 16, 352–374.

Menzies, R. G., & Clarke, J. C. (1993). The etiology of fear of heights and its relationship to severity and individual response patterns. *Behaviour Research and Therapy*, 31, 355-365.

- Menzies, R. G., & Clarke, J. C. (1994).** Retrospective studies of the origins of phobias: a review. *Anxiety, Stress, and Coping*, 7, 305-318.
- Menzies, R. G., & Clarke, J. C. (1995).** Individual response patterns, treatment matching and the effects of behavioural and cognitive interventions for acrophobia. *Anxiety, Stress and Coping*, 8, 141-160.
- Merckelbach, H., Arntz, A., Arrindell, W. A., & de Jong, P. J. (1992).** Pathways to spider phobia. *Behaviour Research and Therapy*, 30, 543-546.
- Merckelbach, H., Arntz, A., & de Jong, P. J. (1991).** Conditioning experiences in spider phobias. *Behaviour Research and Therapy*, 29, 333-335.
- Merckelbach, H., de Jong, P., Arntz, A., & Schouten, E. (1993).** The role of evaluative learning and disgust sensitivity in the etiology and treatment of spider phobia. *Advances in Behaviour Research and Therapy*, 15, 243-255.
- Merckelbach H., de Jong, P. J., Muris, P., & van den Hout, M. A. (1996).** The etiology of specific phobias: a review. *Clinical Psychology Review*, 16, 337-361.
- Merckelbach H., de Ruiter, C., van den Hout, M. A., & Hoekstra, R. (1989).** Conditioning experiences and phobias. *Behaviour Research and Therapy*, 27, 657-662.
- Merckelbach, H., & Muris, P. (1997).** The etiology of childhood spider phobia. *Behaviour Research and Therapy*, 35, 1031-1034.
- Merckelbach, H., Muris, P., & Schouten, E. (1996).** Pathways to fear in spider phobic children. *Behaviour Research and Therapy*, 34, 935-938.
- Merckelbach, H., van den Hout, M. A., Jansen, A., & van der Molen, G. M. (1988).** Many stimuli are frightening, but some are more frightening than others: The contributions of preparedness, dangerousness, and unpredictability to making a stimulus fearful. *Journal of Psychopathology and Behavioral Assessment*, 10, 355-366.

- Merckelbach, H., van der Molen, G. M., & van den Hout, M. A. (1987).** Electrodermal conditioning to stimuli of evolutionary significance: failure to replicate the preparedness effect. *Journal of Psychopathology and Behavioral Assessment*, *9*, 313–326.
- Michelon, P., Snyder, A. Z., Buckner, R. L., McAvoy, M., & Zacks, J. M. (2003).** Neural correlates of incongruous visual information: An event-related fMRI study. *NeuroImage*, *19*, 1612-1626.
- Mineka, S. (1979).** The role of fear in theories of avoidance learning, flooding, and extinction. *Psychological Bulletin*, *86*, 985-1010.
- Mineka, S. (1985).** Animal models of anxiety-based disorders: Their usefulness and limitations. In A. Tuma & J. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 199—244). Hillsdale, NJ: Erlbaum.
- Mineka, S., & Cook, M. (1986).** Immunization against the observational conditioning of snake fear in rhesus monkeys. *Journal of Abnormal Psychology*, *95*, 307-318. doi: 10.1037/0021-843X.95.4.307
- Mineka, S., & Cook, M. (1993).** Mechanisms involved in the observational conditioning of fear. *Journal of Experimental Psychology*, *122*, 23–38.
- Mineka, S., Davidson, M., Cook, M., & Keir, R. (1984).** Observational conditioning of snake fear in rhesus monkeys. *Journal of Abnormal Psychology*, *93*, 355-372.
- Mineka, S., & Öhman, A. (2002).** Born to fear: non associative vs. associative factors in the etiology of phobias. *Behaviour Research and Therapy*, *40*, 173-184.
- Mineka, S., & Zinbarg, R. (2006).** A contemporary learning theory perspective on the etiology of anxiety disorders: it's not what you thought it was. *American Psychologist*, *61*, 10-26. doi:10.1037/0003-066X.61.1.10

- Mineka, S., & Öhman, A. (2002).** Born to fear: non associative vs. associative factors in the etiology of phobias. *Behaviour Research and Therapy*, 40, 173-184.
- Mogg, K., & Bradley, B. P. (2002).** Selective orienting to masked threat faces in social anxiety. *Behaviour Research and Therapy*, 40, 1403-1414.
- Moore, P., Whaley, S., & Sigman, M. (2004).** Interactions between mothers and children: Impacts of maternal and child anxiety. *Journal of Abnormal Psychology*, 113, 471-476.
- Mowrer, O. H. (1947).** On the dual nature of learning—a reinterpretation of conditioning and problem solving. *Harvard Educational Review*, 17, 102-148.
- Mowrer, O. H. (1956).** Two-factor learning theory reconsidered, with special reference to secondary reinforcement and the concept of habit. *Psychological Review*, 63, 114-128.
- Mowrer, O. H. (1960).** *Learning theory and behavior*. New York: Wiley.
- Muris, P., Bodden, D., Merckelbach, H., Ollendick, T. H., & King, N. (2003).** Fear of the beast: a prospective study on the effects of negative information on childhood fear. *Behavior Research & Therapy*, 41, 195-208.
- Muris, P., Merckelbach, H., & Collaris, R. (1997).** Common childhood fears and their origins. *Behaviour Research and Therapy*, 35, 929-937.
- Muris, P., Steerneman, P., Merckelbach, H., & Meesters, C. (1996).** The role of parental fearfulness and modeling in children's fear. *Behaviour Research and Therapy*, 34, 265-268.
- Muris, P., Van der Heiden, S., & Rassin, E. (2007).** Disgust sensitivity and psychopathological symptoms in nonclinical children. *Journal of Behaviour Therapy & Experimental Psychiatry*, 39, 133-146. ISSN: 0005-7916. doi: 10.1016/j.jbtep.2007.02.001

