A COGNITIVE THEORY OF
THE ETIOLOGY OF FEAR

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This thesis is submitted in fulfilment of the requirements for
the degree of Doctor of Philosophy

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September 2008

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Prologue

“I attempt an arduous task; but there is no worth in that which is not a difficult achievement.” Ovid (BC 43-AD 18)

Behavioural or ‘pseudo’ sciences, like the ‘hard’ sciences, often present theories as fundamentally axiomatic. While there may be room for debate at the margins of the theory, the core concepts and precepts go largely unchallenged. Psychology, as a scientific field, frequently operates in this way. Despite the explosion of psychological research in the later half of the 20th century and into the 21st century, research is often little more than tinkering at the margins of long-standing theories. This is, in and of itself, not necessarily problematic. However, when theory is accepted as truth merely as a result of its temporal longevity, scientific progress may be impeded.

Sometimes a change in zeitgeist, or a paradigm shift, is required before old problems are looked at anew (Kuhn, 1962). In physics, Einstein’s theories of relativity challenged Newtonian physics and provided a framework from which to re-examine long-trusted theories. In astronomy, the adoption of Copernican for Ptolemaic theories challenged the way people thought about the world and provided new insights. In psychology, the Freudian approach revolutionised what was a fragmented field, but then was in turn replaced by the behaviourist perspective, heralded by such agents-of-change as Pavlov, Skinner and Mowrer.

The influence of a dominant paradigm on scientific enquiry can be profound. It shapes not only how one looks at the world and its inhabitants but the questions one asks about them. In Psychology, the cognitive perspective has supplanted the behaviourist perspective in many areas, yet in some specific areas behaviourism still dominates. One of these areas, the realm of this thesis, is in regards to understanding the causes and etiology of specific phobias and fears.

An appreciable amount of theorising has gone into the origins of and causative factors involved in specific phobias and their non-clinical counterparts. These theories have been blown by the variable and changing winds of psychological enquiry: psychoanalytic theory, behaviourist theory, and most recently cognitive theory. In many
regards, however, etiological theories of specific fears and phobias have remained firmly mired in behaviourist theory. An experience causes pain, discomfort or emotional turmoil and this leads to the development of fear. This can be regarded as behaviourist theory with ecological overtones. And yet, there are major weaknesses and problems with existing theories of the etiology of specific fears and phobias.

This dissertation has its genesis in an earlier Honours thesis and is based upon critical consideration almost two decades previously. As an undergraduate psychology student I was disillusioned and unconvinced by the existing theories of the etiology of specific fears. I believed that certain characteristics of specific fears and phobias were either inadequately explained by existing theories or there was a gross overuse of post hoc rationalisations. This prompted a period of reflection which culminated in the development of a new comprehensive theory of the etiology of fear. In 1994 I devoted my Psychology Honours thesis to working on further developing the model and testing it in two separate studies. The testing of the model that commenced in 1994 continues to this day and shall continue into the future with further research already being pursued.
PART ONE
CHAPTER 1 – THE CURRENT UNDERSTANDING OF FEAR

The investigation of fear is a perennial area of psychological inquiry. This is, perhaps, not surprising given both the ubiquity of fear in the human population and the strength of the emotion. Indeed, fear is widely regarded as a “basic emotion”, capable of being both recognised (Ludemann & Nelson, 1988; Schwartz, Izard, & Ansl, 1985; Serrano, Iglesias, & Loeches, 1992) and identifiably expressed (Hiatt, Campos, & Emde, 1979; Izard, 1978; Izard, Huebner, Risser, & Dougherty, 1980) by infants at around four to five months of age. Fear may be expressed behaviourally by either a tendency to freeze and become mute or by a flight response, the avoidance or escape of the situation.

Differentiating fear, anxiety, and phobia

There is considerable uncertainty surrounding the definition of complex emotional/behavioural responses such as fear, both at the lay level and in the psychological literature. This is, no doubt, a consequence of the problems inherent in explaining subjective feelings or emotions in symbolic form. Words do not capture but only ever approximate our inner experience (Taylor & Arnow, 1988). Adding to this problem is the multiplicity of terms relating to fear. Examples of these terms, which express various nuances or shades of emotion, include concern, worry, trepidation, nervousness, disquiet, solicitude, phobia, dread, edginess, anxiety, apprehension, terror, agitation, qualm, misgiving, and alarm. While this rich vocabulary of expressions underlines the importance of the feeling of fear to humans (Marks, 1987) it also adds to the difficulties encountered in defining core psychological terms such as anxiety, fear, and phobia. Exactly how do these expressions differ from one another? In what ways do they overlap? The answer to these questions is a necessary first step in understanding the causes of these emotional states and will therefore be addressed below.

One way to solve the problem of delineating core terms is simply to define them into mutually exclusive categories. However, this risks abstracting these terms from their common usage and, therefore, may sacrifice their ecological validity. Some balance must
be struck between the establishment of a scientifically dictated usage of fear-related words and their lay usage, the source from which all words are ultimately mandated. Greist, Jefferson, and Marks (1986) argue that to impose rigid definitions on terms such as fear and anxiety is futile and, rather than leading to enlightenment, would more likely create confusion.

However, to shy clear of providing even loose definitions risks scientifically intolerable imprecision. This has resulted in fear and anxiety, for example, being frequently employed interchangeably in the literature. Indeed, the primary diagnostic tool used in psychology, The Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV, American Psychiatric Association, 1994), includes specific phobias as an anxiety disorder yet defines it as a “persistent and irrational fear”. However, despite this confusion, attempts have been made by a number of researchers to delineate the terms fear, anxiety, and phobia.

What is fear?

The Macquarie Dictionary (1991) defines fear as a “painful feeling of impending danger, evil, trouble, etc.” The etymology of the word fear is the Old English term fær meaning sudden attack or danger. In keeping with such a definition, many authors include the element of danger as central to the elicitation of fear. Hoehn-Saric (1979), for example, epitomises this approach by defining normal fear as a “response to a realistic external threat that is potentially unpleasant and harmful” (p. 449). Similarly, Barlow (1991) sees fear as arising from direct and immediate threat, whether by wild animals or by modern-day dangers. Marks (1987) likewise identifies fear as “an emotion produced by the perception of present or impending danger” (p. 3). Further, Izard (1991) believes that all fears have one thing in common, they are perceived as a threat to security or safety.

Fear is not a unidimensional emotion but can be seen as an emotional response syndrome comprising cognitive-subjective, behavioural, and physiological components (Marks, 1987). The exact combination of these elements is impossible to determine, and is phenomenologically distinct in any event. Certainly the subjective experience of fear can be potent, producing marked effects on perception, thought and action (Izard, 1991). However, fear is not always extreme and can range from feelings of apprehension or uneasiness all the way to terror or panic.
What is anxiety?

Anxiety is generally seen as being akin to fear except for the lack of an identifiable source of threat (Marks, 1987; Taylor & Arnow, 1988). For example, Greist, Jefferson, & Marks (1986) identify anxiety, in contrast to fear, as “a response to a less obvious, ill-defined, irrational, distant, or unrecognized source of danger” (p. 2). However, Barlow (1991) contends that anxiety is more than merely fear without a cue. In turn, he conceptualises anxiety as “a loose cognitive-affective structure which is composed primarily of high negative affect, a sense of uncontrollability, and a shift in attention to a primarily self-focus or a state of self-preoccupation” (p. 60). Barlow proposes that a lack of both predictability and control leads an individual to experience a state of “helplessness” in the face of a danger or potentially negative event, although this viewpoint stands in isolation from the mainstream.

Contemporary psychological research generally defines anxiety as an aversive emotional state related to an anticipated or expected encounter with a feared stimulus. While a physical cue might not be immediately present there is at least some expectation of an upcoming aversive experience. Taylor and Arnow (1988) identify anxiety as having subjective, behavioural, physiologic and cognitive dimensions. Indeed, anxiety is often defined as a blend of different emotions and cognitions or as a diffuse affective network stored in memory (Barlow, 1991).

Complicating definitional progress is the taxonomy adopted by the American Psychiatric Association, where the raft of disorders including Generalized Anxiety Disorder, Post-traumatic Stress Disorder, Social Phobia, Agoraphobia, Specific Phobia and Obsessive Compulsive Disorder are classified as anxiety disorders and defined as characterised by felt anxiety or related symptoms. Many of these disorders have clear and demarcated cues or stimuli which a person fears, marking them as disorders of fear rather than anxiety, if we were to use the generally accepted definitions. And yet, there is no doubt that there is some sort of relatedness between the various disorders, with a shared emotional and behavioural response pattern. For the purpose of discussion of fears characterised under the diagnostic category ‘Specific Phobia’, therefore, the term fear shall be used to describe the emotional, cognitive, behavioural and physiological state associated with a given cue or stimulus, while anxiety will be considered the complex state induced in anticipation of encountering the cue or stimulus. A fear of dogs or the dentist then, may be said to comprise both the anxiety related to future concerns about
encountering dogs or attending the dentist and the fear response accompanying the actual encounter.

**What is a phobia?**

By definition, a phobia can be distinguished from a common fear by the significant degree to which a phobia interferes with a person’s normal routine, occupational or academic functioning, or social activities and relationships (DSM-IV). A phobia, then, is simply an intense fear which, to a certain extent, limits the functioning of an individual in one or more domains. Additionally, phobias are generally seen as irrational fears. That is, “a phobia is fear of a situation that is out of proportion to its danger” (Marks, 1987, p. 5) and “not based on sound judgement” (Reber, 1985, p. 543). This criterion may be taken to imply the existence of a cognitive impairment which somehow impacts upon the emotional response to encountering a specific object or situation.

Although irrationality and functional impairment are generally assumed to characterise phobic disorders, these characteristics have not gone unquestioned. Many objects of people’s concerns are, or have the potential to be, dangerous or life-threatening. Car and aeroplane crashes are relatively common, resulting in mortality and morbidity. In countries such as Australia, India, the United States or throughout Africa, many animals can kill or cause considerable pain or illness. Fears of being robbed, attacked or being shot are certainly not unfounded in many parts of the world. Indeed, a strong case could be put that many fears or phobias are entirely rational. The suggestion has even been made that dental phobia be relabelled Posttraumatic Dental-Care Anxiety because most people with a dental “phobia” do not recognise their symptoms as “excessive” or “unreasonable” (Bracha, Vega, & Vega, 2006), as defined by DSM-IV. Unfortunately, the use of the term irrational to define phobias appears to be accepted much more than it is rejected. Nonetheless, it should be kept in mind that just because a fear might appear disproportionate to possible danger, or functionally problematic, to an external observer, to minimise the experience of the fear by judging the person as being irrational or unreasonable is to distance oneself from genuinely understanding that person’s fear.

Specific phobias are classified into four subtypes plus a catch-all “Other Type”. The subtypes employed in DSM-IV are Animal Type, Natural Environment Type, Blood-Injection-Injury Type and Situational Type (APA, 1994). Situational phobias are the most
common while animal phobias are the least common. Situational phobias include phobias such as those related to heights (acrophobia) and closed spaces (claustrophobia) and tend to have a later age of onset than other phobias (Himle, Crystal, Curtis, & Fluent, 1991).

Characteristics and demographic features of fears and specific phobias

Diagnostic threshold

Although Specific Phobia is defined as a qualitatively distinct disorder, fear and avoidance of specific stimuli occur broadly across the population. Diagnostic criteria for Specific Phobia requires clinical judgement regarding the degree of functional impairment and the extent of fear expressed, decisions which require the clinician to create a defined, yet ultimately arbitrary, cut-point along a continuum of fear. As Mitchell (1982) acknowledges, “the degree to which the individual is aware of the phobia, and the degree to which its presence affects and limits his life, is variable” (p. 10). Of course, while a phobia is, by definition, associated with a “marked and persistent fear” (ADA, 1994, p. 410), a person may have an extreme fear but not have Specific Phobia, or have a less extreme fear with functional impairment resulting in a diagnosable Specific Phobia.

Prevalence

Specific Phobia is a relatively common anxiety disorder, although prevalence statistics vary across countries and cultures. For example, in a study of almost a thousand women in Dresden, Germany, Becker et al. (2006) found a lifetime prevalence of 12.8%, with the most common phobia relating to animals (5.0%). In contrast, a study of young conscripts in the Israeli army found 8.7% exhibited phobic symptoms (Iancu, Levin, Dannon, Poreh, Yehuda, & Kotler, 2006) and this is similar to the 8.8% prevalence found in Iceland (Lindal & Stefánsson, 1993). In New Zealand, Specific Phobia was found to have a higher prevalence (7.3%) than Major Depressive Disorder (5.7%) and Social Phobia (5.1%) (Wells, Oakley Brown, Scott, McGee, Baxter, & Kokaua, 2006). However, lifetime prevalence of Specific Phobia in China is estimated as only 2.6% and this is less than Major Depressive Disorder (3.5%) in that country (Lee et al., 2006).
Prevalence of Specific Phobia among children is quite low, with a recent review finding that it occurs in approximately 5% of children and about 15% of children referred for anxiety-related problems (Ollendick, King, & Muris, 2002). Some studies, however, have reported lower prevalence rates (Anderson, Williams, McGee, & Silva, 1987; Bird et al., 1988; Essau, Conradt, & Petermann, 2000; Stenhausen, Metzke, Meier, & Kannenberg, 1998), with variations depending on child sex and age. Variations in prevalence rates for both children and adults may result from differences in diagnostic criteria and judication of the functional impairment associated with the phobias (Ollendick et al., 2002). Studies of anxiety disorders indicate that minor variations in impairment criteria can have a significant effect on reported prevalence (Pelissolo, Andre, Moulard-Martín, Wittchen, & Lepine, 2000).

Prevalence of sub-clinical fears is, not surprisingly, much more common than Specific Phobia. The use of scales such as the Fear Survey Schedule (Geer, 1965) reveal an array of common fears of varying prevalence.

**Gender differences and age of onset**

Like many other anxiety disorders, epidemiological investigations have consistently revealed a greater proportion of females than males with Specific Phobia (Bourdon, Boyd, Rae, Burns, Thompson, & Lockke, 1988). Indeed, Wells et al. (2006) found sex differences in Specific Phobia prevalence to be greater than for other anxiety disorders (10.1% for females compared to 4.3% for males). The sex ratio reportedly varies across phobia subtypes, with 75% to 90% of people with the Animal, Natural Environment and Situational Type being female, and 55% to 70% of individuals with the Blood-Injection-Injury Type being female (APA, 1994). In relation to common fears experienced by children, Bowd (1984) found that 73% of girls reported fear of animals compared to 51% of boys. At the other end of the age distribution, of 51 fears examined by Liddell, Locker, and Burman (1991), women aged 50+ years had significantly more fear on 28 of the fears, with older men only indicating more fear on the item ‘Fear of God’. Although it has been claimed that gender differences in the reporting of fears and phobias may be the result of men’s greater propensity to lie (Pierce & Kirkpatrick, 1992) this suggestion has subsequently been criticised (Pickersgill & Arrindell, 1994). Although females have been found to be more confident in expressing fears than are males (Blier &
Blier-Wilson, 1989) the propensity to lie has been found to have only a minimal effect of fear reporting (Arrindell & Buikhuisen, 1992).

Thyer, Parrish, Curtis, Nesse and Cameron (1985) found the mean age of onset of Specific Phobia was 16.1 years, however the age of onset is believed to vary according to type (APA, 1994). While the Situational Type has a bimodal distribution, with peaks in childhood and the mid-20s, the other Specific Phobia types usually begin in childhood. Consistent with this, Himle, McPhee, Cameron, and Curtis (1989) found the mean age of onset of animal and blood-injection phobias to be 14.9 years and 12.4 years respectively and the mean age of onset of situational phobias to be 27.3 years. Öst (1987) found mean age of onset of animal phobias to be 6.9 years, blood phobias to be 8.8 years and dental phobias to be 11.7 years. However, looking at earliest age of recall when the phobia caused significant distress or functional impairment (that is, became diagnosable as a DSM-IV disorder), Antony, Brown, and Barlow (1997) found age of onset of height phobia to be 34.1 years, animal phobia to be 20.0 years, blood/injection phobia to be 14.5 and driving phobia to be 32.2. The age at which the fear began was appreciably prior to when the fear could be diagnosed as a phobia, ranging from 6.5 years earlier for blood/injection phobias to 13.7 years earlier for heights phobias. Interestingly, a recent study by Becker et al. (2006) indicates age of onset for various specific phobias as being significantly lower than estimates provided by other authors. However, this may reflect the onset of the person’s relevant fear, rather than the onset of a diagnosable phobia.

The cause(s) of fears and phobias – nature vs nurture

It has been known, or at least suspected, for quite some time that anxiety disorders run in families. Moran and Andrews (1985), for example, found that parents and siblings of agoraphobic probands have a significantly greater prevalence of agoraphobia than the general population. Similar results have been shown when investigating other anxiety disorders (Cloninger, Martin, Clayton, & Guze, 1981; Crowe, Noyes, Pauls, & Slymen, 1983). In relation to specific phobias and fears, Fyer et al. (1990) found that first-degree relatives of phobic probands were almost 3 times more likely to have Specific Phobia in comparison to never mentally ill controls (31% versus 11%). Similarly, mothers and fathers of women with snake or spider phobia have been found to have 37% and 7%
prevalence respectively, significantly higher than population prevalence figures (Fredrikson, Annas, & Wik, 1997). It is also known that individuals with an anxiety disorder have a higher prevalence of comorbid conditions than the prevalence of those conditions in the general population. Indeed, comorbidity is so common that it is often considered unlikely for an individual to suffer a single anxiety disorder in isolation (Goldenberg et al., 1996). Comorbidity within a diagnosis also occurs. Animal phobia, for instance, often presents as an integrated set of fears to a number of animals rather than as isolated fears to specific animals (Bernstein & Allen, 1969; Laudy & Gaupp, 1977).

Familial aggregation and comorbidity provide compelling evidence that external forces are impacting on disease acquisition and expression. There are two possible explanations for these associations. First, underlying the greater concordance of familial and inter-individual psychopathology are genetic or hereditary factors. Second, it is possible that these associations are a result of the learning environment in which people grow up, and that familial aggregation in anxiety disorders stems from idiosyncrasies in learning perpetuated within the family. Essentially, these explanations reflect the great nature versus nurture debate.

Genetic transmission

One of the most common ways to determine the degree to which a shared characteristic is hereditary is by looking at the disease prevalence of identical or monozygotic (MZ) twins and non-identical or dizygotic (DZ) twins. In many twin studies, MZ twins reared together (who share family environment and genes) are compared to DZ twins reared together (who also share family environment but only share half their genes). Higher disease concordance among MZ compared to DZ twins is taken to indicate the influence of genetic transmission, and estimates of heritability can be determined. Effectively, heritability is a measure of the extent to which biological relatives resemble each other because they share genotypes and the role of genes in the differences between individuals. Mathematically, heritability is the proportion of the variance of a population's phenotype which is due to genetic variance within that population.

In one of the earliest twin studies, Torgersen (1979) found that genetic factors play a part in both the strength and content of phobic fears, although environmental factors also appeared to be important. However, a large-scale study of 2,163 female twins in the
US found that the familial aggregation of phobias appeared to result from genetic rather than environmental factors, with estimates of hereditability of liability ranging from 30% to 40% (Kendler, Neale, Kessler, Heath, & Eaves, 1992). Looking at male twins, specific phobia subtypes were found to aggregate within twin pairs, and this was also attributed largely to genetic factors with hereditability of liabilities ranging from 25% to 37% (Kendler, Myers, Prescott, & Neale, 2001). In an intriguing study looking at the mechanics of fear conditioning, Hettema and colleagues found that genetic factors appeared to account for nonassociative processes of habituation, acquisition and extinction and also for associative fear conditioning processes (Hettema, Annas, Neale, Kendler, & Fredrikson, 2003). More recently, Hettema, Prescott, Myers, Neale & Kendler (2005) believe they have revealed two additive genetic factors common across anxiety disorders, one relating more strongly to generalised anxiety disorder, panic disorder and agoraphobia, and one loading primarily on specific phobias. They identified only a small role for a single common environmental factor accounting for less than 12% of the total variance for any disorder.

Unlocking the human genome has led to new methodologies in trying to understand the role of genetics in anxiety disorders. A number of chromosomal regions have shown evidence of linkage to panic disorder, phobias and anxiety traits (Villafuerte & Burmeister, 2003) and a chromosome 14 risk locus has been identified for specific phobias (Gelernter, Page, Bonvicini, Woods, Pauls, & Kruger, 2003). Indeed, gene expression profiles in the amygdala and hippocampus have been found to show dynamic changes in response to fear conditioning (Mei, Li, Dong, Jiang, Wang, & Hu, 2005) and it now looks increasingly likely that the conflux of advances in genomics and neurophysiology will eventually reveal the complex interplay between gene function, biological processes, and fear expression.

**Environmental transmission**

While it has been argued that familial-environmental factors are of little etiological significance in fears and phobias (Kendler, Markowski, & Prescott, 1999), this view is not universal and there is some evidence to the contrary. Lichtenstein and Annas (2000), for example, found that genetic, shared environmental and nonshared environmental effects all contributed to individual differences in fears and phobias in young children. This study essentially replicated an earlier twin study of children and youngsters showing effects for
both shared environment and genes (Stevenson, Batten, & Cherner, 1992). Using factors extracted from the multi-fear Fear Survey Schedule (situational fears, illness-injury fears, social fears and small animal fears), Sundet and colleagues found that the impact of the common genetic and common environmental factor appeared to vary across the four dimensions (Sundet, Skre, Okkenhaug, & Tambs, 2003).

While there is currently mixed evidence concerning the role of shared environmental factors in the familial aggregation of fears, there is strong evidence for the importance of non-shared or individual environmental factors in the etiology of fear. In a meta-analysis of a number of anxiety disorders, Hettema, Neale, and Kendler (2001) found that the role of these nonshared environmental experiences was significant, which underscored for them the need to identify the putative environmental risk factors involved in predisposing people to anxiety. Lichtenstein and Annas (2000) found that nonshared environmental effects contributed to both general susceptibility and specific fearfulness, with these effects being primarily fear specific. Recently, a longitudinal twin study has revealed changes in genetic and environmental contributions to fear across time (Kendler, Gardner, Annas, Neale, Eaves, & Lichtenstein, In Press). Looking at four age groups between 8–9 and 19–20 they found a developmentally dynamic pattern, with the influence of the shared environment declining and the unique environment increasing. A set of stable genetic risk factors were found to act in childhood and at later ages, however new sets of genetic risk factors were seen during early and late adolescence and in early adulthood.

**Temperament**

Temperament refers to emotional and behavioural consistencies which appear early in life and are assumed to have a biological basis (Caspi, Roberts, & Shiner, 2005). Although some researchers believe temperament reflects that part of personality which is genetically determined (Carey & DiLalla, 1994), others see temperament as the observable manifestation of a child’s emerging personality (Matthews, Deary, & Whiteman, 2003). In any event, a number of researchers have linked early child temperament styles to the subsequent development of anxiety disorders (Goldsmith & Lemery, 2000; Muris & Ollendick, 2005; Muris, Merckelbach, Wessel, & van de Ven, 1999; Pérez-Edgar & Fox, 2005). While temperament is not seen as causing psychopathology, there is a belief that
certain types of early temperament and later phobic reactions may reflect common causal mechanisms.

Some researchers have argued that anxiety disorders arise out of a confluence of high negative emotionality and low effortful control (Clark and Watson, 1991; Nigg, 2006), a style which includes elements of attentional control, low intensity pleasure and attention shifting and focusing behaviours. There has also been some research that behavioural inhibition, the characteristic responding to novel situations with restraint and avoidance and to people with shyness and timidity, is related to anxiety disorders. In relation to specific phobias, Muris and colleagues found behavioural inhibition to correlate significantly with Blood-Injection-Injury Phobia, although not with phobias of the Animal or Situational type (Muris et al., 1999).

There is good evidence to indicate that early childhood temperament is a good predictor of adult personality, with studies finding that the temperament of 3-year-old children predicts adult personalities more than 20 years later. (Caspi, 2000; Caspi, Harrington, Milne, Amell, Theodore, & Moffitt, 2003; Caspi & Silva, 1995). However, more research looking at specific phobias in particular is required before the role of temperament in the development of fears and phobias can be understood.

**Etiological theories of fears and phobias**

While reports of phobias go back to antiquity, it was not until Sigmund Freud that psychological theory was systematically applied to the understanding of specific phobias. According to Freud, phobias emerge because of an unresolved oedipal conflict, a developmental conflict that emerges during the third (or oedipal) stage of Freud's psychosexual development stages. In the case of ‘Little Hans’, reported in 1909, Freud attributed the fear of horses experienced by the 5-year-old Hans to an unresolved oedipal conflict. He argued that Hans experienced fear and guilt over both his repressed sexual feelings for his mother and his wish that his father would die. The development of the phobic symptom fulfilled the function of helping to maintain Little Hans’s psychic balance. However, psychological theories of the etiology of specific fears and phobias have moved beyond psychoanalytic theory and these shall be described below.
**Classical conditioning theory**

The laws of classical conditioning are based on Pavlov’s series of experiments in learning which were carried out during the 1890s and 1900s and eventually translated into English in 1927 (Pavlov, 1927). Although Pavlov won the 1904 Nobel Prize in Physiology and Medicine, his initial experiments into gastric functioning in digestion gave way to investigations into the basic laws for the establishment and extinction of what he called "conditional reflexes". These reflex responses, like salivation, were discovered to be conditional upon specific previous experiences of the animal. An example of (what later came to be called) classical conditioning is shown in Figure 1. Before conditioning, an unconditioned stimulus (UCS), in this case food, is found to automatically bring forth an unconditioned response (UCR) such as salivation. This response, known as an unconditioned reflex, is automatic, requires no learning, and is readily apparent in most animal species. Prior to conditioning, the conditioned stimulus (CS) is an initially neutral stimulus that elicits no response. In his experiments Pavlov used a wide variety of stimuli, including whistles, metronomes, bells and tuning forks as well as an array of visual stimuli. When a neutral stimulus is paired with an unconditioned stimulus (UCS), learning

![Figure 1. The process of classical conditioning as discovered by Pavlov.](image-url)
occurs. After conditioning, the neutral stimulus, now known as the conditioned stimulus (CS), elicits the same unconditioned response, now known as the conditioned response (CR), without being paired with the unconditioned stimulus (UCS).

In 1917, Watson and Morgan spoke of the possibility of the laboratory as a way of bringing human emotions under experimental control and argued, albeit parenthetically, that reactions such as fear of the dark “should be looked upon as conditioned fear reactions” (Watson & Morgan, 1917, p. 166). Shortly after, Watson and Rayner (1920) provided experimental support for the conditioning of emotional reactions in a famous investigation subsequently dubbed the ‘Little Albert’ study. The goal of the experiment was to show how the recently discovered principles of classical conditioning could be applied to condition fear of a white rat into “Albert B”, an 11 month old boy. Indeed, the researchers found that pairing the presentation of the rat with a loud noise resulted in subsequent emotional reactivity to and behavioural avoidance of the rat when presented alone.

Wolpe and Rachman (1960) clearly expounded the case for a learning theory interpretation of phobias several decades later, stating:

“In brief, phobias are regarded as conditioned anxiety (fear) reactions. Any neutral stimulus, simple or complex, that happens to make an impact on an individual at about the time that a fear reaction is evoked, acquires the ability to evoke fear subsequently. If the fear at the original conditioning situation is of high intensity or if the conditioning is many times repeated, the conditioned fear will show the persistence that is characteristic of neurotic fear.” (p. 193)

By this time, there was considerable support for the classical conditioning theory of fear coming from a number of areas. Many experiments with laboratory animals proved consistent with conditioning theory. Observation of people involved in military combat also showed that traumatic experiences can lead to the acquisition of fears. Finally, several studies of phobic people showed classical conditioning experiences as being central to their fear acquisition. In 1965, Eysenck and Rachman proclaimed that the central tenets of the behaviourist theory of phobia development “are supported by the full weight of almost all the evidence accumulated in research on the learning process” (p. 82). In addition, great success was being achieved in extinguishing fears using learning principles, with counter-conditioning produced by the pairing of relaxation to representations of the phobic stimulus (Wolpe & Lazarus, 1969).

The classical conditioning model of fear acquisition was extended by Mowrer (1947) when he advanced his two-factor theory of avoidance learning. Mowrer proposed
that avoidance learning involved instrumental conditioning as well as classical conditioning. It was argued that any response that removes the fear-evoking stimuli established via classical conditioning becomes negatively reinforced. The avoidance response, therefore, is said to be reinforced through instrumental conditioning. Mowrer (1960) subsequently revised his two-factor theory, distinguishing between danger signals, which are associated with the onset of a noxious stimulus, and safety signals, which are associated with cessation of such a signal. Rachman (1976) has argued that the need for symmetry in the theory and the exaggerated emphasis on fear as a motivating factor in human behaviour were responsible for the revision of Mowrer’s theory.

Despite the apparent success of classical conditioning and Mowrer’s (1947, 1960) two-factor theory in explaining the etiology of fears and phobias, McNally (1987) points out that apparent differences between phobias and laboratory conditioned fears led a number of theorists to question the ability of the model to explain the origin and maintenance of phobias (Costello, 1970; Eysenck, 1979; Rachman, 1977; Reiss, 1980 Seligman, 1971). Some of these criticisms will be dealt with later in this chapter. Nonetheless, there has been a new wave of enthusiasm for research into classical conditioning. This stems from the formulation of more complex conditioning models (e.g., Mineka & Zinbarg, 1996), findings from animal research identifying specific temporal-lobe circuits engaged in fear conditioning (Blair, Schafe, Bauer, Rodrigues, & LeDoux, 2001), and human research investigating the relationship of fear conditioning to changes in brain physiology (Bechara et al., 1995; LaBar, Gatenby, Gore, LeDoux, & Phelps, 1998; Maren, 2001). Field (2006) has recently argued that learning theory has developed appreciably since earlier formulations, stating that “conditioning can not only account for how fears might be acquired, but also offers a framework for understanding how associations between mental representations are formed that themselves may lead to fear” (p. 15).

Despite renewed interest stimulated by physiological research and although learning principles still form the basis of a number of contemporary models of the etiology of fears and phobias, classical conditioning has now been supplanted as a sufficient etiological explanation. Rachman (1991) has argued that by the late 1970s “so many weaknesses had emerged that clinicians and researchers lost interest in the theory, and turned instead to cognitive explanations” (p. 155). Nonetheless, numerous attempts have been made to modify or alter the basic premises of classical conditioning in an effort to make it fit the characteristics of specific fears and phobias. Some of these attempts have
been widely accepted by the professional and lay community although none are without problems.

**Eysenck’s incubation theory of fear/anxiety**

In response to Watson’s proposition that many neurotic or anxiety disorders are conditioned emotional disorders of either a direct or transferred type (Watson & Rayner, 1920), Eysenck (1968, 1979) has pointed out a number of weaknesses which he believes are so destructive as to render Watson’s original theoretical formulation as completely untenable (Eysenck, 1985). Eysenck (1979) argues that: (1) Watson’s theory was based on only a single case study, that of “little Albert”; (2) phobias are restricted to a relatively small set of stimuli, in violation of the equipotentiality principle implicitly accepted by Watson and other behaviourists; (3) traumatic events, or single-trial conditioning, occur rarely in the history of the development of peace-time anxiety disorders; (4) the precise conditions necessary to establish CS-UCS pairings in the laboratory are almost unobtainable in real-life situations; (5) unreinforced conditioned reactions extinguish quickly in laboratory settings, yet this seldom happens in relation to phobias in real life; (6) clinical studies find that an enhancement effect often occurs whereby the unreinforced CS produces successively more anxiety (CR) with each presentation of the CS; (7) many phobias involve an insidious onset without any event that could be called traumatic; and (8) many neuroses lack the involvement of pain or shock in their development. Eysenck argues that preparedness theory (Seligman 1970, 1971 – see pp 30–35) can ‘save’ the first four criticisms of Watson’s theory. However, he argues that the final four criticisms of Watson’s theory of neuroses require a reformulation of behaviourist theory, and that a rewriting of the laws of extinction is required.

Eysenck believed that classical extinction theory was beset by experimental anomalies and in 1968 rewrote the laws of extinction, arguing that two consequences may follow upon a CS-only presentation (Eysenck, 1968). It was proposed that CSs which do not produce drives operate under the classical law of extinction, whereas CSs which do produce drives act in accordance with the law of enhancement or incubation (Eysenck, 1976). Eysenck identifies three parameters under which incubation effects occur. First, incubation is assumed to be conditional upon Pavlovian B, in contrast to Pavlovian A, conditioning. Pavlovian A conditioning is believed by Eysenck to involve both the external manipulation of motivation and essentially dissimilar CRs and UCRs. One of the
principal characteristics of Pavlovian B conditioning, on the other hand, is that the UCS itself acts as a drive. Eysenck argues that if the UCS acts as a drive then the CS can also act as a drive, due to its association with the UCS. The CS will, therefore, produce CRs functionally similar, if not identical, to the UCR. CS-alone presentations may, therefore, be seen as evoking a CR which leads to reinforcement rather than extinction of the response. Under such circumstances, a positive feedback circuit may be said to be established. Eysenck (1985) proposes that “under certain conditions...the extinction process may be weaker than the reinforcement process, and observable incubation will result” (p. 91). The incubation process has elsewhere been referred to as ‘paradoxical enhancement’ (Rohrbaugh & Riccio, 1970).

Two other parameters are believed to be important in the determination of incubation effects. The first is the presence of a strong CR which is related to the strength of the UCR. Eysenck (1985) refers to a typical UCR as a “PFA”, a mixture of pain, fear, and anxiety. When the strength of a CR is above a critical level it is believed to act as reinforcement in a manner similar to that of a UCR. The stronger the UCR the greater the likelihood that enhancement will result while the weaker the UCR the more probable it is that extinction will occur. The second condition required for incubation effects is proposed to be short-term CS-alone exposure. Increasing exposure beyond a given point leads to an outweighing of the strong CR exhibited at or near the point of CS-alone exposure by weaker CRs. Short-term exposure to CS-alone is proposed to lead to strong enhancement effects (Eysenck, 1976).