- Muris, P., Van Zwol, L., Huijding, J., & Mayer, B. (2010).** Mom told me scary things about this animal! Parents installing fear beliefs in their children via the verbal information pathway. *Behaviour Research and Therapy*, 48, 341–346.
- Muris, P. M., & Field, A. P. (2008).** Distorted cognition and pathological anxiety in children and adolescents. *Cognition and Emotion*, 22, 395-421.
- Muris, P., & Merckelbach, H. (2001).** The etiology of childhood specific phobia: A multifactorial model. In M.W. Vasey & M.R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp.355-385). New York: Oxford Press.
- Muris, P., Huijding, J., Mayer, B., van As, W., & van Alem, S. (2011).** Reduction of verbally learnt fear in children: a comparison between positive information, imagery, and a control condition. *Journal of Behaviour Therapy & Experimental Psychiatry*, 42, 139-44. doi: 10.1016/j.jbtep.2010.11.006
- Muris, P., Merckelbach, H., de Jong, P. J., & Ollendick, T. H. (2002).** The etiology of specific fears and phobias in children: a critique of the non-associative account. *Behaviour Research and Therapy* 40, 185–195.
- Murray, E. J., & Foote, F. (1979).** The origins of fear of snakes. *Behaviour Research and Therapy*, 17, 489–493.
- Myers, K.M., & Davis, M. (2007).** Mechanisms of Fear Extinction. *Molecular Psychiatry* 12, 120–50. doi:10.1038/sj.mp.4001939
- Myers, K. M., Ressler, K. J., & Davis, M. (2006).** Different mechanisms of fear extinction dependent on length of time since fear acquisition. *Learning & Memory* 13, 216–223.
- New, J., Cosmides, L., & Tooby, J. (2007).** Category-specific attention for animals reflects ancestral priorities, not expertise. *Proceedings of the National Academy of Sciences*, 104, 16593-16603.

- National Institute of Mental Health (1982).** *Television and behavior: Ten years of scientific progress and implications for the eighties: (Vol. 1), Summary report* (DHHS Publication No. ADM 82-1195). Washington, D.C.: U. S. Government Printing Office.
- Nicholaichuk, T. P., Quesnel, L. J., & Tait, R. W. (1982).** Eysenck's theory of incubation: An empirical test. *Behaviour Research and Therapy*, 20, 329–338.
- Nesse, R. M. (1990).** Evolutionary explanations of emotions. *Human Nature*, 1, 261–289.
- Noyes, R. J., Crowe, R. R., Harris, E. L., Hamra, B.J., McChesney, C. M., & Chaudhry D. R. (1986).** Relationship between panic disorder and agoraphobia. A family study. *Archives of General Psychiatry*, 43, 227-232.
- Öhman, A. (1979).** The orienting response, attention and learning: an information-processing perspective. In H.D. Kimmel, E.H. Van Olst and J.F. Orlebeke (Eds.): *The orienting reflex in human* (pp. 55-80). Hills-dale, N.J.: Erlbaum.
- Öhman, A. (1986).** Face the beast and fear the face: Animal and social fears as prototypes for evolutionary analyses of emotion. *Psychophysiology*, 23, 123-145.
- Öhman, A. (1993).** Fear and anxiety as emotional phenomena: Clinical phenomenology, evolutionary perspectives, and information processing mechanisms. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp.511-536). New York: Guildford Press.
- Öhman, A. (2000).** Fear and anxiety: Clinical, evolutionary, and cognitive perspectives. In M. Lewis & J. M. Haviland (Eds.) *Handbook of Emotions*. 2<sup>nd</sup> ed. New York: Guilford, pp 573-593.
- Öhman, A. (2007).** Has evolution primed humans to “beware the beast”? *Proceedings of the National Academy of Sciences of the U.S.A*, 104, 16396-16397.



- Öhman, A.** (2008). Fear and anxiety: Overlaps and dissociations. In M. Lewis & J. M. Haviland-Jones (Eds.) *Handbooks of emotions* (3rd ed.). New York: Guilford, pp 709-729.
- Öhman, A., & Dimberg, U.** (1978). Facial expressions as conditioned stimuli for electrodermal responses: A case of "preparedness"? *Journal of Personality and Social Psychology*, 36, 1251-1258.
- Öhman, A., Dimberg, U., & Ost, L. G.** (1985). Animal and social phobias: Biological constraints on learned fear responses. In S. Reiss & R. R. Bootzin (Eds.), *Theoretical issues in behavior therapy* (pp. 123-178). New York: Academic Press.
- Öhman, A., Eriksson, A., & Olofsson, C.** (1975). One-Trial Learning and Superior Resistance to Extinction of Autonomic Responses Conditioned to Potentially Phobic Stimuli, *Journal of Comparative and Physiological Psychology*, 88, 619-627. doi: 10.1037/h0078388
- Öhman, A., Flykt, A., & Esteves, F.** (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General*, 130, 466-478.
- Öhman, A., Fredrickson, M., Hugdahl, K., & Rimmo, P.A.** (1976). The premise of equipotentiality in human classical conditioning: Conditioned electrodermal responses to potentially phobic stimuli. *Journal of Experimental Psychology: General*, 105, 313-337.
- Öhman, A., & Mineka, S.** (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Journal of Personality and Social Psychology*, 80, 381-396
- Öhman, A., & Mineka, S.** (2003). The malicious serpent: Snakes as a prototypical stimulus for an evolved module of fear. *Current Directions in Psychological Science*, 12, 2-

9.Reprinted in T. F. Oltmanns & R. E. Emery (Eds.) *Current directions in abnormal psychology* (pp. 62-68). Upper Saddle River, NJ: Pearson/Prentice Hall.

**Öhman, A., & Soares, J. J. F. (1993).** On the automaticity of phobic fear: Conditioned electrodermal responses to masked fear-relevant stimuli. *Journal of Abnormal Psychology, 102*, 121-132.

**Öhman, A., & Wiens, S. (2003).** On the automaticity of autonomic responses in emotion: An evolutionary perspective. In R. J. Davidson, K. Scherer & H. H. Hill (Eds.) *Handbook of affective sciences*. New York: Oxford University Press, pp. 256-275.

**Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Tolin, D. F. (2007).** Multimodal assessment of disgust in contamination-related obsessive compulsive disorder. *Behaviour Research and Therapy, 45*, 263–276.

**Ollendick, T.H. (1979).** Fear reduction techniques with children in M.Hersen, E.R. Eisler and P.M. Miller (eds) *Progress in Behaviour Modification*, New York: Academic Press pp 127-68.

**Ollendick, T. H., Hagopian, L. P., & King, N. J. (1997).** Specific phobias in children. In G. C. L. Davey (Ed.), *Phobias: A handbook of theory, research and treatment* (pp. 201-224). Chichester, UK: Wiley.

**Ollendick T. H., & King, N. J. (1991).** Origins of childhood fears: An evaluation of Rachman's theory of fear acquisition. *Behaviour Research and Therapy, 29*, 117-123.  
doi: 10.1016/0005-7967(91)90039-6

**Ollendick, T. H., King, N. J., & Muris, P. (2002).** Fears and phobias in children: Phenomonology, epidemiology, and etiology. *Child and Adolescent Mental Health, 7*, 98–106.

- Ollendick, T. H., & March, J. S. (2004). *Phobic and anxiety disorders in children and adolescents: A clinician's guide to effective psychosocial and pharmacological interventions*. New York: Oxford.
- Olsson, A., Nearing, K.I., & Phelps, E.A. (2007). Learning fears by observing others: the neural systems of social fear transmission. *Social Cognitive and Affective Neuroscience Advance Access*, 2, 3-11.
- Olsson, A., & Phelps, E. A. (2004). Learned Fear of 'Unseen' Faces after Pavlovian,. Observational, and Instructed Fear. *Psychological Science*, 12, 822-828.
- Öst, L. G. (1985). Single-session exposure treatment of injection phobia: A case study with continuous heart rate measurement. *Scandinavian Journal of Behavior Therapy*, 16, 125-131.
- Öst, L. G. (1987). Age of onset in different phobias. *Journal of Abnormal Psychology*, 96, 223–229.
- Öst, L. G. (1991). Acquisition of blood and injection phobia and anxiety response patterns in clinical patients. *Behaviour Research and Therapy*, 29, 323 332.
- Öst, L. G., & Hugdahl, K. (1981). Acquisition of phobias and anxiety response patterns in clinical patients. *Behaviour Research and Therapy*, 19, 439-447. doi: 10.1016/0005-7967(81)90134-0
- Öst, L. G., & Treffers, P. (2001). *Onset, course and outcome for anxiety disorders in children*. In *Anxiety Disorders in Children and Adolescents* (ed. P. Treffers). Cambridge:Cambridge University Press.
- Pappens, M., Smets, E., Vansteenwegen, D., Van Den Bergh, O., & Van Diest, I. (2012). Learning to fear suffocation: A new paradigm for interoceptive fear conditioning. *Psychophysiology*, 49, 821–828.

- Pavlov, I. P. (1927).** *Conditioned Reflexes* (G. V. Anrep,trans.). London: Oxford University Press.
- Phares, V., & Compas, B. E. (1992).** The role of fathers in child and adolescent psychopathology: Make room for daddy. *Psychological Bulletin*, *111*, 387-412.
- Phares, V., Lopez, E., Fields, S., Kamboukos, D., & Duhig, A. M. (2005).** Are fathers involved in pediatric psychology research and treatment? *A Journal of Pediatric Psychology*, *30*, 631-643.
- Phares, V., Fields, S., Kamboukos, D., & Lopez, E. (2005).** Still looking for poppa. *American Psychologist*, *60*, 735-736.
- Phillips, K., Fulker, D. W., Rose, R. J., & Eaves, L. J. (1987).** Path analysis of seven fear factors in adult twin and sibling pairs and their parents. *Genetic Epidemiology*, *4*, 345-355. doi: 10.1002/gepi.1370040504
- Pleck, J. H. (1997).** Paternal involvement: Levels, origins, and consequences. In M. E Lamb (Ed.), *The role of the father in child development*, 3rd ed. (pp. 66-103). New York: Wiley.
- Poulton, R., Davies, S., Menzies, R. G., Langley, J., & Silva, P. A. (1998).** Evidence for a non-associative model of the acquisition of a fear of heights. *Behaviour Research and Therapy*, *36*, 537-544.
- Poulton, R., & Menzies, R. G. (2002).** Fears born and bred: Toward a more inclusive theory of fear acquisition. *Behaviour Research and Therapy*, *40*, 197-208.
- Poulton, R., Menzies, R. G., Craske, M. G., Langley, J. D., & Silva, P. A. (1999).** Water trauma and swimming experiences up to age 9 and fear of water at age 18: a longitudinal study. *Behaviour Research and Therapy*, *37*, 39-48.
- Poulton, R., Milne, B. J., Craske, M. G., & Menzies, R. G. (2001).** A longitudinal study of the etiology of separation anxiety. *Behaviour Research and Therapy*, *39*, 1395-1410.