Eysenck believed that the revision of the law of extinction and his subsequent formulation of the ‘learning model’ of neurosis removed the essential stumbling block in the unmitigated acceptance of the conditioning model (Eysenck, 1976). He also pointed to a number of studies which seemed to provide empirical support for the incubation hypothesis (e.g., Bindra & Cameron, 1953; Brush, 1964; Denny & Ditchman, 1962; Dykman, Mack, & Ackerman, 1965; McAllister & McAllister, 1963, 1965; Rohrbaugh & Riccio, 1970). The experiment often cited by Eysenck as best illustrating how incubation works was conducted by Napalkov (1963) who used a single-trial conditioning paradigm to produce strong enhancement effects. Working with dogs, Napalkov reported a gradual but continuous increase in blood pressure (the CR) following up to 100 CS-alone presentations.
On the basis of the various studies identified by Eysenck, it was concluded that “on the whole the evidence for the existence of incubation phenomena is strong” (Eysenck, 1981, p. 362). However, there have been a number of inconsistencies from studies investigating incubation effects. In a review of the literature, Nicholaichuk, Quesnel, and Tait (1982) identified numerous problems in the studies interpreted as demonstrating enhancement effects. These include the presence of inadequate procedural descriptions (e.g., Napalkov, 1963), the failure to include adequate Pavlovian controls, inadequate CS specification, the basing of results on unsystematic observations, confounding with operant contingencies, and confounding with increases in fear that occur naturally with time. In addition, a number of studies have incorrectly claimed incubation effects on the basis of retarded extinction (e.g., Boyd, 1981, 1984; Chorot & Sandin, 1993; Sandin & Chorot, 1989, 2002) rather than from increases in the CR. Finally, some studies have found results contrary to incubation theory (Kaloupek, 1983; Malloy & Levis, 1990; Nicholaichuk, et al., 1982; Richards & Martin, 1990).

Apart from receiving what may be considered as dubious empirical support, there are also various theoretical problems with Eysenck’s incubation theory (Bersh, 1980; Kimmel, 1979). Bersh (1980), for example, argues that unmistakable evidence for incubation effects is very limited, that certain features of Eysenck’s theory are contraindicated by available data, and that the theory is lacking in predictive power, a condition which seriously undermines both its utility and scientific status. He argues that the theory provides little more than “qualitative guidelines for arranging conditions under which incubation may be more or less likely to occur” (p.16). Paxton (1983) also criticises the theory, arguing that Eysenck overstates the applicability of the theory, incorporates questionable assumptions, and fails to adequately consider alternative accounts.

A number of other problems are also evident with Eysenck’s theory. First, Eysenck’s assumption that the UCR comprises a mixture of pain, anxiety, and fear is essentially unsupported by empirical evidence. Indeed, it seems more likely that fear or anxiety represents the CR rather than the UCR, especially where the conditioning experiences involve single-trial acquisition. In this case, the difference between the UCR and CR is not predicted by Eysenck’s theory. In addition, the differing nature of the UCR and CR is contrary to the terms of Pavlovian B conditioning which Eysenck argues is required for enhancement effects to occur. Second, and perhaps most damning, is the failure of Eysenck’s theory to explain the very phenomenon which it was introduced to
account for in the first place. Incubation effects were postulated as a possible means to explain the lack of traumatic events in the history of some people with anxiety disorders. It was proposed that the fear reaction to a ‘sub-traumatic experience’ could experience incubation resulting in increasing and eventually phobic fear over time. However, Eysenck himself surprisingly undermines this claim by proposing that incubation is unlikely to occur following a less intense UCS in comparison to an intense UCS. Yet, following an intense UCS, there is no need to postulate enhancement effects to CS-alone presentations, as the elicitation of a strong CR would be predicted from conditioning theory in any event.

Because of its assorted perceived flaws, Eysenck’s incubation theory is rarely discussed in contemporary descriptions of the etiology of fear while Eysenck himself went on to make important theoretical advances relating to personality and intelligence. Generously, perhaps, Sturgis and Scott (1984) conclude simply that the incubation theory appears to explain very few phobias. Nonetheless, Eysenck’s attempt to rectify the glaring problems with classical conditioning theory was a precursor of things to come.

**Preparedness theory**

In 1971, Seligman posed the following question: “What is it about phobias that makes them (1) selective, (2) so resistant to extinction, (3) irrational, and (4) capable of being learned in one trial?” (p. 312). He saw these characteristics as problematic to the classical conditioning account of phobia acquisition and proposed the notion of preparedness to account for them. In discussing the laws of learning, Seligman (1970) argued that “when an organism is placed in a classical conditioning experiment, not only may the CS be more or less perceptible and the US more or less evocative of a response, but also the CS and US may be more or less associable” (p. 408). It was proposed that a continuum of preparedness exists, whereby, and depending on the species, organisms can be prepared, unprepared or contraprepared for learning about the contingency of events. Such relative preparedness can be determined from the amount of input which must occur before an output which is taken to be evidence of acquisition, reliably occurs (Seligman, 1970). In Seligman’s conceptualisation, a phobia is an instance of prepared fear conditioning.

Preparedness theory is perhaps the most well accepted modification of classical conditioning theory. This is despite the fact that the exact mechanism for biological
preparedness has never been specified. Nonetheless, and despite a number of damaging critiques (McNally, 1987; Davey, 1995) preparedness theory is still widely accepted as a valid account of the etiology of fears and phobias. A decade on from Davey’s comment that biological preparedness is “enshrined as psychological fact in most introductory psychology textbooks” (Davey, 1997, p. 363) this is, somewhat remarkably, still the case.

Seligman’s preparedness theory fits neatly with an evolutionary perspective of fear. Mineka and Öhman (2002) believe that the process of evolution has led to an innate fear to some objects and situations and has produced relatively hardwired and reflexive escape reactions. A series of experiments by Cook and Mineka (1989, 1990) examined the acquisition of snake fear in rhesus monkeys. Using an observational fear conditioning paradigm they found that lab-reared monkeys showed fear behaviour to fear-relevant stimuli such as toy snakes and toy crocodiles but not to fear-irrelevant stimuli such as flowers or a toy rabbit. However, there has been debate over whether these findings are evidence of selective sensitisation (Gray, 1982; Lovibond, Siddle & Bond, 1993) or selective associations as Öhman and Mineka (2001) would have it. The interpretation of the results of the studies by Mineka and colleagues has also been questioned by Davey (1995) who proposes that the alarm calls (in relation to snakes) of the taped rhesus monkeys might actually be conveying very specific information about the predator, which would be incongruous in relation to the fear-irrelevant flowers and toy rabbits.

Seligman’s original vision of biological preparedness is generally seen as being supported by research from Öhman and his colleagues (e.g., Öhman, 1979; Öhman & Soares, 1993). Öhman sees his approach as a more radical departure from traditional learning theory than Seligman’s, with phobias analysed in terms of the behavioural systems within which the components of fear have probably evolved rather than in terms of what he sees as an abstract notion of general biological preparedness (Öhman, Dimberg, & Öst, 1985). Indeed, although fitting into an evolutionary perspective, Öhman’s approach does not rely on appealing to instances of presumed noncognitive learning but rather seeks to demonstrate the involuntary nature of fear-relevant phobias predominantly through the use of a backward masking procedure (Öhman & Soares, 1993). Backward masking involves the prevention of conscious recognition of a target stimulus by visually presenting a masking stimulus a very short time after the target stimulus, allowing unconscious processing but preventing the conscious percept by disrupting the process of synthesesing the unconscious units into environmental objects.
and events (Öhman, 1986). A series of experiments using snakes and spiders as fear-relevant stimuli and flowers and mushrooms as fear-irrelevant stimuli found that skin conductance responses (SCRs) conditioned to fear-relevant stimuli survived masking whereas masking abolished differences in responding to fear irrelevant stimuli (Öhman & Soares, 1993; Soares & Öhman, 1993a, 1993b).

Fitting into his ecological perspective, Öhman (1986; Öhman et al., 1985) has proposed a model of emotional processing which distinguishes between two different modes of emotional processing (see Figure 2). It is believed that there are both unconscious and conscious pathways to emotional processing. In the case of phobias, it is argued that the automatic affective reaction to a stimulus overrides the controlled processing routines, so that conscious ‘rational’ analyses impact only weakly on the selection of overt responses (Öhman et al., 1985). Functionally, the automatic priming of the efferent system ensures an organism becomes maximally ready to deal with external threats (Öhman, 1986).

Figure 2. A schematic model of emotional processing (Öhman, Dimberg, & Öst, 1985)

Although the research by Öhman and colleagues is widely regarded as being methodologically rigorous, this is not accepted universally. Lovibond and Shanks (2002), for example, argue that evidence from subliminal conditioning studies such as that
conducted by Öhman & Soares (1993) are inconclusive because the effectiveness of the ‘mask’ was based on a forced-choice identification test of the masked stimuli. Shanks and Lovibond (2002) argue that stimulus identification is only acceptable as a test of conscious information under conditions in which partial identification can not influence target responding. Indeed, Öhman, Esteves, and Soares (1995) acknowledge this issue by stating that subjects might have been able to “base their expectancies on vague hunches either from some information leaking through the mask or, perhaps more theoretically interesting, from bodily feedback originated in the conditioned response” (p.104). While participants in the backward masking study may not have been able to subsequently identify masked slides as spiders or snakes, certain stimulus features may have been detected and known to predict an unconditioned stimulus.

Alternative accounts of preparedness effects

One of the foremost criticisms of preparedness theory and the support received by Öhman’s research program involves the supposed fear-relevance and fear-irrelevance of the stimuli used. One such criticism is that while backward masking studies show a difference in rate of extinction between fear-relevant and fear-irrelevant stimuli they do not, in fact, address the principal evolutionary hypothesis of preparedness theory (Hugdahl & Johnsen, 1989). Often, fear relevance is confounded with phylogenetic significance. Although a series of experiments by Cook, Hodes, and Lang (1986) attempted to address this experimental gap by comparing the resistance to extinction of conditioned responses to both phylogenetically fear relevant (snakes, spiders) and ontogenetically fear relevant (handguns, rifles) stimuli, these studies have subsequently been criticised for the use of pictures of guns facing to the side rather than towards the participants (Hugdahl & Johnsen, 1989). Hugdahl and Johnsen (1989) conducted an experiment using both supposedly phylogenetic (snakes) and ontogenetic (handguns) fear-relevant stimuli, varying both the direction of the stimulus (pointing directly towards the participant versus pointing to the side) and the associated UCS (shock or noise). They found that after controlling for the direction of the stimuli in the slides, images of snakes did not yield resistant conditioning compared to images of handguns.

The central thesis of preparedness theory is that some items are biologically prepared for enhanced learning due to their supposed survival relevance to pretechnological people. In an interesting test of this assumption, a number of human
biology researchers were presented with a list of 38 items taken from preparedness research (and including rabbits, spiders, snakes, flowers, mushrooms, electrical outlets, angry faces, darkness, scissors etc.) and asked to rate the fearfulness, survival relevance, dangerousness and unpredictability of the various stimuli (Merckelbach, van den Hout, Jansen, & van der Molen, 1988). Rated fearfulness correlated more strongly with dangerousness and unpredictability than with survival relevance, and the relationship between fearfulness and survival relevance almost disappeared after controlling for unpredictability. It was also found that mushrooms were rated as more survival relevant than spiders and this is consistent with the view of Delprato (1980) who argues that it is reasonable to suspect that the risk posed to the human species by mushroom poisoning is greater than that of spiders and snakes combined. Delprato also questions the possible confounding of the developmental history of fear-relevant and fear-irrelevant stimuli. Whereas flowers, rabbits and mushrooms are repeatedly associated with neutral and positive experiences, references to snakes are almost always negative (Bandura, 1977).

Additional problems with preparedness theory

In a review of research into preparedness theory in 1987, McNally identified a number of shortcomings. Perhaps the biggest concern was that the evidence most consistent with preparedness theory was enhanced resistance to extinction of electrodermal responses. In regards to ease of acquisition, irrationality and belongingness, there was either little or equivocal empirical support. Indeed, some studies have failed to replicate the effect of even delayed extinction (Merckelbach, van der Molen, & van den Hout, 1987). In regards to the facts about phobias which preparedness theory was designed to explain, McNally (1987) found only one that remained unaltered by subsequent data and analyses, that most phobias are associated with threats of potentially evolutionary significance. Likewise, de Jong and Merckelbach (1997) argued that, other than delayed extinction, “several other predictions from the preparedness theory were tested to destruction in laboratory studies” (p. 362). They further note that whereas “some evidence of delayed extinction emerged from laboratory experiments, the results of clinical studies are embarrassing for a preparedness theory of phobias” (p. 362). In summary, they argue that because preparedness theory is built on evolutionary arguments and is therefore essentially untestable it can only be considered an acceptable theory if it both has its predictions supported by research and can not be accounted for by alternative
hypotheses. Given that neither of these criteria appears to be met, de Jong and Merckelbach conclude that there is no convincing evidence for the preparedness theory of the etiology of phobias.

**Rachman’s “three pathways” theory**

Besides preparedness theory, the most widely accepted theory of the etiology of fear is the so-called the “three pathways” theory espoused by Rachman (1976, 1977). Indeed, by the mid 1990s, this theory was considered as “now universally accepted” (Menzies & Clarke, 1995a, p. 35). Essentially, the three pathways theory is just an extension of the classical conditioning theory to incorporate new modalities for learning. The seed for Rachman’s elaboration of traditional learning theory sprang from studies in social learning by Bandura and colleagues (Bandura, Grusec, & Menlove, 1967; Bandura, Blanchard, & Ritter 1969) that showed modelling to be at least as effective as systematic desensitisation in reducing snake fears. In 1968 Rachman found it necessary to rewrite the traditional traumatic theory of phobias to incorporate the research produced by observational learning. However, Rachman (1972) still regarded the clinical applications of observational learning, imitation and modelling to lie in the realm of treating phobias. It was not until his seminal paper in 1977 that Rachman applied the research on social learning to the acquisition, rather than merely the extinguishing, of fears and phobias in order to explain a number of problems with the classical conditioning paradigm.

After a review of the evidence, Rachman (1977) argued that conditioning theory did not provide a satisfactory comprehensive account of the etiology and maintenance of fears. In particular, it failed to explain why some people did not acquire fears after traumatic experiences, why reported fear rarely followed conditioning procedures, the difficulty in transforming some stimuli into fear signals, the uneven distribution of fears, the absence of apparent trauma in the genesis of many fears or phobias, and the capability for fear to be vicariously transmitted. To account for these issues, he employed two arguments. The first was the recognition that fears could be acquired via both vicarious and informational transmission as well as by classical conditioning. Experimental evidence supported the idea of vicarious transmission of fears while reason, rather than empirical evidence, rendered the acquisition of fears via informational transmission as being apparently “undeniable” (p. 384). The second argument Rachman resorted to was Seligman’s (1971) recently developed idea of biological preparedness. Rachman
concluded that the three pathways hypothesis and biological preparedness could together account for all of the characteristics of fears and phobias.

Support for Rachman’s three pathways theory has come almost exclusively from retrospective studies investigating whether people recall negative conditioning, vicarious and informational experiences as having occurred at some point in the past. Conventionally, adults or children are asked to remember events that occurred as far back as early childhood, when many specific fears are known to start. Many of the early studies made use of the Phobic Origins Questionnaire (POQ) developed by Öst and Hugdahl (1981) and designed to specifically tap Rachman’s hypothesis that fear could be acquired by his three nominated pathways. Section 1 of the POQ contains nine questions; two covering conditioning experiences, three concerning instructional learning, and four related to vicarious experiences, so that participants’ ‘pathways’ to fear can be classified as conditioning, vicarious learning, instruction/information or no recall. However, some later studies used a modified Origins Questionnaire (OQ; Menzies & Clarke, 1993a) which classified subjects into seven categories: conditioning, vicarious learning, informational/instruction, non-conditioning traumatic experience, always been this way, can’t remember, and can’t classify. In 1998, King, Eleonora, and Ollendick conducted a review of Rachman’s three pathways theory, and presented a summary of research findings on the origin of childhood fears and phobias. Their summary is presented in Table 2 with the addition of studies using adults as well as studies with children conducted since that time. It should be noted that in some studies, participants indicated all types of conditioning experiences they may have encountered so the totals do not add to 100%, whereas in other studies participants were categorised according to what the researchers or a panel of experts believed was the learning category most likely to be responsible for fear development.

Table 2 shows appreciable differences in the classification of conditioning events across studies, across phobic disorders, across study populations, and across time. Classical conditioning experiences in fear of spiders, for example, varies from 9.5% to 57.1% of study samples. Meanwhile, studies looking at dental fear show high percentages of subjects having experienced classical conditioning relevant events yet people with fear of water or heights have very few classical conditioning experiences. More recent studies also tend to show fewer experiences classifiable as conditioning events with more frequent categorisations of ‘non-conditioning traumatic event’ and ‘always been this way’.
Table 2
Summary of research findings on the origins of fears and phobias in children and adults

<table>
<thead>
<tr>
<th>Author</th>
<th>Phobia</th>
<th>Sample</th>
<th>Method of investigation</th>
<th>Phobic origins categories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimm, Janda, Lancaster, Nahl &amp; Dittmar (1977)</td>
<td>Misc. specific fears</td>
<td>45 females; age not specified</td>
<td>Structured interview</td>
<td>Direct conditioning</td>
<td>35.6</td>
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<td></td>
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<td></td>
<td>Vicarious</td>
<td>6.7</td>
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<td>Verbal instructions</td>
<td>8.9</td>
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<td></td>
<td>No recall</td>
<td>28.9</td>
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<td></td>
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<td></td>
<td></td>
<td>Unclassifiable</td>
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<td></td>
<td>Vicarious</td>
<td>27.5</td>
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<td>Instruction/information</td>
<td>15.0</td>
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<td></td>
<td></td>
<td>No recall</td>
<td>10.0</td>
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<tr>
<td>McNally &amp; Steketee (1985)</td>
<td>Animal phobias</td>
<td>22 adults (2 male, 20 female); aged 22–57 yrs</td>
<td>Structured interview</td>
<td>Conditioning</td>
<td>23.0</td>
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<td></td>
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<td>Vicarious</td>
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<td></td>
<td></td>
<td>Instructional</td>
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<td></td>
<td>No recall (always had fear)</td>
<td>68.0</td>
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<tr>
<td>Öst &amp; Hugdahl (1985)</td>
<td>Dental phobias</td>
<td>51 adults; aged 15–66 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>68.6</td>
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<td></td>
<td>Vicarious</td>
<td>11.8</td>
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<td></td>
<td>Instruction/information</td>
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<td></td>
<td></td>
<td>No recall</td>
<td>13.7</td>
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<tr>
<td>Davey (1989a)</td>
<td>Fear of dentists</td>
<td>47 adults (males and females)</td>
<td>Self-report questionnaire</td>
<td>1+ painful experience</td>
<td>93.6</td>
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<td>Close friend/relative receiving painful treatment</td>
<td>29.7</td>
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<td></td>
<td>Discussions/information</td>
<td>4.3</td>
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<tr>
<td>Merckelbach, Arntz, &amp; de Jong (1991)</td>
<td>Spider phobia</td>
<td>42 adults (3 males, 39 females); aged 17–54 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>57.1</td>
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<td></td>
<td>Modelling</td>
<td>71.4</td>
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<td></td>
<td>Informational learning</td>
<td>45.2</td>
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<td></td>
<td>No recall</td>
<td>7.1</td>
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<td>Ollendick &amp; King (1991)</td>
<td>Ten common fears</td>
<td>1092 children (553 boys, 556 girls); aged 9–14 yrs</td>
<td>Self-report questionnaire</td>
<td>Direct conditioning</td>
<td>37.0</td>
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<td></td>
<td>Vicarious conditioning</td>
<td>56.0</td>
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<td></td>
<td>Information</td>
<td>39.0</td>
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<td>Öst (1991)</td>
<td>Injection phobia</td>
<td>56 adults (13 males, 43 females); aged 17–58 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>57.1</td>
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<td></td>
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<td>Vicarious experiences</td>
<td>21.4</td>
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<td></td>
<td>Instruction/information</td>
<td>5.4</td>
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<td></td>
<td></td>
<td>No recall</td>
<td>16.1</td>
</tr>
<tr>
<td>Merckelbach, Arntz, Arrindel &amp; de Jong (1992)</td>
<td>Spider phobia</td>
<td>41 adults (1 male, 40 females); aged 15–61 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>22.0</td>
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<tr>
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<td></td>
<td>Modelling</td>
<td>9.8</td>
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<td>Informational learning</td>
<td>2.4</td>
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<td>Mixed pathway</td>
<td>56.1</td>
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<td></td>
<td></td>
<td>No recall</td>
<td>9.8</td>
</tr>
<tr>
<td>Doogan &amp; Thomas (1992)</td>
<td>Fear of dogs</td>
<td>30 children (15 boys, 15 girls); aged 8–9 yrs.</td>
<td>Child interview and questionnaire</td>
<td>1+ painful/frightening encounter with a dog</td>
<td>91.0</td>
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<td></td>
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<td></td>
<td></td>
<td>Father dislikes dogs</td>
<td>73.0</td>
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<td></td>
<td></td>
<td></td>
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<td>Distressing media reports</td>
<td>82.0</td>
</tr>
</tbody>
</table>
Table 2 cont.

Summary of research findings on the origins of fears and phobias in children and adults

<table>
<thead>
<tr>
<th>Author</th>
<th>Phobia</th>
<th>Sample</th>
<th>Method of investigation</th>
<th>Phobic origins categories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menzies &amp; Clarke (1993a)</td>
<td>Height phobia</td>
<td>50 adults (14 males, 36 females); mean age 19.8 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>18.0</td>
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<td>Information/instruction</td>
<td>8.0</td>
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<td>Non-conditioning traumatic event</td>
<td>12.0</td>
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<td></td>
<td>Always been this way</td>
<td>30.0</td>
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<td>Can’t remember</td>
<td>8.0</td>
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<td></td>
<td>Can’t classify</td>
<td>4.0</td>
</tr>
<tr>
<td>Menzies &amp; Clarke (1993b)</td>
<td>Water phobia</td>
<td>50 children (20 boys, 30 girls); mean age 5.5 yrs</td>
<td>Parent-completed questionnaire</td>
<td>Direct conditioning</td>
<td>2.0</td>
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<td>Vicarious conditioning</td>
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<td></td>
<td>Information</td>
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<td></td>
<td></td>
<td>No explanation</td>
<td>16.0</td>
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<td>Merckelbach, Muris, &amp; Schouten (1996)</td>
<td>Spider phobia</td>
<td>22 girls; aged 9–14 yrs</td>
<td>Child interview Child (reported here) and parent interviews</td>
<td>Direct conditioning</td>
<td>40.9</td>
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<td></td>
<td>Modelling father</td>
<td>13.6</td>
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<td>Modelling others</td>
<td>4.5</td>
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<td>Information</td>
<td>4.5</td>
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<td></td>
<td>Always been afraid</td>
<td>45.5</td>
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<tr>
<td>King, Clowes-Hollins, &amp; Ollendick (1997)</td>
<td>Dog phobia</td>
<td>30 children (14 boys, 16 girls); aged 1-12 yrs</td>
<td>Parent-completed questionnaire</td>
<td>Direct conditioning</td>
<td>26.7</td>
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<td>Vicarious conditioning</td>
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<td>Information</td>
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<td></td>
<td></td>
<td>No explanation</td>
<td>13.3</td>
</tr>
<tr>
<td>Graham &amp; Gaffan (1997)</td>
<td>Fear of water</td>
<td>36 children; aged 5–8 yrs (9 only with current fear)</td>
<td>Parent-completed questionnaire</td>
<td>Direct conditioning</td>
<td>0.0</td>
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<td></td>
<td>Vicarious conditioning</td>
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<td></td>
<td></td>
<td>Fear present at first contact</td>
<td>78.0</td>
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<td></td>
<td></td>
<td>No explanation</td>
<td>22.0</td>
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<tr>
<td>Merckelbach &amp; Muris (1997)</td>
<td>Spider phobia</td>
<td>26 girls; mean age 12.6 yrs</td>
<td>Child interview</td>
<td>Direct conditioning</td>
<td>23.1</td>
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<td>15.3</td>
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<td>Information</td>
<td>3.8</td>
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<td></td>
<td>Always been afraid</td>
<td>61.5</td>
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<tr>
<td>Taylor, Deane, &amp; Podd (1999)</td>
<td>Fear of driving</td>
<td>109 adults; mean age 46.5 yrs</td>
<td>Self-report questionnaire</td>
<td>Classical conditioning</td>
<td>21.2</td>
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<td>Information conditioning</td>
<td>5.9</td>
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<td></td>
<td>Mixed conditioning</td>
<td>11.8</td>
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<td>Non-conditioning traumatic</td>
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<td>Always been this way</td>
<td>27.1</td>
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<td>Cannot remember</td>
<td>12.9</td>
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<td></td>
<td></td>
<td></td>
<td>Cannot classify</td>
<td>3.5</td>
</tr>
<tr>
<td>Menzies &amp; Parker (2001)</td>
<td>Fear of heights</td>
<td>54 adults (6 males, 48 females); mean age 19.6 yrs</td>
<td>Self-report questionnaire</td>
<td>Conditioning</td>
<td>14.8</td>
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<td></td>
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<td>Vicarious</td>
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<td>Information/instruction</td>
<td>7.4</td>
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<td>Non-conditioning traumatic</td>
<td>20.3</td>
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<td>Always been this way</td>
<td>35.2</td>
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<td>Can’t remember</td>
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<td>Can’t classify</td>
<td>1.9</td>
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One possible explanation for the trend to have fewer fears put down to classical conditioning events across time is that earlier studies often used the POQ devised by Öst and Hugdahl (1981) while a number of later studies used the OQ developed by Menzies & Clarke (1993a). While the earlier measure was based on Rachman’s three pathways theory the later instrument was developed in response to the non-associative model of fear acquisition proposed by Menzies and Clarke (1993a). In addition, the OQ enquires in some detail about possible CS-UCS pairings at the time of onset of the phobia, something which the POQ does not. Because each of the origins questionnaires has different theoretical underpinnings it might be expected that they would generate different results. Indeed, a study of 33 spider phobic people, who were provided with copies of both the POQ and OQ, found just that (Kirkby, Menzies, Daniels, & Smith, 1995). While the POQ found 51.5%, 54.5% and 48.5% of spider phobics to have had classical, vicarious and informational learning experiences respectively, the OQ found the corresponding categories to comprise only 6.1%, 6.1% and 3.0% of the sample respectively. While 15.2% of participants on the POQ were classified as not recalling the origin of their fear, 45.4% of participants were classified as having always been afraid of spiders on the OQ. It would appear then, that the strong support allegedly found for Rachman’s three pathways model might have been largely a product of the instrument designed to assess these pathways. This suspicion is shared by Marks (1987) who suggests that the methodology used by Öst and colleagues may have led to a significant overestimate of the occurrence of conditioned cases.

Another serious problem with the early studies taken to support Rachman’s (1977) three pathways theory is that even though they showed often high percentages of people experiencing negative conditioning, vicarious and informational experiences with their fear-relevant stimuli, there was no control group with which to compare these percentages. Indeed, only a few studies have compared the learning experiences of phobic or fearful individuals with those of non-fearful people. Davey (1989a), for example, found that people who were either anxious about receiving dental treatment or had been anxious in the past had had more painful experiences and were more likely to have been upset by a close friend or relative having received painful dental treatment, although there was no difference in terms of having been influenced by discussions or information to attend dentists less regularly. In another study, Merckelbach and Muris (1997) found that spider phobic children more often reported aversive conditioning,
modelling and informational learning experiences with spiders than did control children. However, other research paints a different conclusion. Menzies and Clarke (1993a), for example, found no differences in the learning history of height fearful and non-fearful participants. Similarly, studies have found no difference between dog phobic individuals and controls in terms of aversive learning experiences with dogs (Di Nardo, Guzy, Jenkins, Bak, Tomasi, & Copland, 1988; Doogan & Thomas, 1992).

One of the main problems with almost all phobic origin research is that it relies on retrospective accounts of encounters and assumes etiological significance for any experiences. While cross-sectional studies with retrospective accounts are relatively easy to conduct, the accounts are subject to both memory bias and forgetfulness. In addition, studies with children have not conclusively demonstrated whether negative experiences with fear-relevant stimuli are causes or consequences of fear (Ollendick & King, 1991). Concluding their review of Rachman’s three pathways theory as it applies to the etiology of childhood phobias, King et al. (1998) contend that retrospective studies are flawed and that, ideally, we need a large prospective, longitudinal cohort study in order to identify the processes responsible for the development of fears and phobias.

To date, the only longitudinal prospective study of fear is being conducted in New Zealand as part of the Dunedin Multidisciplinary Health and Development study (Silva & Stanton, 1996). Looking at water trauma and swimming experiences up to age 9 as a predictor of fear of water at age 18, researchers found no associations although children less confident in immersing themselves at age 9 reported more fear at age 18. While this study provides some fascinating insights into the development of fear of water, the low prevalence of fear of water in the population (less than 5% fearful and only about 1% considered to have a phobia) will make it difficult to obtain significant results. Unfortunately, given the time, expense and commitment required to implement a project like the Dunedin study, it is likely that few such longitudinal prospective studies will ever get under way. However, recent prospective testing of some of Rachman’s predictions has occurred using an experimental paradigm. In a series of experiments, Field and colleagues (Field, 2006; Field, Argyris, & Knowles, 2001; Field, Hamilton, Knowles, & Plews, 2003; Field & Lawson, 2003) manipulated information provided to children in order to determine outcomes on reported fear, using both social and novel stimuli. For example, providing children with negative information relating to a toy monster produced considerably more fear of the monster than when positive information was given (Field et
al., 2001). Although this approach is exciting and clearly warranted, it is still the case that it provides only “tentative support for the role of information in the aetiology of ... fears and phobias” (Lawson, Banerjee, & Field, 2007).

A final problem with the three pathways theory is that certain predictions by Rachman have not been confirmed. For example, Rachman (1977) predicted that intense fears of biological significance would more likely be associated with classical conditioning processes, whereas more common, everyday fears are probably acquired via information-giving or vicarious exposure. However, Withers and Deane (1995) failed to find support for the predictions that directly conditioned fears would be stronger and indirectly conditioned fears would relate to relatively weaker fears and have more elevated cognitive correlates. Instead, they found that reported memories were mainly of conditioning events for strong and moderate fears, implying that direct conditioning events may simply lend themselves to easier recall than indirect conditioning events.

Ultimately, the problem with Rachman’s three pathways theory of the etiology of fear is that it is not comprehensive. While processes consistent with classical conditioning may provide for the genesis of some fears, and there is evidence that both modelling and information transmission may also impact upon resultant emotion, we still need to ask why these pathways lead to fear. Retrospective accounts, cohort studies and prospective experiments, while providing supporting evidence for a possible ‘pathway’ to fear, do not bear on the underlying reasons for the development of fear. What is it about the information received which may lead to fear? Why for some people but not others? Rachman’s three pathways may indeed represent routes to fear, but more than three decades after they were proposed they remain incapable of informing us from where the pathways lead.

**Menzies & Clarke’s non-associative account**

Preparedness theory is not the only attempt to tie in the genesis of phobias to an evolutionary perspective. Menzies and Clarke (1995a), for example, take quite a contrary tack to that presupposed by the concept of preparedness in their non-associative theory. Whereas Seligman argued that human beings are biological predisposed or prepared to develop fears to some stimuli due to their supposed evolutionary significance, Menzies and Clarke argue that we are in fact born with a number of innate, evolutionary-relevant
fears. In reference to Rachman’s (1977) three pathways theory, Poulton and Menzies (2002) claim that the innate nature of these fears represents a fourth pathway to fear. According to the non-associative perspective, fear of some stimuli can arise in the absence of any previous experience with the feared stimuli. Rather than focusing on how we learn to be afraid, the emphasis is on how we learn to not be afraid. The non-associative theory is Darwinian in nature, and relies on classical conditioning to explain the absence of fears in some people. According to Clarke and Jackson (1983), the waning of a fearful response results from repeated non-traumatic exposure to a stimulus, while maintenance of fear may stem from poor habituation or a lack of opportunity for subsequent safe exposures.

Menzies and Clarke (1995a) claim several lines of support for the non-associative account of the development of fears and phobias. Indeed, Charles Darwin himself is quoted as saying “May we not suspect that the vague but very real fears of children, which are quite independent of experience, are the inherited effects of real dangers and abject superstitions during savage times” (Darwin, p. 288). Fear of the unknown, separation anxiety, the clasp reflex in infants, the ‘visual cliff’ phenomenon, and studies of early fear reactions in baby animals are examples of non-learned behaviours and are all believed to at least support the possibility of inbuilt fears as a survival-relevant mechanism. One of the main avenues of support, however, is argued to be findings using retrospective accounts of the origin of fears with many people reporting their fear as having always been present. For example, Menzies and Clarke (1993b) found that 58% of parents of children with fear of the water claimed the fear was present at their first encounter. Similarly, an unpublished study of spider-fearful undergraduate students by Jones and Menzies, cited by Menzies and Clarke (1995a) found 63% reported having been always afraid of spiders.

What counts as a non-associative fear? Poulton and Menzies (2002) list several criteria which they believe a fear must meet before it can be regarded as non-associative in nature. These include: (1) it has a plausible, evolutionary basis; (2) retrospective evidence with clinical cases indicates that associative learning has not taken place; (3) prospective evidence that associative learning is not required for the fear; (4) the fear is characteristic of other animals to whom it may have had an evolutionary adaptive advantage; (5) that a substantial genetic contribution to the fear can be found.