- Poulton, R., Thomson, W. M., Davies, S., Kruger, E., Brown, R. H., & Silva, P. (1997).** Good teeth, bad teeth and fear of the dentist. *Behaviour Research and Therapy*, 35, 327–334.
- Rachman, S. (1977).** The conditioning theory of fear-acquisition: A Critical examination. *Behaviour Research and Therapy*, 15, 375–387. doi:10.1016/0005-7967(77)90041-9
- Rachman, S. (1990).** The determinants and treatment of simple phobia. *Advances in Behaviour Research and Therapy*, 12, 1-30.
- Rachman, S. (1990).** *Fear and Courage*. New York. Freeman.
- Rachman, S. (1997).** The evolution of cognitive behaviour therapy. In D. Clark & C. Fairburn (Eds.) *The science and practice of cognitive behaviour therapy*. Oxford: Oxford University. Press
- Rachman, S. (1998).** A cognitive theory of obsessions: Elaborations. *Behaviour Research and Therapy*, 36, 385–401.
- Rapee, R. M. (2001).** *Generalised Anxiety Disorder*. In M. W. Vasey & M. R. Dadds (Eds.), New York: Oxford University Press.
- Rapee, R. M., Schniering, C. A., & Hudson, J. L. (2009).** Anxiety disorders during childhood and adolescence: origins and treatment. *Annual Review of Clinical Psychology*, 5, 311-341.
- Rescorla, R.A. (1966).** Predictability and number of pairings in Pavlovian fear conditioning. *Psychological Science*, 4, 383-384.
- Rescorla, R. A. (1974).** Effect of inflation of the unconditioned stimulus value following conditioning. *Journal of Comparative and Physiological Psychology*, 86, 101-106.
- Rescorla, R. A. (1980).** Simultaneous and successive associations in sensory preconditioning. *Journal of Experimental Psychology: Animal Behavioral Processes*, 6, 339–351.

- Rescorla, R. A. (1988).** Pavlovian conditioning: It's not what you think it is. *American Psychologist*, 43, 151-160.
- Rescorla, R. A. (2004).** Spontaneous Recovery. *Learning and Memory*, 11, 501-509.
- Rescorla, R. A., & Wagner, A. R. (1972).** A theory of Pavlovian conditioning: Variations in the effectiveness of reinforcement and nonreinforcement. In A.H. Black & W.F. Prokasy (Eds.), *Classical conditioning II: Current theory and research* (pp. 64-99). New York: Appleton-Century-Crofts.
- Ratcliff, R. (1993).** Methods for dealing with reaction time outliers. *Psychological Bulletin*, 114, 510-532.
- Rimm, D.C., Janda, L.H., Lancaster, D.W., Nahl, M., & Dittmar, K. (1977).** An exploratory investigation of the origin and maintenance of phobias. *Behaviour Research Therapy*, 15, 231-238.
- Rinck, M., Reinecke, A., Ellwart, T., Heuer, K., & Becker, E.S. (2005).** Speeded detection and increased distraction in fear of spiders: evidence from eye movements. *Journal of Abnormal Psychology*, 114, 235-48.
- Roberts, J. T. (1993).** Psychosocial effects of workplace hazardous exposures: Theoretical synthesis and preliminary findings. *Social Problems*, 40, 74-89.
- Rose, R. J., & Ditto, W. B. (1983).** A developmental-genetic analysis of common fears from early adolescence to early adulthood. *Child Development*, 54, 361-368.
- Rosen, J. B., & Schulkin, J. (1998).** From normal fear to pathological anxiety. *Psychological Review*, 105, 325-350.
- Rosenthal, S. (1994).** Students as Teachers: At-risk high school students teach science to fourth-graders. *Thrust for Educational Leadership*, 23, 36-8.

- Roosendaal, B.** (2002). Stress and memory: opposing effects of glucocorticoids on memory consolidation and memory retrieval. *Neurobiology of Learning and Memory*, 78, 578–595.
- Ryle Design.** (1997). ExacTicks (version 1.10) [Computer Software]. Mt. Pleasant, Michigan: Ryle Design.
- Saigh, P. A.** (1984). An experimental analysis of delayed post-traumatic stress. *Behaviour. Research and Therapy*, 22, 679-682.
- Seligman, M. E. P.** (1970). On the generality of the laws of learning. *Psychological Review*, 77, 406-418.
- Seligman, M. E. P.** (1971). Phobias and preparedness. *Behavior Therapy*, 2, 307-320.
- Seligman, M. E. P.** (1972). Learned helplessness. *Annual Review of Medicine*, 23, 407-412.
- Seligman, M. E. P., & Hager, J. L.** (1972). Biological boundaries of learning. The saucy-bearnaise syndrome. *Psychology Today*, 6, 59-61, 84-87.
- Schafe, G. E., Nader, K., Blair, H. T., & LeDoux, J. E.** (2001). Memory consolidation of Pavlovian fear conditioning: a cellular and molecular perspective. *Trends in Neurosciences*, 24, 540–546.
- Schmidt, S. R.** (2012). *Extraordinary Memories for Exceptional Events*. Psychology Press.
- Schmidt, N. B., Richey, J. A., Buckner, J. D., & Timpano, K. R.** (2009). Attention training for generalized social anxiety disorder. *Journal of Abnormal Psychology*, 118, 5–14.  
doi:10.1037/a0013643
- Shanks, D. R., & Dickinson, A.** (1990). Contingency awareness in evaluative conditioning: A comment on Baeyens, Eelen and van den Bergh. *Cognition and Emotion*, 4, 19–30.
- Silva, P. A., & Stanton, W. R.** eds. (1996). *From child to adult: The Dunedin Multidisciplinary Health & Development Study*, Auckland, Oxford University Press.