While McNally (2002a) congratulates non-associative theorists for “articulating a fresh perspective on the emergence of fears and phobias”, the non-associative account has
been heavily criticised. It has been pointed out, for example, that the non-associative approach infers causality from a failure to document learning experiences and that it largely ignores factors found to be vital to the development of early childhood fears, such as stimulus characteristics and the developmental level of the child (Muris, Merckelbach, de Jong, & Ollendick, 2002). In addition, Davey (2002), writing under the shadow of his own contrary neo-conditioning theory, argues that results of retrospective and prospective studies have been misinterpreted and suggests that the ‘nonassociative’ pathway would be better described as a ‘nonspecific’ pathway. Davey suggests that the non-associative account must still achieve three aims to be considered intellectually coherent: (1) provide evidence for the adaptive significance of prevalent phobias without resorting to post hoc constructions; (2) show why some clearly dangerous phylogenetic stimuli have not become the focus for phobias; and (3) demonstrate that ontogenetically fear-relevant stimuli differ in their etiology to phylogenetically fear-relevant stimuli.

Kleinknecht (2002) summarises the current state of opinion regarding the non-associative account as being “new and imaginative”, however “a number of questions remain to be resolved before we are able to accept their conclusions” (p. 159). While the non-associative account has provided an interesting account of why many people fail to recall incidents associated with fear development, it has so far failed to gain little more than circumstantial evidence for its main claims.

Davey’s contemporary conditioning theory

Perhaps the most theoretically developed, if not accepted, off-shoot of the classical conditioning model is Davey’s neo-conditioning approach. Fundamentally, Davey’s model extended classical conditioning theory by proposing an extra level in the conditioning process – that the CS presentation activates an internal representation of a stimulus which in turn mediates the conditioned response (Davey, 1983, 1987). In 1989, Davey presented a model which proposed that a number of UCS evaluation processes intervened between the cognitive representation of the UCS and the subsequent conditioned response (Davey, 1989b). These processes affecting the evaluation of the UCS included experience with the UCS alone, having received socially or verbally transmitted information about the UCS, and other response attribution processes. The evaluation of the UCS was argued to determine the strength and, indeed, the form of the CR in some instances. By 1992 the model was fully realised with Davey (1992a) adding in another
layer of processes. Davey proposed that human contingency learning could be considered in terms of “expectancies”, an idea advanced by Steven Reiss many years earlier (Reiss, 1980). The idea was that people assess the relationship between a cue (CS) and outcome (UCS) by making use of a variety of information, forming an expectancy of the likely outcome when presented with the CS. The schematic representation of the main features of Davey’s contemporary model of human conditioning is reproduced in Figure 3.

Davey proposed that his model differed from traditional conditioning theories in two main ways. First, there was the idea that a number of factors could influence the association between the CS and the UCS beyond the experienced contingency. Second, there is a ‘performance’ component, meaning that the strength of the CR is determined by nonassociative factors which influence the evaluation of the UCS. Although Davey’s model is discussed in some depth in Chapter 4 (Paper 1) of this thesis, a brief description of the some of the major components of the model and how they relate to aspects of specific phobias shall be dealt with below.

*Individual differences in fear acquisition*

Davey believed that his contemporary conditioning model could account for situations where people failed to acquire a fear despite the pairing of pain or trauma with a particular situation. This effect of prior exposure is also known as latent inhibition (Lubow & Moore, 1959). Like Eysenck, Davey (1992a) used the idea of latent inhibition to help explain the failure of a CR to develop despite a CS-UCS pairing. For example, not all people who experience pain while undergoing dental treatment acquire a dental phobia (Lautch, 1971) and only a low percentage of people who experience a traumatic flying event report a subsequent fear of flying (Aitken, Lister, & Main, 1981; Goorney, 1970). In conditioning terms, latent inhibition takes place when pre-exposure to a CS reduces conditioning of the CR when the CS and UCS are later presented together.
There are several theories concerning latent inhibition. Lubow and Moore (1959) originally proposed that a CS acquires inhibitory properties when it is presented prior to conditioning, interfering with subsequent excitatory conditioning. However, prior exposure to a stimulus has been found to subsequently retard not only excitatory but also inhibitory conditioning (Rescorla, 1971; Baker & MacKintosh, 1977).
MacKintosh (1983) has suggested that the effect of CS pre-exposure may result from either habituation processes or from a decline in the predictive value of the pre-exposed stimulus. Both these theories have their proponents. Wagner (1978, 1981), for example, has postulated that habituation may occur following CS-alone presentations as a result of the reduced ‘processing’ that occurs in relation to familiar stimuli or situations. MacKintosh (1975), on the other hand, takes a more cognitive approach, arguing that animals seek information which allows them to predict the occurrence of significant environmental events. If a stimulus is perceived as a poor predictor of changes in reinforcement it may be seen as unlikely to be the cause of future changes (MacKintosh, 1983). Similarly, it has been argued that a stimulus which is presented alone without reinforcement will come to signal an event of no consequence, subsequently making it difficult to be established as a signal for reinforcement (Lubow, Schnur, & Rifkin, 1976).

However, and despite the various theorising, the processes underlying latent inhibition in humans is still poorly understood.

Latent inhibition is well documented in the animal conditioning literature, having being demonstrated with a variety of animals using a number of indices of conditioning (Lubow, 1973). However, the results of human conditioning studies have generally proven equivocal. While some studies have demonstrated an effect for pre-exposure on subsequent fear (Maltzman, Raskin, & Wolff, 1979; Schnur & Ksir, 1969; Surwit & Poser, 1974) other studies have failed to find this effect (Grant, Hake, Riopelle, & Kostlan, 1951; Perlmuter, 1966). Siddle and Remington (1987) reconcile these findings by arguing that much of the research that has failed to demonstrate latent inhibition effects has not used appropriate control procedures necessary to establish stimulus specific and associative effects for pre-exposure. However, even when such procedures have been followed, the effects produced have been weak relative to those found in the animal literature (Siddle & Remington, 1987). More research is, therefore, required to establish the phenomenon of latent inhibition for humans in laboratory settings.

As discussed above, the process of latent inhibition does not convincingly explain the characteristics of fears and phobias. But Davey had additional recourse to the notion of an individual’s specific UCS evaluation, arguing that fear might not result if an individual is able to devalue the aversiveness of traumatic experience. He argued that there was a “variety of psychological processes that could lead to devaluation of the traumatic UCS” (Davey, 1992a, p. 43).
Apparent absence of trauma in clinical anamneses

The inability of some phobic individuals to remember a traumatic experience has been problematic for some theories of the etiology of fear and been a foundation for other theories, such as the non-associative account. Davey argues that an association can be learned between a CS and a UCS when the UCS is relatively unaversive (such as is shown during sensory preconditioning), but that later the aversiveness can be inflated through UCS revaluation. An analogue fear study by White and Davey (1989) using an electrodermal conditioning paradigm did indeed find that a picture of a triangle (CS) paired with an innocuous noise (UCS) could subsequently come to elicit a differential skin conductance response compared to an irrelevant picture after increasing the aversiveness of the noise in isolation from the CS. In summarising this result the authors concluded that the study showed that “a contemporary conditioning model of acquired fears is not bound by the need to discover contiguous stimulus-trauma experiences in the histories of clinical phobias” (White & Davey, 1989, p. 161), a claim repeated in a subsequent paper (Davey, 1992b).

It is perhaps unfortunate that despite Davey’s qualifying statement that such laboratory analog studies await clinical substantiation, this seems to never have occurred. Indeed, laboratory studies of sensory preconditioning and UCS inflation have been seldom revisited. Interestingly, a study by Hosoba, Iwanaga, and Seiwa (2001) managed to replicate the findings of White and Davey (1989), with increased skin conductance responses linked to UCS inflation, but when participants were asked to report on the aversiveness of the CS there was no differential responding related to the manipulations of UCS intensity. The finding that skin conductance responses but not subjective aversiveness were related to UCS inflation and deflation procedures is highly problematic for Davey’s theory and throws into question the ability of the model to explain real-world scenarios where traumatic experiences appear to be missing.

The uneven distribution of fears

The uneven distribution of fears within both clinical and normal populations is described by Davey (1992a) as being a “constant source of embarrassment to traditional conditioning accounts of phobias” (p. 44). However, because Davey’s model does not propose a straight CS–UCS contingency, this embarrassment can, presumably, be avoided.
It is argued that because conditioning is dependent upon prior expectations and beliefs about an event, one would expect an uneven distribution of feared stimuli based upon the outcome expectancy biases.

**Problems with Davey’s model**

One problem with Davey’s model is the lack of support for some core concepts. For example, findings regarding latent inhibition effects are dubious. In one study, Davey (1989b) reported that people who have had a painful experience with a dentist and who did not develop a dental fear had a history of dental treatment favourable to latent inhibition. He found that subjects who had always been anxious of dentists (A) and those subjects who had once been anxious but were currently relaxed (A→R) reported less time between their first dental treatment and their first painful dental experience than subjects who had either always been non-fearful (R) or who had been non-fearful but were currently anxious (R→A). However, the evidence for latent inhibition provided by these results is not as strong as Davey claims. If long, relative to short, pre-exposure to a stimulus decreases the likelihood of developing a conditioned fear response to an aversive encounter, then those subjects who had a greater time between their first dental treatment and their first painful dental experience would be less likely to develop fear. However, and contrary to expectations, the time between first dental experience and first painful dental experience was significantly longer for R→A subjects than for A→R subjects. Davey attempts to explain this finding by pointing out that people in the R→A group were more likely to have had a very painful experience than subjects in the other groups. However, almost half the R→A subjects did not experience a very painful event. It appears therefore that this explanation, at most, can only provide part of the answer to the question as to why subjects with a long history of non-painful experience with dentists eventually acquired a dental fear.

Other studies also provide mixed support for the idea that pre-exposure ‘inoculates’ against the acquisition of fear. Zimet (1992) found that people who knew a person with AIDS, compared to those who did not, reported less fear about interacting with a person with AIDS. However, Murray and Foote (1979) found no significant difference between phobic, high fear, and low fear subjects in experience with snakes. Also, personal contact with people with mental disorders does not appear to influence
either feelings of fear or personal rejection of mentally ill people (Murphy, Black, Duffy, Kieran et al., 1993). In a study of driving phobia, Ehlers, Hofman, Herda, and Roth (1994) reported that people with these phobias had had, on average, 10 years of driving experience before their fear began. Such a long history of driving should have made the development of a driving phobia extremely unlikely. Finally, in direct contrast to the proposition of latent inhibition, Bond (1996) has found that increased familiarity with cockroaches is related to higher rather than lower fear of cockroaches.

The biggest and most serious problem with Davey’s contemporary conditioning model is that by incorporating a number of cognitive components into the conditioning process it becomes capable of explaining almost everything yet experiences trouble in predicting specific outcomes given fixed stimulus characteristics. Any end result can be explained post hoc with reference to expectancies or UCS reevaluations, and the theory is so far removed from traditional conditioning theory that existing laws of conditioning have become almost infinitely malleable. While this situation is to some extent a result of the complexity of human experience leading to the development of fear, such a theory can be construed as no less than non-scientific. As Karl Popper (1963) famously remarked: “A theory which is not refutable by any conceivable event is non-scientific” (p. 37). While Davey (2002a) argues that the process of UCS revaluation serves as a useful tool in identifying how, and under what conditions, threat relevant associations can be formed, the reality is that very little work has been done which allows us to better understand such factors. Therefore, although Davey’s model may be used to explain many of the characteristics of fears and specific phobias, it is less helpful in predicting fear than the original classical conditioning model of the etiology of fear.

Cognitive theories - fear and cognition

The term cognition is used in a number of more or less related ways to refer to a faculty for the human-like processing of information and applying knowledge. Effectively, cognition is the act or process of knowing and is a combination of memory, thinking, concentrating, problem solving, perceiving and reasoning. Neisser (1967) has famously defined the term "cognition" as referring to “all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. It is concerned with these
processes even when they operate in the absence of relevant stimulation, as in images and hallucinations” (p. 4). Cognition or cognitive processes can be conscious or subconscious and can have a strong social component.

The success of the cognitive approach is evidenced by its current acceptance as the core model in contemporary psychology, having gradually gained a foothold during the 1950s when it began to usurp the behaviourist approach. It can be seen from the neo-behaviourist theories of the etiology of fear that a straight behaviourist model was simply incapable of explaining the many aspects of fears and specific phobias. The reality is that human beings, although all sharing a number of common aspects, are also all different and may react in entirely different ways to any given stimulus. These differences in reactions are a product of differences in how people think about a stimulus and may result from differences in a person’s goals, attainments, motivation, and personality. What might frighten one person may exhilarate or even bore another. The value of cognitive theories of the etiology of fear is that they can be used to explain individual differences in fear expression without the need for recourse to invariant stimulus-response laws.

Albert Ellis’s theory

In the 1950s Albert Ellis developed what he called Rational Therapy, later to be called Rational Emotive Therapy (RET). This new approach to dealing with certain psychopathologies stressed actively working to change a client’s self-defeating beliefs and behaviours (Ellis, 1969). Ellis related everything to core irrational beliefs and believed that through rational analysis, people could understand their errors in light of the core cognitive distortions and then construct a more rational position. In his ABC theory of RET (Ellis, 1991a), he proposed that Activating Events (A’s) in people’s lives contribute to emotional and behavioural consequences (C’s) primarily because they are acted upon by people’s Beliefs (B’s) about the Activating Events (A’s).

Later, Ellis was to identify 11 dysfunctional beliefs that people often hold and called the adoption of these extreme beliefs “awfulising”. One of these is that “if something is or may be dangerous or fearsome, then one should be constantly and excessively concerned about it and should keep dwelling on the possibility of it occurring.” More recently, and arising out of observations from RET, Ellis (2003) has elaborated on the idea of discomfort anxiety, which he defines as “emotional tension that
results when people feel...that their comfort (or life) is threatened” (p. 183). It is argued
that this type of anxiety shows up in “dangerous” situations such as fears or phobias of
heights, open spaces, elevators and trains. Ellis (2003) argues that people come to fear the
anxious or uncomfortable feelings associated with their phobic stimulus as much as the
stimulus itself and therefore must be helped to deal with the ‘awfulising’ about their
feelings of anxiety before they can start ‘anti-awfulising’ about the original feared object.

While Ellis’s use of cognitive distortions centred on harm may explain some
phobic stimuli they relate imperfectly to many other feared situations. Indeed, Ellis
(1991b) believes that people with simple phobias “are irrationally commanding that they
must perform well and must not suffer discomfort and are thereby largely creating their
own phobic reactions” (p.452). While pertinent to social and some other phobias, such a
view poorly fits with, say, a fear of mice or frogs or cockroaches. Perhaps not surprisingly,
because beliefs about specific phobias developed out of therapy, they are more focused
on treatment than on etiology. Also, although Ellis (1991b) argues that people with
phobias are almost always born and raised with strong tendencies to create discomfort
anxiety there is no research to support this contention. Ultimately, the major problem with
Ellis’s cognitive theory of the etiology of specific phobias is that is represents little more
than an afterthought to the broader theory and is therefore inadequately explained, tested
and proven. While dysfunctional beliefs centred on harm may be a part of the experience
of some people with phobias and fears they can not be used to account for the many
characteristics of specific phobias and fears.

Beck and Emery’s theory

Ellis was not alone in putting forward the idea that maladaptive or ‘faulty’
cognitions were an important component of anxiety disorders. Aaron Beck and colleagues
were also proponents of the idea that the type of emotional information and the manner in
which it is processed is crucial in the etiology, maintenance and treatment of anxiety
disorders, including Specific Phobia (Beck, 1985; Beck & Emery, 1985). Beck and Emery
(1985) argue that a sense of vulnerability lies at the core of anxiety disorders. Vulnerability
is defined by them as a person’s perception of themself as “subject to internal or external
dangers over which his [or her] control is lacking or is insufficient to afford...a sense of
safety” (p. 68). Upon encountering a potentially harmful stimulus a number of processes
are believed to come into play. Beck and Emery adopt the coping model of Lazarus (1966)
to describe this sequence of processes. First, an individual is believed to make a primary
appraisal of the situation, which takes the form of an initial impression of the potential
threat to their domain. If the situation is appraised as noxious, successive reappraisals are
made concerning such questions as whether the situation represents an immediate threat
to vital interests and whether it involves possible physical injury. While making a primary
appraisal, a person is posited as simultaneously making a secondary appraisal concerning
their resources for dealing with the threat. The relation of the person’s perceived coping
resources to the perceived danger of the situation is believed to determine the response of
the person to the situation.

An evaluation of the model

The central idea of Beck and Emery’s (1985) theory is that phobias result from a
systematically biased interpretation of the danger associated with a stimulus. Some support
for this argument may be seen as coming from a study by Thorpe and Salkovskis (1995)
which found high correlations between harm cognitions concerning spiders and both fear
and avoidance. There are, however, methodological problems in this study and what
Thorpe and Salkovskis label as harm cognitions include a number of harm-irrelevant
cognitions. In addition, Thorpe and Salkovskis (1995) found that the specific belief “I
would come to physical harm” was endorsed by only 24% of the people with phobias
prior to actual exposure to a spider.

Beck and Emery (1985) also rely to a considerable extent on the concept of
learned avoidance and preparedness in order to explain the etiology of specific phobias.
However, the process of learned avoidance has trouble explaining, for example, fear of
snakes where a person may not have actually encountered a snake. The belief that
phobias may stem from the learned avoidance of an already feared stimulus also fails to
explain both the origin of any pre-existing fear and why avoidance would lead to the
heightened experience of anxiety characterising specific phobias. In addition, there is
currently conflicting research in relation to the validity of preparedness theory (see
McNally, 1987), which Beck and Emery also advance in an attempt to explain the
individual differences found in fear acquisition.
Expectancy theory

In the mid 1980s Steven Reiss and Richard McNally proposed what they called the expectancy model of fear which was founded on three important assumptions (Reiss & McNally, 1985). First, it was assumed that almost all people are motivated to avoid stimuli or situations that arouse expectations of danger. Second, it was assumed that anxiety sensitivity is a personality variable related to both biological factors and to learning about the real and imagined consequences of becoming anxious. Finally, it was assumed that people come to learn that there are certain environmental cues which make them anxious.

The central tenet of the theory has been expressed by the formula \( F_b = E_d + (E_a \times S_a) \), where \( F_b \) represents fear behaviour or the tendency to avoid a feared stimulus, \( E_d \) is the expectation of danger, \( E_a \) is the anxiety expectancy and \( S_a \) is the anxiety sensitivity, which refers to the degree to which a person finds the experience of anxiety to be noxious. The formula implies that two categorically different reasons for avoiding a feared stimulus exist with either expectations of danger or expectations of experiencing anxiety motivating avoidance of a stimulus. Elsewhere, Reiss (1991) expands upon the theory, claiming that the key to understanding human fears is expectancies concerning what will happen when the feared stimulus is encountered and sensitivities which are related to the reasons a person holds for fearing the anticipated event. According to Reiss, some but not all fears are partially or wholly motivated by expectations and sensitivities to anxiety.

Effectively, Reiss and McNally’s (1985) concepts of anxiety expectancy and anxiety sensitivity are similar to the idea of fear of fear – that is, people are afraid of, or find aversive, their own reactions to the feared stimulus. McNally (1999) identifies an early reference to this concept in the writings of Montaigne in 1573, however it has recently been advanced by researchers in relation to anxiety disorders such as agoraphobia (Arrindell, 1993a, 1993b; Chambless & Gracely, 1989; Goldstein & Chambless, 1978). Although the vast majority of research on anxiety sensitivity has been conducted in relation to panic psychopathology (Zvolensky, Schmidt, Bernstein, & Keough, 2006), Reiss and McNally argue that anxiety expectancy may be a fundamental motivating factor behind phobic avoidance in specific fears.

Reiss’s expectancy theory has received little support for its main hypothesis, that some fears are motivated partially or wholly by expectations and sensitivities to anxiety. Or at least, there has been little support for types of fears not likely to be symptomatic of agoraphobia. As an example of the contribution of anxiety expectancy to a phobic
disorder, Reiss (1991) quotes one subject as saying “I do not worry that a snake will attack me; instead I worry that my fear of snakes will cause me to have a panic attack if I ever encounter a snake” (p. 145). Another example related to fear of flying is that there may be an expectancy of becoming anxious while flying, eliciting anticipations of other people noticing the fear of flying leading to possible embarrassment (Reiss & McNally, 1985). Interestingly, these examples appear to relate explicitly to Agoraphobia with Panic Disorder in the first instance, and Social Phobia in the second. In support of this contention, McNally and Louro (1992) found anxiety expectations to be very strong for people with Agoraphobia with Panic Disorder but non-existent for people diagnosed as having Specific Phobia.

A study by McNally and Steketee (1985), that found that people with severe animal phobias anticipated physical attack, panic attacks, concerns about insanity, embarrassment and having a heart attack upon encountering their feared animal, has been used to argue that fears can be motivated by expectations of danger, panic attacks or embarrassment (Reiss, 1991) and that people with severe animal phobias “are very much concerned about possible anxiety reactions to the feared animals” (Gursky & Reiss, 1987). However, the expected outcomes in the study by McNally and Steketee were not, in fact, rated by participants as underlying their fears and there is, therefore, no valid reason to conclude that the possible outcomes of an encounter with the feared stimuli are causally significant in animal phobias. To argue otherwise would be akin to stating that going hungry is a motivating factor for not taking one’s lunch to work. Indeed, the measures of anxiety expectancy described by Reiss and McNally (1985) and developed by Gursky and Reiss (1987) for specific fears involve outcomes (such as perspiring, feeling faint or nauseous, having your heart pound or beat rapidly, feeling nervous or shaky etc.) that are the precise physiological and emotional symptoms described as characterising a phobic of fear response.

Reiss discriminated between what he called fundamental fears, fear of anxiety, fear of illness, injury or death, and fear of negative evaluation, and common fears, such as fear of spiders, flying or going to the dentist, which are not inherently aversive but arise through the interaction of the fundamental fears and experiences. Perhaps the strongest support for his expectancy theory comes from studies looking at the association between anxiety sensitivity and a wide variety of stimuli and situations (Asmundson, Wright, & Hadjistavropoulos, 2000). For example, Taylor, Koch, and Crockett (1991) found spider
phobic university students to have a higher score on the Anxiety Sensitivity Index (ASI) than non-phobic controls assessed in a study by Peterson and Reiss (1987). However, a telling study by Taylor, Koch, and McNally (1992) found individuals with Specific Phobia to have the least anxiety sensitivity in comparison to participants with a range of other anxiety disorders, and found no difference in anxiety sensitivity between people with Specific Phobia and non-phobic control participants. The authors argue that “simple phobics may be unlikely to develop anxiety sensitivity beliefs because the ‘panic’ attacks in this disorder are predictable and situationally bound” (p. 257). In another study, Taylor (1993) found significant correlations between the ASI and agoraphobia ($r = 0.33, p < 0.01$), but not between the ASI and animal fears ($r = 0.06, p > 0.05$). Finally, Schoenberger, Kirsch, and Rosengard (1991) also found non-significant associations between a number of common fears and the ASI.

While many hundreds of studies attest to the role of anxiety sensitivity in a host of psychological disorders and chronic health conditions, there remains little convincing evidence that the expectancy theory originally proposed by McNally and Reiss can adequately explain the etiology of true specific phobias (that is, they can not be better classified as cases of, for example, Panic Disorder with Agoraphobia). Indeed, the expectancy model of fear (Reiss & McNally, 1985) has received little attention in more recent research. This is perhaps nothing more than the consequence of a theory which could not, in the end, gather enough support to sustain interest or belief. While the related concepts of fear of fear and anxiety sensitivity are useful for understanding a number of psychopathologies and chronic health conditions, they have poor explanatory power when it comes to specific fears and phobias.

**Harm-looming model**

A series of studies by Riskind and his colleagues have now extensively investigated the “harm-looming” model of the etiology of fear which was originally proposed in an unpublished manuscript by Riskind (1991, cited in Riskind, Kelley, Harman, Moore, & Gaines, 1992). Riskind has posited that the perception of “loominess” is essential to the understanding of fear, asserting that fear stems from a person’s anticipation that a danger is rapidly moving closer (Riskind et al., 1992). This anticipation is assumed to involve perceptions of both velocity and acceleration (Riskind, Moore, & Bowley, 1995; Riskind, 1997). Perceptions of velocity comprise the belief that danger is increasing over time
while the sense of acceleration involves the belief that the rate of increase itself is increasing over time. It is claimed that individuals fear stimuli in direct proportion to their perception of such forward motion in these stimuli and not simply to the extent that the objects or events are perceived as heralding aversive consequences.

The harm-looming model proposes that people’s reactions to anticipated future experiences are guided by cognitive scripts that contain various roles, props, and sequence rules. A person with an intense fear of spiders may therefore refer any movement of a spider to their fear script and, as a result, interpret it as looming movement. Indeed, a spider may even be perceived as looming when it is, in fact, motionless. Riskind et al. (1992) propose that the magnification and distortion of danger inherent in perceptions of loomingness may spark various threat cognitions (such as expectancies of harm) which generate and subsequently maintain anxiety.

The looming vulnerability model is seen as consistent with but extending Beck’s theoretical formulation of anxiety (e.g., Beck & Emery, 1985). It is argued that while exaggerated threat appraisals result in fear and anxiety, these are most intense when they involve dynamic mental scenarios of intensifying danger and rapidly rising risk (Williams, Shahar, Riskind, & Joiner, 2005).

Although looming appraisals of threats were originally conceived as a state elicitation, Riskind and colleagues (Riskind & Williams, 1999; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000; Williams et al., 2005) have also argued that a more durable cognitive pattern, termed the looming maladaptive style (LMS), can also occur. Riskind et al. (2000) argue that “the pernicious effects of the looming maladaptive style (LMS) can lead individuals to mentally simulate active and dynamic scenarios involving relatively mundane, non-threatening situations” (p. 838). Elsewhere, borrowing from both schema theory and preparedness theory, the LMS is proposed as being a schema-driven, evolutionary based process of threat/harm appraisal (Williams et al., 2005).

Riskind and Maddux (1994) claim that various developmental and ethological studies which examine reactions to looming stimuli (e.g., Ball & Tronick, 1971; Dunkeld & Bower, 1980; Schiff, Caviness, & Gibson, 1962) provide support for the harm-looming model. These studies demonstrate that looming visual stimuli elicit defensive reactions in both human and animal infants. Such responses indicate that the ability to avoid rapidly approaching visual stimuli may represent a basic visuomotor competence.
However, this conclusion requires two caveats. First, various differences have been found in the response to looming stimuli both within and across species. For example, Jones, Duncan, and Hughes (1981) found that different strains of domestic hens exhibited diverging behavioural and physiological reactions to looming humans. An environmental effect was also observed with pen-reared hens demonstrating more disturbance than caged-reared subjects to the looming stimulus. In addition, some animals show an inability to avoid collision with an approaching object (Rosinski & Keselica, 1977). This suggests that the capacity to avoid looming stimuli is not necessarily essential for ecological survival.

Second, King, Dykeman, Redgrave, and Dean (1992) have pointed out that defensive reactions to looming stimuli have only been reported for infants. Although adults are both capable of recognising expanding figures as approaching and can calculate time to collision (e.g., Schiff & Detwiler, 1979), overt defensive responding has not been reported for adults under laboratory conditions. Indeed, King et al. propose that during the course of maturation higher-level systems may come to either suppress or erase the basic avoidance response to looming stimuli. Consistent with this hypothesis, their series of studies found avoidance movements of the head to looming stimuli only when the subjects were distracted by a tracking task. Avoidance reactions were not obtained when subjects were not distracted.

The series of studies by King et al. (1992) raise serious problems for the loomingness model. The results indicate that looming stimuli are not necessarily accompanied by defensive reactions in adults. It appears that adults generally override any tendency to flinch away from an approaching stimulus and only exhibit avoidance behaviours where conscious processing of the looming stimulus is blocked. The harm-looming model provides no explanation of this finding. Further, King et al report that on 43% of the occasions where defensive movements did occur these were accompanied by laughter. Indeed, although Riskind claims that studies of the “loomingness effect” demonstrate fear (as well as agitation and startle) reactions to the rapid visual approach of a stimulus (Riskind & Maddux, 1993, 1994; Riskind & Wahl, 1992), there is, in actuality, no evidence that looming motions produce fear. King et al. report that some subjects actually found the experience of looming objects to be enjoyable. Clearly, this is inconsistent with the harm-looming model and undermines any support offered by ethological studies for this model.
Although a number of studies by Riskind and colleagues have been interpreted as providing strong support for the original harm-looming model, and for the role of perceived loomingness in the etiology of fears and phobias, there are a number of problems with these studies. For example, in an initial series of three studies reported in a single paper by Riskind et al. (1992) it was found that varying perceptions of the loomingness of danger discriminated spider fear from general anxiety from depression. Perceptions of the loomingness of spiders was higher for high spider-fearful than for low spider-fearful groups. However, the findings (Studies 1 and 2) are also consistent with the idea that the relationship between loomingness perceptions and fear is spurious, resulting from high correlations between threat cognitions (comprising uncontrollability, unpredictability and dangerousness) and both spider fear and perceptions of loomingness. In addition, the series of studies is characterised by various methodological and reporting problems. Statistical analyses are selectively reported and some potentially important analyses are not conducted. Also, the items that comprise a number of the measures are not described, and the significant effect for loomingness found in Study 3 of the paper may stem from demand characteristics resulting from the use of a repeated measures design.

A similar problem with demand characteristics may affect the study by Riskind and Maddux (1993), which attempted to experimentally manipulate both perceptions of loomingness and self-efficacy in relation to spiders. A more serious concern with this study, however, is the dubious relevance of its findings to the harm-loombing model. In an attempt to manipulate perceived loomingness, participants were shown film clips of a spider moving towards them, remaining stationary, and moving away from them. The manipulation check on the Motion conditions consisted of two questions which asked about the speed and the physical mobility of the spider. However, although these questions do indeed relate to perceptions of motion, discussion of the statistical analyses were frequently couched in terms of perceptions of loomingness. This is despite the fact that perceptions of loomingness were not measured in the experiment. Therefore, the conclusion by Riskind and Maddux that “experimentally induced perceptions of looming motion...influenced perceptions of fear” (p. 82) is a misstatement of their findings.

Problems also affect the series of studies by Riskind and Wahl (1992). The authors used a hypothetical situation in which the movement (hands and legs) of either a mental patient or a clown was manipulated. Perception of activity was determined by three questions (e.g., “How active is the person in this description?”). Once again, however, and
even though perceptions of loomingness were not measured and, in fact, not even
mentioned in the results sections of the studies, Riskind and Wahl concluded that their
“results provide strong support for the extension of the harm-loomng model to fear of
individuals who are psychiatrically ill” (p. 361). In reality, the results of the study only
support the proposal that active mental patients are feared more than inactive mental
patients and active or inactive clowns. The reasons underlying this state can not be
inferred from this study nor can they be attributed to differences in the perception of
loomngness.

Another study taken to support the harm-loomng model has been reported by
Riskind and Maddux (1994). In this case, the authors investigated perceived loomingness
in the fear of HIV or AIDS. The study found that the perception of loomingness of HIV
(this time operationalised via a four item self-report measure) was moderately correlated
with fear of HIV situations. However, the study also found perceived lack of control,
perceived danger, perceived likelihood of harm, and unpredictability of the HIV to
correlate moderately with fear of HIV situations. When collapsed into a global index of
threat cognitions, these variables predicted 41% of the variance in HIV fear scores.
Loomingness, however, only predicted 4.5% of the variance in fear of HIV after
controlling for threat cognitions. These results are similar to those reported by Riskind et
al. (1992) where the perceived loomingness of spiders accounted for only 2.8% and 4.3%,
in Studies 1 and 2 respectively, of the variance in spider fear scores beyond the
contribution of the threat cognitions measured in these studies. Once again, Riskind and
Maddux conclude that these results provide evidence for a mediated sequence whereby
perceived loomingness sparks threat cognitions that in turn generate fear. As mentioned
previously, however, the pattern of results found in this study is also consistent with the
proposal that the relationship between loomingness and fear is principally a spurious one.
Indeed, given more substantial measures of the threat cognitions, it may be that
loomngness does not contribute anything to predicting fear beyond the contribution of
the vulnerability variables.

Another study reported by Riskind et al. (1995) looked, once more, at the
perceptual distortion of movement and menace in spiders. Again, scores on the perceived
loomngness of spiders (measured, this time, by two items) were found to be higher for
high-fear than for low-fear participants. A discriminant function analysis revealed that
perceptions of the spider as looming towards the self was the biggest independent
contributor to the classification of participants as high- or low-fearful. Consistent with previous studies, however, scores on the Threat Cognitions Index were also higher for high- than low-fear subjects.

The harm-looming model forms the basis of many published studies on the etiology of fear and now has a dedicated laboratory (the Cognitive Vulnerability to Anxiety Lab) based at George Mason University in the United States devoted to researching the looming vulnerability model. Surprisingly, although a number of the studies by Riskind and colleagues suffer considerable flaws and major limitations, there has currently been no published work critical of this research program, and loomingness theory appears to have enjoyed an unchallenged intellectual run. Indeed, the only published research relating to the harm-loom ing model is that which has come out of the research program headed by Riskind, the chief proponent of the theory. It remains the case, however, that loomingness theory remains to be convincingly demonstrated.

**Self-Efficacy theory**

One of the major cognitive theories of specific phobias has been put forward by Bandura (1977, 1983) who proposed that a person’s self-efficacy or perceived ability to perform specific, effective courses of action, as well as their expectations about the likely outcomes of such actions, are major determinants of action. In relation to phobias it is argued that a person’s self-efficacy in performing an action related to the phobic stimulus is an important causal factor in the ability to actually perform that action. Several studies have provided support for the self-efficacy theory of phobic behaviour (Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy, & Howells, 1980; Bandura, Reese, & Adams, 1982; Williams & Watson, 1985).