- Silverman, W. K., & Field, A. P. (2011). *Anxiety Disorders in Children and Adolescents* (second edition). Cambridge: Cambridge University Press.
- Singer, M. I., Slovak, K., Frierson, T., & York, P. (1998). Viewing preferences, symptoms of psychological trauma, and violent behaviors among children who watch television. *Journal of the American Academy of Child and Adolescent Psychiatry*, 37, 1041-1048.
- Soares, S., Esteves, F., & Flykt, A. (2009). Fear, but not fear-relevance, modulates reaction times in visual search. *Journal of Anxiety Disorders*, 23, 136-144.
- Sorce, J. F., Emde, R. N., Campos, J., & Klinnert, M. D. (1985). Maternal emotional signaling: its effects on the visual cliff behavior of 1-year-olds. *Developmental Psychology*, 21, 195–200.
- Spence, D. P. (1982). *Narrative truth and historical truth: Meaning and interpretation in psychoanalysis*. New York: Norton.
- Stevenson, J., Batten, N., & Cherner, M. (1992). Fears and fearfulness in children and adolescents: A genetic analysis of twin data. *Journal of Child Psychology and Psychiatry*, 33, 977–985.
- Svejda, M., & Campos, J. (1982). *The development of the regulation of infant behavior by the mother's voice*. Paper read at meetings of the International Conference on Infant Studies, Austin, Texas.
- Taylor, C.B., & Arnow, B. (1988). *The nature and treatment of anxiety disorders*. New York: Free Press.
- Taylor, J. E., Deane, F. P., & Podd, J. V. (1999). Stability of driving fear acquisition pathways over one year. *Behaviour Research and Therapy*, 37, 927-939.
- Thorpe, S. J., Salkovskis, P. M. (1995). Phobic beliefs: do cognitive factors play a role in specific phobias? *Behaviour Research and Therapy*, 33, 805-816.



- Thurston, J. A. (1994). Art partners: A new focus on peer teaching. *School Arts*, 94, 41-42.
- Tipples, J., Young, A. W., Quinlan, P., Broks, P., & Ellis, A. W. (2002). Searching for threat. *The Quarterly Journal of Experimental Psychology*, 55A, 1007–1026.
- Tolin, D. F., Lohr, J. M., Sawchuk, C. N., & Lee, T. C. (1997). Disgust and disgust sensitivity in blood-injection-injury and spider phobia. *Behaviour Research and Therapy*, 35, 949–953.
- Tucker, M., & Bond, N. W. (1997). The role of gender, sex role, and disgust in fear of animals. *Personality and Individual Differences*, 22, 135–138.
- Van Damme, S., Crombez, G., Hermans, D., Koster, E. H. W., & Eccleston, C. (2006). The role of extinction and reinstatement in attentional bias to threat: A conditioning approach. *Behaviour Research and Therapy*, 44, 1555-1563.
- van Overfeld, W. J. M., de Jong, P. J., Peters, M. L., Cavanagh, K., & Davey, G. C. L. (2006). Disgust propensity and disgust sensitivity: separate constructs that are differentially related to specific fears. *Personality and Individual Differences*, 41, 1241-1252.
- Van Reekum, C. M., van den Berg, H., & Frijda, N. H. (1999). Cross- modal preference acquisition: Evaluative conditioning of pictures by affective olfactory and auditory cues. *Cognition & Emotion*, 13, 831–836.
- Vasey, M. W., & MacLeod, C. (2001). Information-processing factors in childhood anxiety: A review and developmental perspective. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 253–277). New York: Oxford University Press.
- Vaughan, K. B., & Lanzetta, J. T. (1980). Vicarious instigation and conditioning of facial expressive and autonomic responses to a model's expressive display of pain. *Journal of Personality and Social Psychology*, 38, 909-923.

- Ware, J., Jain, K., Burgess, I., & Davey, G. C. L. (1994). Disease-avoidance model: Factor analysis of common animal fears. *Behaviour Research and Therapy*, 32, 57–63.
- Waters, A. M., & Lipp, O. V. (2008). The influence of animal fear on attentional capture by fear-relevant animal stimuli in children. *Behaviour Research and Therapy*, 46, 114-121. doi:10.1016/j.brat.2007.11.002
- Watson, J. B. (1913). Psychology as the Behaviorist Views it. *Psychological Review*, 20, 158-177.
- Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology*, 3, 1–14.
- Weiss, A., & Wilson, B. (1996). Children's Cognitive and Emotional Responses to the Portrayal of Negative Emotions in Family-Formatted Situation Comedies. *Human Communication Research*. 24, 584-609.
- Westbrook, R. F., Iordanova, M., McNally, G., Richardson, R., & Harris, J. A. (2002). Reinstatement of fear to an extinguished conditioned stimulus: Two roles for context. *Journal of Experimental Psychology: Animal Behavior Processes*, 28, 97–110.
- Whithers, R. D., & Deane, F. P. (1995). Origins of common fears: effects on severity, anxiety responses and memories of onset. *Behaviour Research and Therapy*, 33, 903-915.
- Wichmann, F. A., Sharpe, L. T., & Gegenfurtner, K. R. (2002). The contributions of color to recognition memory for natural scenes. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 28, 509-520.
- Williams, J. M. G., MacLeod, C., Watts, F., & Mathews, A. (1997). *Cognitive psychology and emotional disorders (2nd ed.)*. Chichester: Wiley.
- Wilson, G. D. (1966). Arousal properties of red versus green. *Perceptual and Motor Skills*, 23, 947-949.

- Wilson, R. (2008). *Nature and young children: Encouraging creative play and learning in natural environments*. New York: Routledge.
- Wilson, B. J., & Cantor, J. (1985). Developmental differences in empathy with a television protagonist's fear. *Journal of Experimental Child Psychology*, 39, 284-299.
- Wilson, G. T., & Davidson, G. C. (1971). Processes of fear reduction in systematic desensitisation: Animal studies. *Psychological Bulletin*, 76, 1-14.
- Wolpe, J. (1958). *Psychotherapy by reciprocal inhibition*. Stanford, CA: Stanford University Press.
- Wolpe, J. (1961). The systematic desensitization treatment of neuroses. *Journal of Nervous and Mental Diseases*, 132, 180-203.
- Wolpe, J., Lande, S. D., McNally, R. J., & Schotte, D. (1985). Differentiation between classically conditioned and cognitively based neurotic fears: Two pilot studies. *Journal of Behavior Therapy and Experimental Psychiatry*, 16, 287-293.
- Woods, A. M., & Bouton, M. E. (2008). Immediate extinction causes a less durable loss of performance than delayed extinction following either fear or appetitive conditioning. *Learning & Memory*, 15, 909-920.
- Woody, S. R., McLean, C., & Klassen, T. (2005). Disgust as a motivator of avoidance of spiders. *Journal of Anxiety Disorders*, 19, 461-475.
- Woody, S. R., & Tolin, D. F. (2002). The relationship between disgust sensitivity and avoidant behavior: Studies of clinical and nonclinical samples. *Journal of Anxiety Disorders*, 16, 543-559.
- Wright, J. C., & Huston, A. C. (1995). *Educational effects of children's television*. Presentation at a symposium on Educational Children's Television chaired by Hillary Rodham Clinton, The White House.

- Yarrow, F., & Topping, K. J. (2001). Collaborative writing: the effects of metacognitive prompting and structured peer interaction. *British Journal of Educational Psychology*, 71, 261–282.
- Yates, W. R. (2009). Phenomenology and epidemiology of panic disorder. *Annals of Clinical Psychiatry*, 21, 95–102.
- Yeater, D., & Kuczaj, S. A. (2010). Observational learning in wild and captive dolphins. *International Journal of Comparative Psychology*, 23, 379-385.
- Zarbatany, L., & Lamb, M. E. (1985). Social referencing as a function of information source: Mothers versus strangers. *Infant Behavior and Development*, 8, 25–33. doi: 10.1016/S0163-6383(85)80014-X
- Zvolensky, M. J., Eifert, G. H., Lejuez, C. W., Hopko, D. R., & Forsyth, J. P. (2000). Assessing the predictability of anxiety related events: A report on the Perceived Predictability Index. *Behavior Therapy and Experimental Psychiatry*, 31, 201-218.

## 9 Appendices

### Appendix A Animal stimuli

Quoll:



Quokka:

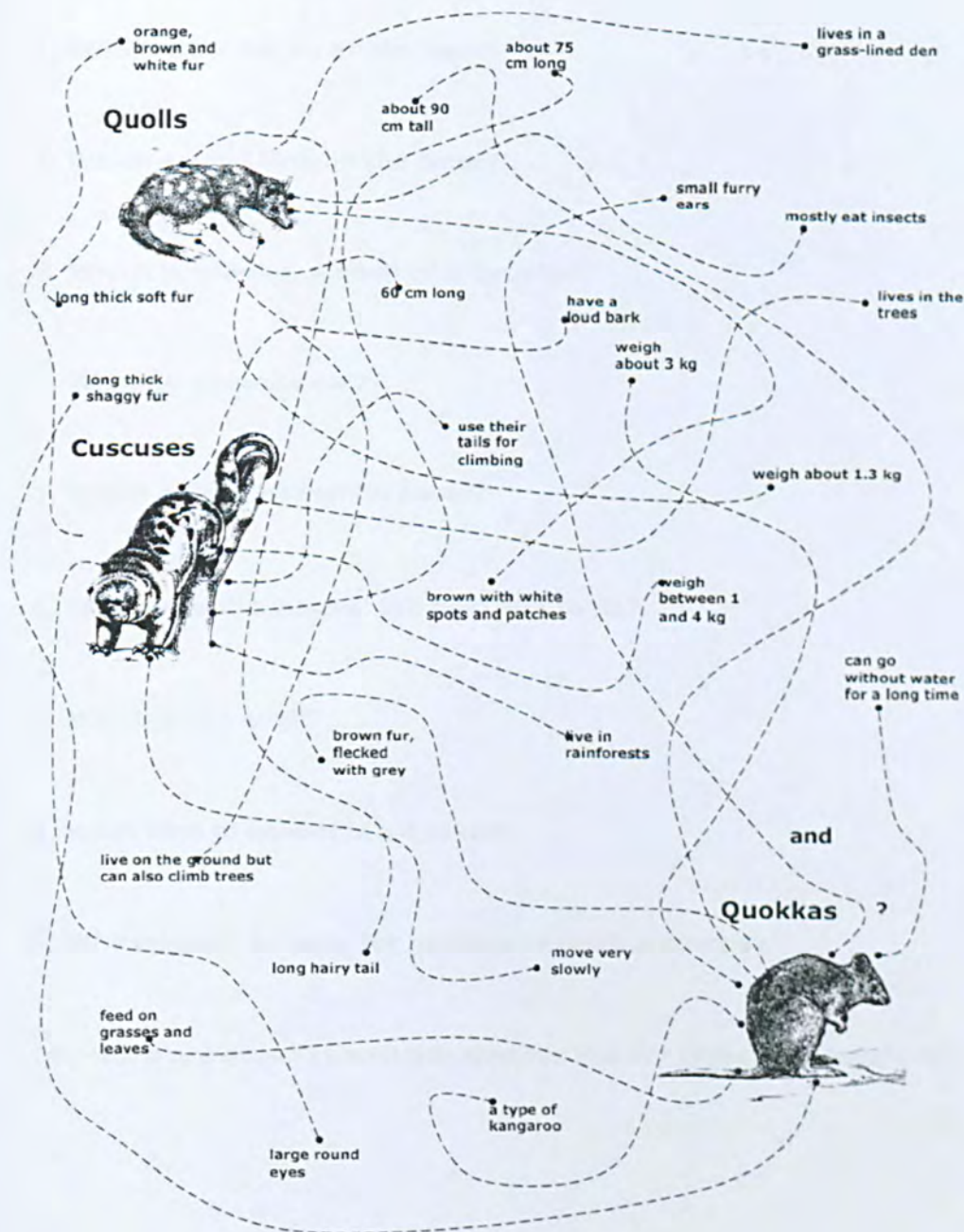


Cuscus:



## Appendix B: Animal activity sheets

**Can you untangle the truth about...**



## **The Truth About Quolls, Cuscuses and Quokkas**

Use the information you've untangled to answer these questions.

- 1. What colour fur do quolls have?**
- 2. Which animal lives in the trees?**
- 3. Which is heavier, a quoll or a quokka?**
- 4. What do quokkas eat?**
- 5. Which animal has white spots?**
- 6. What does the cuscus' tail help him to do?**
- 7. How big is a quoll?**
- 8. What kind of animal is a quokka?**
- 9. Why might it be easy for hunters to catch a cuscus?**
- 10. How are quokkas well adapted for the hot climate of Australia?**

## **The Truth About Quolls, Cuscuses and Quokkas**

### **Quolls (genus *Dasyurus*)**



Quolls are found in many habitats including grasslands, rainforests, eucalyptus forests bounded by agricultural fields, alpine areas, and scrubland. Although they can live in a wide variety of habitats, some species, such as the Eastern Quoll, have become endangered because of competition from wild cats, dogs and foxes.

The quoll is nocturnal (most active at night). During the day it retreats to a grass-lined den in a burrow, a rock-pile, or a hollow log.

The quoll is about 60 cm long including a long tail, and weighs roughly 1½ kg. The female is slightly smaller than the male. It has thick, soft grey-brown to black fur with white spots. The long tail is hairy and has no spots.

Quolls are carnivores (meat-eaters) who mostly eat insects (especially grubs and beetles), but also occasionally prey upon rabbits, mice and rats. They sometimes scavenge carrion (dead animals that they find) and eat fruit. They compete with the Tasmanian Devil for food.

Up to 18 young are born in a litter, but only 6 babies survive after 2 days. The young spend their early months in the mother's pouch, each drinking milk from one of her 6 teats.

### **Cuscuses (genus *Phalanger*)**



The spotted cuscus lives in lowland tropical rainforests and neighbouring mangroves, which are found only in the very north of Australia.

Cuscuses are nocturnal, and in the daytime they sleep curled up in hollow trees and clumps of vegetation. When they are active, they move around slowly, making them an easy target for people who hunt cuscuses for their thick soft fur.

Cuscuses can vary in size from as small as a mouse to as big as a large domestic cat, and weigh between 1 and 4 kg. The spotted cuscus is usually about 75 cm long, with its body being 35 - 45cm and its tail between 30 - 40 cm. It is sometimes described as having a monkey-like appearance. This is especially true of the face, which is round



with large eyes, a sensitive nose and tiny ears. It has dense fur, which is shades of orange, brown and white. Their tails are curled towards the end, and have no fur from about halfway down. The cuscus' tail is prehensile (meaning that it can hold onto things) so it can wrap it around branches and tree limbs for more security when it's climbing.

Cuscuses mainly eat fruit, leaves, nectar and insects, but they do sometimes eat small animals, like birds. The spotted cuscus has few enemies, but if it is frightened it can attack with its front paws and will use its loud bark to scare intruders away.

Typically, the female has only one baby, which is raised in her pouch until it is ready to leave, when it is carried on the mother's back.

### **Quokkas** (*Setonix brachyurus*)



The quokka is a cat-sized wallaby that lives in southwestern Western Australia. The species is common on Rottnest Island off Perth, and is used to being hand-fed by tourists who visit the island.