Despite the support for self-efficacy theory, there are a number of problems with its use in the explanation of the etiology of specific phobias. First, studies investigating self-efficacy theory have failed to establish the direction of causality between self-efficacy cognitions and behaviour. For example, experimental manipulations of self-efficacy have tended to use procedures such as modelling which, according to social-learning theory itself, would be likely to affect phobic behaviour. Second, the validity of self-efficacy as a cause of behaviour has yet to be established. Third, the concentration of self-efficacy theory on phobic behaviours ignores the importance of anxiety and fear which are, by
definition, critical features of specific phobias. Finally, self-efficacy theory is incapable of explaining some of the characteristics associated with specific phobias, such as the uneven distribution of feared stimuli. For these reasons self-efficacy theory currently represents an inadequate conceptualisation of the genesis of phobic fears.

**Kirsch’s Expectancy Model of Fear**

Although the cognitive theories reviewed above constitute the major contemporary theories of the etiology of fears and phobias, they are by no means the only ones. For example, similar to Reiss’s expectancy model, Irving Kirsch (Kirsch, 1985a, 1985b, 1997) combined anxiety and danger expectancies with self-efficacy which was proposed as being an immediate determinant of approach behaviour (Figure 4). Like Reiss, Kirsch was interested primarily in response expectancies rather than stimulus expectancies, with the idea being that because the experience of extreme fear is aversive, the expectancy of its occurrence produces a strong motivation to avoid becoming afraid (Kirsch, 1985a). Very little empirical research has investigated this theory and it is currently little mentioned.

![Figure 4. Kirsch’s (1990) model of the interaction of anxiety expectancy and self-efficacy as predictors of fear and avoidance (adapted from Schoenberger et al., 1991).](image-url)
Barlow’s Triple Vulnerability Theory

In the Triple Vulnerability Theory, put forward by Barlow (1988), it was proposed that anxious apprehension in people with existing biological and psychological vulnerabilities increases the intensity of an alarm response during a frightening experience. Later, Barlow (2000, 2003) posited that a sense of unpredictability and uncontrollability lies at the core of anxiety and hypothesised an interacting set of three diatheses or vulnerabilities relevant to the development of anxiety. These are generalised biological or genetic vulnerabilities, generalised psychological vulnerabilities and specific psychological vulnerabilities (Figure 5). The third set of vulnerabilities was introduced to account for the development of some specific anxiety disorders, such as sexual dysfunction.

NOTE:
This figure is included on page 62 of the print copy of the thesis held in the University of Adelaide Library.

Figure 5. A model of the ways a specific phobia may develop (reproduced from Barlow & Durand, 2005).
Barlow’s theory rests squarely on behavioural theory and elsewhere he describes the causes of phobias as being a combination of biological and evolutionary vulnerability and the learning pathways of direct conditioning, observational learning and informational transition (Barlow & Durand, 2005). Barlow sees unpredictability and uncontrollability as focussed largely on possible future threat or danger, leading to anxious apprehension. A perceived inability to influence personally salient events and outcomes arises from the evocation of anxious propositions.

In a review of the relevant literature, and consistent with the Triple Vulnerability Theory, Chorpita and Barlow (1998) propose that a person’s psychosocial history with control influences the etiology of fear following a potentially traumatic experience. Perhaps because it has received very limited testing, there has of yet been no critique of this model. The lack of support for the model has been acknowledged by Barlow (2003), who has stated that despite there being retrospective evidence that generalised vulnerabilities lead to anxiety disorders, the theory requires in-depth prospective confirmation. Indeed, the only research directed at testing the model so far is a doctoral thesis by Steward (2005), who also noted that no published study had at that point tested a specific a priori causal model which links uncontrollable childhood stressors with subsequent perceptions of control and psychological distress. Using retrospective reporting of child maltreatment as a traumatic developmental stressor, Steward only found moderate support for the postulates of the Chorpita and Barlow (1998) model as hypothesised.

Other cognitive research

Irrespective of the problems in applying cognitive theory to specific phobias, there have been many studies investigating the various cognitive factors related to anxiety and phobias. Such cognitive concepts include negative self-focused attention (Sarason, 1975; Wine, 1971), patterns of anxious self-statements (Cacioppo, Glass, & Merluzzi, 1979; Huber & Altmaier, 1983), memory bias (MacLeod & McLaughlin, 1995; Rapee, McCallum, Melville, Ravenscroft, & Rodney, 1994; Watts & Coyle, 1993; Watts, Trezise, & Sharrock, 1986), anxious cognitive schemas (Beck, 1976), attentional bias (Martin, Horder, & Jones, 1992; Mogg, Mathews, & Weinman, 1989; Watts, McKenna, Sharrock, & Trezise, 1986), deficits in storage and retrieval processes (Mueller, 1980), perceived loomingness (Riskind et al., 1992), automatic questioning (Kendall & Ingram, 1987), and
cognitive asymmetry in negative and positive self-statements (Schwartz, 1986). However, despite the litany of cognitive concepts and mechanisms found to be related to anxiety and fear, it remains for the direction of causality between these mechanisms and anxiety disorders to be established.

Another problem with cognitive approaches to the investigation of specific phobias is their tendency to abstract the various cognitive phenomena, whether structures, propositions, operations, or products (see Kendall & Ingram, 1987), from the stimuli which give rise to them. Cognitive research, therefore, often loses track of what is significant about the specific stimuli that lead to cognitive distortions. In relation to specific phobias, the question which needs to be addressed, and which must be subsumed within a broader theoretical framework, is what makes some stimuli more likely to be feared than others? The answer to this question must be a necessary supplement to the reason why some individuals experience fear to certain stimuli whereas others do not, despite similar experiences. It is proposed, therefore, that to account for the various characteristics of specific phobias it is necessary to explain both stimulus differences in fear propensity and individual differences in fear acquisition. These will be covered in the next two chapters.

Summary

One of the primary justifications for the present research is the inadequacy of previous and current theories of the etiology of fear to explain many of the peculiarities of fears and phobias. In particular, theories of the etiology of fear have frequently received poor or mixed empirical support and have not successfully been able to account for (1) the origins of the fear, (2) individual differences in fear given similar experiences, and (3) the differential fear distribution. A summary evaluation of models of fear is presented in Table 3. In summary, it can be seen that there is, at best, mixed empirical support for current theories of the etiology of fear. However, and despite the problems characterising these theories, several of them currently occupy a prominent position in the phobic literature. It would seem, therefore, that there is a need for further theorising and empirical investigation into the area of fear acquisition and, more specifically, into the etiological factors involved in specific fears and phobias.
### Table 3

A summary evaluation of previous and current models of fear

<table>
<thead>
<tr>
<th>Models/Theories</th>
<th>Etiology</th>
<th>Individual Differences</th>
<th>Fear Distribution</th>
<th>Empirical Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classical Conditioning</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Incubation (Eysenck)</td>
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CHAPTER 2 – PERCEPTUAL CHARACTERISTICS OF FEARED STIMULI

Danger and harm

In attempting to describe why a given stimulus, such as a particular type of animal, tends to evoke a higher proportion of fear responses in the population than any other stimulus, the degree of danger or harm it represents is an obvious explanation. The importance of danger or harmfulness is emphasised by almost all theories of the etiology of specific phobias and has occupied a prominent place in many of those theories reviewed so far. It is surprising, therefore, that there has been comparatively little research into the relationship between perceptions of danger and fear. In addition, experimental studies generally use aversive or unpleasant stimuli rather than objectively dangerous or harmful stimuli when looking at response conditioning. Indeed, the association between danger perceptions and fear is probably seen by many as fundamentally axiomatic, meaning that a perceived need for further research does not exist.

One of the problems with the concept of danger is that it is very much a product of social construction, collective agreement, and socialisation (Simpson, 1996). While objective dangers do exist, perceptions of danger rarely derive directly from observation of the world. Simpson (1996) argues that the belief by psychologists that dangers exist as part of an objective environment is misplaced. She proposes that because danger is often unobservable it is impossible to determine with certainty when we are in danger, and because safety also rarely manifests itself in an observable way, there are similarly no safety signals that unequivocally indicate when we are safe. Indeed, even when danger may seem to be clear and present, Simpson (1996) argues that there is much room for inference and interpretation. Numerous examples as well as individual, cultural, geopolitical and temporal variations in danger perceptions support such a thesis. Simpson further proposes that people tend to perceive danger from one of three possible cognitive frameworks; that things are dangerous until proven safe, that everything is safe until proven dangerous, and that the environment is neutral and that only exceptional entities
may be considered explicitly safe or dangerous. It is useful to remember when thinking about danger perceptions that these are not just psychological but sociological constructs, which do not reflect objective conditions but are in many ways subjective in nature (Simpson, 1996).

Animal studies

Dangerous stimuli have been classified as one of the five subdivisions of fear-producing stimuli, along with novel stimuli, stimuli involved with learning, intense stimuli and stimuli learned from social processes (Gray, 1979). Most animals exhibit negative emotional responses towards specific stimuli that relate to persistent dangers in the ecology of that particular species (Boissy, 1995) and this has obvious survival relevance. Animal laboratory experiments using shock and other painful stimuli also show ready conditioning to harmful stimuli.

Human studies

Studies using humans are obviously limited in their potential to hurt or inflict pain on participants, so evidence of the relationship between danger and fear must be gleaned from other observations. Certainly, analogue pain studies using unpleasant or uncomfortable stimuli such as mild shock, loud noise, or blasts of air have been employed to mimic, albeit at a quantitatively different level, more noxious or harmful stimuli. Physiological measures are also often taken to be an indicator of fear. For example, Grillon and Davis (1997) using the startle response as an indicator of fear, found that mild electric shock (3.0 mA for 5 ms duration) could induce a stronger startle response. Even the threat of pain can produce a physiological reaction. Among individuals reporting both high and low dental fear, threat cues (the possibility of an electric shock) resulted in potentiated startle blinks, heightened skin conductance, and cardiac deceleration compared to non-threat cues (Bradley, Silakowski, & Lang, In Press). These types of studies, undertaken to test specific and varying hypotheses, all show that physiological and neurological changes can be induced as a response to being subjected to relatively mild pain or discomfort.

Several other directions of findings support the hypothesised role of danger in the etiology of phobias. Taylor and Rachman (1994), for example, found that people with
snake fears significantly overpredicted the degree of danger associated with a snake, suggesting a potential cognitive mechanism for differences between high and low fear individuals in the perception of danger. Although, subsequent studies failed to confirm this effect (Telch, Valentiner, & Bolte, 1994; Arntz, Hildebrand, & van den Hout, 1994), Taylor (1995) has been critical of the methodology employed by these researchers, and confirmation was eventually achieved in an experimental study by Wright, Holborn and Rezutek (2002).

Fears of commonly perceived dangerous animals also indicate a role for danger. Fear surveys report numerous stimuli, such as nuclear explosions, sharks, spiders, terrorist attacks, murderers, being hit by a car or truck, etc. which represent dangerous stimuli or situations. These have been grouped into a common factor which is generally labelled ‘Fear of death and danger’ (Bouldin & Pratt, 1998). Lipsitz, Barlow, Mannuzza, Hofmann, and Fyer (2002) found that 39% of their participants with specific phobia stated that their fear was focussed on potential danger or harm. Additionally, in an investigation of driving phobia, concerns focussed on accidents and injuries were two of the three most common concerns while driving (Taylor, Deane, & Podd, 1999). More recently, children’s nighttime fears to do with personal security were found to commonly (43.3%) involve expectations of harm (Gordon, King, Gullone, Muris, & Ollendick, 2007). Various other studies have found similar results, all indicating some association between danger and fear.

Neurophysiology

There has been considerable research into the neurophysiology of fear. The role of the amygdala in fear has been extensively studied and the midbrain periaqueductal gray (PAG) has also been implicated in integrating defensive behavioural and autonomic responses to threats (Keay & Bandler, 2004). Suggested brain areas are shown in Figure 6. However, it is difficult to separate in the literature the neurophysiological mechanisms implicated in the experience of danger or harm from that involved in fear. Animal studies often use the delivery of a painful stimulus to produce a fear response, so neurological changes may reflect either the effect of danger perceptions, the effect of pain, or the effect of resultant fear.
Problems with dangerousness per se

Despite the various lines of evidence, danger-relevance, by itself, provides an insufficient explanation of some clinical phobias. For example, many harmless animals such as mice, cockroaches, and moths may elicit substantial fear-responses from some people. In contrast, dangerous animals such as spiders may have low ratings of harmfulness. Davey (1992b) found that only 1.8% of individuals with spider anxiety reported harmfulness as the most frightening feature of spiders, with more than two-thirds reporting ‘legginess’, ‘sudden movements’ and ‘speediness’ as the most frightening features. In addition, studies demonstrate that there are significant differences in the fear ratings of animals even after controlling for harmfulness (e.g., Bennett-Levy & Marteau, 1983). It appears, therefore, that stimulus properties other than danger or harm are important in fear acquisition. This is not to say, however, that perceived danger is an unimportant factor in determining some fears. Many highly feared stimuli, such as snakes, spiders, and dogs represent the propensity for considerable aversive outcomes. However, by itself, this explanation of differential fear acquisition is not enough.
Disgustingness

Disgust is a basic emotion (Ekman, 1992) that has come to attract considerable interest from clinical psychologists. While originally overshadowed by the study of fear, disgust has begun to increasingly be seen as deserving study in its own right (McNally, 2002). A recent literature search of articles with the terms “disgust” and “disorder” using PsycINFO indicates that interest in this concept is on the rise (Olatunji & McKay, 2007). In particular, the role of disgust in the etiology and maintenance of phobic disorders such as blood-injection-injury fears and some animal fears has been increasingly investigated.

What is disgust?

One of the earliest definitions of disgust was put forward in Charles Darwin’s The Expression of the Emotions in Man and Animals (1872) where it was described as both “something revolting, primarily in relation to the sense of taste” (p. 257) but also, and secondarily, anything else which causes a similar feeling. More recently, Rozin, Haidt and McCauley (2000) have identified four critical components of disgust. These are the:

- behavioural component: manifested as a distancing from a stimulus or situation;
- physiological component: feelings of nausea and increased salivation as a concomitant of the nausea;
- expressive component: a facial reaction involving gaping, retraction of the upper lip, nose wrinkling, and dropping of the mouth corners, designed to discourage entry into the body of some food or substance or to encourage discharge;
- qualia, which is the mental or feeling component of disgust and may be described as revulsion.

At its core, disgust is believed to be focussed on food rejection, and requires a sense of oral incorporation, a sense of offensiveness and a concern regarding contamination (Rozin et al., 2000). However, the emotion of disgust is also elicited by body ‘envelope’ violations, some sexual acts, poor hygiene, and death. Physiologically, the disgust experience is associated with brain activation in the frontal area (Davidson, 1992) and basal ganglia structures (Phillips et al., 1997), although a recent study has found

**Disease-avoidance model**

Although the emotion of disgust is believed to have originated as a food-related emotion it has subsequently been transformed and greatly expanded in human cultural evolution (Rozin, Haidt, & McCauley, 2000). Davey and colleagues have proposed that the disgust-evoking properties of some animals may be an important causative factor in fear acquisition, independent of their potential danger (Davey, 1992b, 1993, 1994; Davey, Forster, & Mayhew, 1993; Jain & Davey, 1992; Matchett & Davey, 1991; Ware, Jain, Burgess, & Davey, 1994). In an investigation of spider fears, Davey (1992b) found evidence inconsistent with a straight-forward danger-defence model of animal fears. For example, fear of spiders was found to covary not only with fear of animals labelled fear-evoking (e.g., rats, snakes, and lizards), but also with fear of animals generally considered disgust-evoking, such as caterpillars, maggots, and slugs. It was proposed on the basis of these findings that several common animal fears may derive from a disease-avoidance rather than a predator-defence process (Davey, 1992b; Matchett & Davey, 1991). The disgust-evoking status of a particular animal was hypothesised to stem from the association of the animal with either (1) disease, (2) dirty or disease-ridden places or putrefying food, or (3) natural disgust-eliciting stimuli such as faeces or mucous.

Empirical support for the disease-avoidance model of fear acquisition has been mixed. For example, Davey (1993) found that even in a group of study participants who were given only disease-relevant information about an unknown animal, predicted fear was significantly more related to the subjects’ perception of possible attack than to their perception that they would become infected if bitten. Another study by Arntz, Lavy, van den Berg, and van Rijsoort (1993) found that disgust of spiders does not appear to play a very prominent role in spider phobias. However, this conclusion was based on disgust of spiders being operationalised via a single question (“When there is a spider in my vicinity, I believe that the spider is dirty”) and may, therefore, need replicating using a more substantial and psychometrically validated measure.
Despite the problems in the disease-avoidance literature, evidence suggests that disgustingness may represent, at least in relation to some animals, a considerably aversive property. In a study using people with specific phobias, spider phobics rated pictures of spiders as significantly more disgusting than did blood-injection-injury (BII) phobics and non-phobics, while BII phobics rated pictures of injections as considerably more disgusting than did spider phobics and non-phobics, indicating high content specificity for the association between disgust and fear (Tolin, Lohr, Lee, & Sawchuk, 1999). In another study, Tucker and Bond (1997) found that gender and disgust sensitivity predicted fear of harmless animals. Davison and Neale (1994) have illustrated just one pathway to how this may occur, describing the case of a woman who became terrified of frogs after mowing over some in her backyard. This fear stems not from a danger ascribed to frogs but to the disgust or revulsion and subsequent distress involved in chopping up frogs with the lawn mower. Other research suggests that disgust is not so much related to fear but to avoidance (Woody & Tolin, 2002). Indeed, disgust has been found to be a stronger predictor of spider avoidance than has anxiety (Woody, McLean, & Klassen, 2005).