Quokkas live in warm climates in long grass or shrub land where they make paths and runways for feeding and to allow escape if necessary. Quokkas are nocturnal as well, sleeping in the daytime in the shelter of dense vegetation, often in small groups.

Quokkas look like small wallabies or kangaroos, with a broad, short head and small, rounded ears. They are about 90 cm long and weigh about 3 kg. The quokka has fairly coarse hair, which is generally brown but gets lighter on the quokka's belly. The tail is relatively short and fairly smooth, with only a little hair on it.

The diet of the quokka consists entirely of plant matter, including grasses, leaves, seeds and roots. Quokkas swallow their food and regurgitate it later as a cud, which they then chew. They need very little water and can go for months without drinking, though when fresh water is available up to 150 quokkas can gather round a waterhole.

Each year, the female quokka usually raises one offspring. Young quokkas are called joeys, and they stay in their mother's pouch for approximately 185 days, but may return later if they are cold or frightened.

Appendix C: Scared Face Stimuli

Scared Faces (Actual size in study = 300 x 400 pixels)





Appendix D: Happy Face Stimuli

Happy Faces (Actual size in study = 300 x 400 pixels)



## **Appendix E: Fear Beliefs Questionnaire (FBQ)**

- (XXXXXXX - Replace in each case with name of animal, flower, or object )
- Would you be happy to have a XXXXXXXX at home? \*
- Would you be happy if you found a XXXXXXXX in your garden? \*
- Would you keep your distance if you saw a XXXXXXXX ?
- Would you go up to a XXXXXXXX if you saw one? \*
- Do you think a XXXXXXXX would hurt you?
- Would you be scared if you saw a XXXXXXXX ?
- Would you be happy to hold a XXXXXXXX ? \*

(\* = reverse-scored)

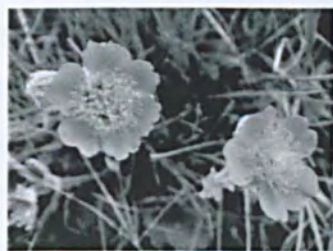
- Would you be happy to have a Cuscus for a pet?
- Would you be happy if you found a Cuscus in your garden?
- If you knew there was a Cuscus in your garden would you stay inside the house?
- Would you go up to a Cuscus if you saw one?
- Do you think a Cuscus would hurt you?
- Would your heart beat faster if you met a Cuscus?
- Would you feel scared if you saw a Cuscus?
- Would you be happy to feed a Cuscus?

## Appendix F: Flower stimuli

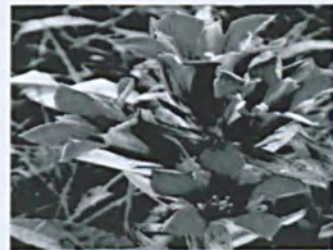
Dotted Loosestrife:



Red Avens:



Willow Gentian:



## **Appendix G: Consent Letter**

Information and consent form

Dear Parent,

We are inviting your child to participate in a psychology project that we are conducting regarding changes in children's fear beliefs. If you agree to participate, your child will do a brief computer-based task in which they will be shown pictures of either Australian marsupials (quoll, quokka, and cuscus), or flowers and asked to complete a Fear Beliefs Questionnaire containing questions regarding the child's feelings about each of these things in a hypothetical scenario (e.g. 'Would you be scared if you saw a quoll?' or 'Would you be happy if you found a cuscus in your garden'). They will then be shown pictures of one of the animals or flowers together with pictures of people looking scared or happy and given the questionnaire a second time. Finally, children will be asked to place a Playmobil model representing themselves on a rectangular board. A picture of one of the animals or flowers will have been placed at one end of the board. The board represents a nature reserve in which the animals or flowers are found and children are asked to place the model of themselves where they would like to be if they visited the reserve.

The session should last no more than 20-30 minutes. There is no right or wrong way to do any of the activities. The preferences of individual children will not be evaluated as we are only interested in how children's fear-related beliefs for animals, flowers and objects can change overall. As a participant, your child will be under no stress, risk or discomfort from taking part in this research. We assure you that your child's answers will remain strictly confidential and all data collected will be used solely for the purpose of this research and will not be passed onto any third parties or external sources. Only your child's first name, age, gender and responses will be retained. No other information will be recorded or published or in any way be associated with your child's answers. Participation is entirely voluntary, you and your child have the right to withdraw from this study, without consequence, at any time for any reason until the data has been published.

You may ask any questions you have about the task at any time during the study. You may also contact me directly for any questions relating to this study or if you wish to remove your child's data from the study via email [k0428107@kingston.ac.uk](mailto:k0428107@kingston.ac.uk). If you are concerned at all



with any part of the experiment and wish to discuss it further with my supervisor you may contact Dr. Chris Askew, School of Social Sciences, Kingston University, Kingston-Upon-Thames at c.askew@kingston.ac.uk Tel: 020 8547 2000

If you agree to your child participating in this study please sign this form below and keep this page for your records. Please explain to your child that if at any point they do not wish to continue with the experiment they should tell the researcher and they can stop.

Thank you very much for your help with this study.

Guler Dunne  
Student, Kingston University

If you have:

- ☐ Read and understood the information above. Asked questions if you wanted to, and got satisfactory answers
- ☐ Explained to your child that they are free to withdraw from the study at any time

Please sign below to indicate that you agree for your child to take part in the study:

I consent to my child's participation in this study

Signed

Date

.....

.....

**Name of Parent:**

**Child's name:**

**Child's date of birth:**

**Child's gender:**