A recent experimental study by Muris, Mayer, Huijding and Konings (In Press) found that providing different disgust-valenced information to children regarding the dirtiness, smell and diseased state of two particular Australian marsupials resulted in a significant increase in both perceived disgust and self-rated fear in relation to the animals. In contrast, stories presenting cleanliness-related information led to a reduction in both disgust and fear beliefs. The findings are consistent with other studies investigating the role of disgust induction in higher fear and anxiety (Davey, 1993; Davey, Bickerstaffe, & MacDonald, 2006; Webb & Davey, 1992).

Development

Interestingly, the only element of disgust which appears to be fully formed during human infancy is the rejection of bitter substances (Rozin et al., 2000; Steiner, 1979). At certain developmentally-relevant periods, the category of disgust is believed to emerge and between the ages of about 4 and 8 disgust breaks off from distaste (Rozin, Hammer, Oster, Horowitz, & Marmara, 1986). Rozin and Fallon (1987) have suggested that most children below about 8 years of age lack the understanding of the physiology of digestion and the process of incorporation, the particulate structure of the physical world, the separation of self and outside world and the temporal continuity of entities, which are
required to experience disgust in an adult manner. For example, disgust in relation to contamination by insects and other small animals requires an understanding of invisible entities such as germs, a concept taught to children and grasped only once children have the necessary cognitive wherewithal and sophistication. In regards to the other elicitors of disgust, it is believed that enculturation is required. Elicitors of disgust are known to differ across cultures and examples evoking moral disgust in particular may vary substantially in different cultures (Rozin et al., 2000).

Disgust sensitivity seems to have a familial transmission path. Significant correlations have been found between parents and children in relation to contamination beliefs in both the US (Rozin, Fallon, & Mandell, 1994) and the UK (Davey et al., 1993). In addition, a twin study has found little difference between the contamination beliefs of monozygotic and dizygotic twins, indicating minimum heritability (Rozin & Millman, 1987).

Disgust sensitivity

One of the extensions of research into disgust has been the idea that some individuals are more or less susceptible to the feeling and expression of disgust and this has been termed ‘disgust sensitivity’. Indeed, the measure of disgust in psychological research has generally involved the measure of disgust sensitivity, and the two are often used almost synonymously.

The most common current measures of disgust sensitivity are the Disgust and Contamination Sensitivity Questionnaire (DSQ) developed by Rozin, Fallon, & Mandell (1984), the Disgust Scale (DS) developed by Haidt, McCauley, & Rozin (1994), and the Disgust Emotion Scale (DES) developed by Walls and Kleinknecht (1997). The evolution of these instruments has allowed for an increasingly detailed examination of the role of disgust in fears and phobias. In particular, researchers have shown interest in both spider fears and blood-injection-injury fears. Numerous studies have demonstrated that disgust sensitivity is related to both these fears (Olatunji, 2006; Olatunji, Connolly, & David, In Press; Olatunji & Deacon, In Press; Olatunji, Sawchuk, Arrindell, & Lohr, 2005; Sawchuck, Lohr, Tolin, Lee, & Kleinknecht, 2000; Woody et al., 2005). For example, Tolin, Lohr, Sawchuk, and Lee (1997) found that spider and blood/injury phobics scored higher on five of the subscales of the DS, in comparison to controls. Sawchuck and
colleagues, using both the DS and the DES, which measures disgust sensitivity across five domains of disgust elicitors, found higher scores for people with blood-injection-injury phobias than for people with spider phobias or non-phobic people, however spider phobics also scored higher than non-phobics (Sawchuck, Lohr, Tolin, Lee, & Kleinknecht, 2000). Disgust sensitivity may mediate the association found between sex and contamination fears, with disgust sensitivity reported more by females than by males (Olatunji et al., 2005), and has been found to relate to fear of vomiting or emetophobia (van Overveld, de Jong, Peters, van Hout, & Bouman, In Press). Interestingly, a study by Merckelbach et al. (1993) found no difference in perceived dirtiness of spiders between spider phobics with high and low disgust sensitivity, indicating that dirtiness might play a role in spider fear irrespective of an individual’s specific disgust sensitivity. In addition, classifying the data by perceived dirtiness showed no differences in acquisition history or treatment outcomes between people with high and low disgust sensitivity.

Problems with the literature

Despite the plausibility of both disgust as a factor in fear acquisition and disgust-sensitivity as a potential personality characteristic which discriminates between fearful and nonfearful responses to some animals, there are several problems in the disease-avoidance literature which need to be addressed. First, the measures of both disgust and disgust sensitivity used in some studies have questionable validity. Disgust sensitivity to animals, for example, has been operationalised by some researchers using a scale which measures how much a person would be prepared to eat contaminated yet desirable food (e.g., Davey, 1994; Davey et al., 1993). Although Merckelbach, de Jong, Arntz, & Schouten (1993) found that spider phobics exhibited more disgust sensitivity than controls using this measure, the specificity of this scale raises doubts concerning its validity as an accurate measure of disgust sensitivity to animals.

Although a more valid and reliable Disgust Scale (DS) has been developed for some time (see Haidt, McCauley, & Rozin, 1994), only recently have studies using this measure, or the updated scales based upon this work, been published. However, calls have already been made to modify the DS, including the removal of 7 items, in order to promote a more psychometrically sound assessment of disgust sensitivity (Olatunji, Williams, et al., 2007). In addition, scales measuring disgust sensitivity have been criticised because they do not measure the perceived harmful consequences of
experiencing disgust, instead measuring ‘disgust propensity’ (Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). The scales have also been criticised because they are domain specific and their content overlaps substantially with symptoms of specific anxiety disorders, which may mean that correlations between these scales and measures of anxiety symptoms merely reflect shared item content rather than causal associations (Olatunji, Cisler et al., 2007). To address these concerns, Olatunji and colleagues developed the Disgust Propensity and Sensitivity Scale-Revised (Olatunji, Cisler et al., 2007), although this scale has not been extensively used to date. In any event, until some consistency emerges with the development and use of disgust scales, or at least until there is an assessment of their relatedness, it is difficult to compare results and conclusions from one study to the next.

Unfortunately, the investigation of disgust has at times relied on dubious methodology. Ware et al. (1994), for example, conducted a principle components analysis of the fear ratings of a number of animals and extracted two factors which they labelled as predatory animals and fear-relevant animals, despite the existence of alternative and perhaps more relevant labels such as exotic and common, or large and small. Yet, on the basis of the labels they applied, and after unjustifiably equating fear-relevant animals with disgust-evoking animals, Ware et al. (1994) went on to declare that it was “clear that fear of animals from the fear-relevant category is significantly associated with disgust” (p. 62). This conclusion was entirely unwarranted given that the concept of disgust itself was not actually measured in the study. In addition, the correlations between disgust sensitivity and predatory animal fears, and disgust sensitivity and fear-relevant animal fears, were both small and not significantly different from one another. However, Davey (1994) subsequently claimed that fear of fear-relevant animals was found to be highly correlated with disgust sensitivity whereas fear of predatory animals was uncorrelated with disgust sensitivity. In these instances, the study of disgust as a variable in fear acquisition has been inadequately carried out and interpretations arising from this research may be misleading.

**Negative outcome: danger and disgust**

There are at least two ways to look at the emotion of disgust in relation to the development and maintenance of fears and specific phobias. Given that disgust is a basic emotion based on food rejection and subsequently extended to other domains, one might view disgust as an aversive experience in the same way that feelings of danger constitute
an aversive experience. If danger and disgust are conceptually discrete and are specific to particular fears, then one or the other would represent a negative outcome capable of eliciting a fear and avoidance response. For a given fear, one and not the other would be related. This is consistent with the disease-avoidance model put forward by Davey and colleagues (Davey, 1992b, 1993; Davey et al., 1993; Matchett & Davey, 1991; Ware et al., 1994). However, if the concepts overlap, then each may function either additively or multiplicatively in the etiology of fear.

There is an almost total lack of evidence specifically related to the association of disgust and danger to fear responses. However, circumstantial evidence indicates that both are related to fear. For example, factor analysis of the Spider Phobia Beliefs questionnaire (Klorman, Weerts, Hastings, Melamed, & Lang, 1974) found both a harm and a dirtyness/contamination factor (Arntz, Lavy, van den Berg, & van Rijsoort, 1993), although the relationship of danger and disgust to fear was not specifically examined. More tellingly, Armfield and Mattiske (1996) found a correlation of 0.55 between perceptions of spiders as dangerous and disgusting. These findings indicate that perceptions of danger and disgust are not mutually exclusive and that danger and disgust may both be relevant concerns for any given individual.

Summary

In summary, there is now considerable evidence that disgust is involved in fear of animals, blood-injection-injury fears, and some other fears. Although a small number of experimental studies support the idea for a causal association, more and better research is needed to confirm this relationship. Still, there is sufficient reason to consider disgust to be an important factor in the etiology of at least some specific fears and phobias.

Unpredictability

While a person’s perception of danger or disgust may be important in fear acquisition and behavioural avoidance, there are other factors that also appear to be important in explaining the genesis of anxiety and fear. One variable that appears to contribute to both the development and maintenance of anxiety and fear is
unpredictability (Zvolensky, Eifert, Lejuez, Hopko & Forsyth, 2000), which may be closely related to uncertainty. Both of these concepts imply a lack of knowledge concerning some aspect of a stimulus, such as its identity, movement, location or timing of possible exposure. A number of studies across a wide range of areas have demonstrated a relationship between anxiety and fear and either unpredictability or uncertainty (Booth-Butterfield, Booth-Butterfield, & Koester, 1988; Craske, Zarate, Burton, & Barlow; 1993; Foa, Steketee, & Rothbaum, 1989; Kennedy & Silverman, 1985; Lox, 1992; Roberts, 1993). These shall be examined in more detail below.

Animal studies

There is an extensive literature related to the outcomes of animal studies of predictability. Certainly, animals appear to prefer predictable to unpredictable aversive events. For example, rats have been found to learn a variety of responses to receive a predictable rather than an unpredictable aversive stimulus (Abbott & Badia, 1979; Badia, Culbertson, & Lewis, 1979; Lockard, 1963). Numerous studies indicate that non-signalled or unpredictable shocks produce harmful physiological consequences compared to signalled or predictable shocks. For example, studies by Weiss in the 1970s found greater gastric ulceration in rats after exposure to predictable rather than unpredictable shock (Weiss, 1970; Weiss, 1971; Weiss 1977) and these studies have been confirmed in other laboratories (Gliner, 1972; Guile, 1987; Guile & McCutcheon, 1984). A classic study by Weiss (1971) using both yoked ("helpless") and non-yoked rats found reduced ulceration when shocks were preceded by a discrete warning signal, compared to rats who had no warning signal, irrespective of whether or not the rats were yoked. Unpredictable shocks have also been found to induce additional physiological changes, including weight loss, body temperature increases and higher levels of plasma corticosterone (Abbott, Schoen, & Badia, 1984). In addition, Lawler, Naylor and Abel (1993) found unpredictable shocks were associated with higher blood pressure in rats.

Despite studies finding that unpredictable aversive events are both less desirable and more physiologically harmful than predictable aversive events, conflicting arguments have been made. After examining the literature, Arthur (1986) concluded the exact opposite, that it is predictable shock that makes a situation more stressful. He argued that studies showing that absence of a warning signal was more stressful contained additional confounding conditions which explained those results. One of the problems identified in
the literature is that unpredictability and uncertainty are imprecise terms and there are many ways to manipulate them in an experimental setting (Imada & Nageishi, 1982). Arthur argued that these complexities accounted for the supposed effects of unpredictability. In addition, other individual studies have not found any effect for signalled versus unsignalled shock on gastric contractions and injuries to the stomach mucosa of rats (Garrick, Minor, Bauck, Weiner, & Guth, 1989). But Abbott and Badia (1986), in response to Arthur’s (1986) commentary, disagree with the argument that predictable shocks are more stressful, arguing that studies demonstrating such an effect are a result of the absence of a signal, effectively a ‘safety signal’, providing a period in which the fear induced by a warning signal and the subsequent shock would be expected to diminish. In support of this view, Scheuer and Greenberg (1982) found that rats preferred a predictable yet uncontrollable shock situation to an unpredictable yet controllable shock, which was interpreted as meaning that control over aversive events is less preferable to situations in which periods of shock and safety are well-defined. Research consistent with the ‘safety-signal’ hypothesis has also come from work on the appetitive bar pressing behaviour of rats (Seligman, 1968; Seligman & Meyer, 1970).

Based on an early review of the literature by Badia, Harsh, and Abbot (1979) the following firm conclusions were made: (1) that rats prefer predictable shock conditions; (2) they prefer predictable situations irrespective of the avoidability or otherwise of the shock; (3) the preference for predictable shock conditions occurs with different procedures, apparatus and shock delivery systems; (4) other animals such as fish and birds also prefer signalled conditions; and (5) that the effect, although robust, can still be effected by shock intensity, signal duration, intershock intervals and some other factors.

**Neurophysiology**

The neurophysiology associated with preferences for predictable aversive and pleasurable events is not well understood. However, a relatively recent hypothesis about dopamine function is that predictability in relation to favourable rewards is a major determinant of dopamine release (Hernandez, Haines, Rajabi, Stewart, Arvanitogiannis, & Shizgal, 2007). Indeed, the role of the midbrain dopaminergic system, as well as those of the cortex and the striatum, has been linked to learning behaviour and reward-predictive activities in several studies (Berns, McClure, Pagnoni, & Montague, 2001; McClure, Burns, & Montague, 2003; Mirenowicz & Schultz, 1994; Schultz, Dayan, & Montague, 1997). In
addition, Tanaka et al. (2006) found that different basal ganglia loops were implicated in reward prediction under predictable and unpredictable learning environments. However, while some work on the neurophysiology of positive predictable rewards continues to take place, the neural substrates underlying the experience of unpredictable aversive stimuli have yet to be properly elucidated.

**Human studies**

It is generally regarded that cued or predictable aversive stimuli in experimental settings give rise to transient fear responses whereas the absence of the cue indicates a period of safety. However, when aversive events are not signalled, or are unpredictable, a more sustained state of anxious anticipation occurs which is not relieved by temporary periods of safety (Ameli, Ip, & Grillon, 2001; Grillon, Bass, Lissek, Smith, & Milstein, 2004; Grillon & Davis, 1997). According to this argument, predictability is an important determining factor in producing either cued fear or contextual anxiety. There is now evidence to suggest that people with anxiety disorders have a high sensitivity to contextual fear which increases baseline startle responses, an analogue indicator of fear (Grillon et al., 2004). Effects have been found in individuals at high risk for anxiety disorders (Grillon, Dierker, & Merikangas, 1998) and in various groups of people with post-traumatic stress disorder (Grillon & Morgan, 1999; Grillon, Morgan, Davis, & Southwick, 1998; Pole, Neylan, Best, Orr, & Marmar, 2003). Consistent with the idea that unpredictability mediates emotional responding, a human study testing predictable against unpredictable shock found that the level of predictability of the shock was rapidly incorporated into the participant’s startle reflex, producing larger startle effects in the unpredictable than in the predictable condition (Mol, Baas, Grillon, van Ooijen, & Kenemans, 2007).

People are also more likely to report that predictable shocks are less aversive. In a study designed to examine individual differences in response to aversive situations, Katz and Wykes (1985) asked female volunteers to report on the level of distress and felt aversiveness of both predictable and unpredictable shock (also reported in Katz, 1984). Waiting for predictable shocks was rated as less distressing and the shocks were considered less aversive and were associated with lower autonomic indices of arousal than were unpredictable shocks. When asked to express a preference for predictable or unpredictable shock, 64% of participants reported a preference for the predictable condition. One of the strengths of the study was that only predictability about the timing
of the shock was manipulated, so the results were not confounded by other types of predictability information being provided.

Unpredictability outside of the laboratory can come in many different forms. For example, one important aspect of unpredictability in relation to animals appears to pertain to an animal’s movement. In a study by Lick, Candiotte, and Unger (1978), a group of phobic participants who were led to believe that the movement of their fear-relevant animal was unpredictable manifested significantly higher levels of cognitive and physiological fear than phobic individuals who believed the animal’s actions to be predictable. Another study has found that the perceived spatiotemporal unpredictability, as well as the perceived dangerousness and survival relevance, of a number of objects was significantly correlated with fearfulness towards those items (Merckelbach et al., 1988). However, after partialling out perceived unpredictability, the correlation between survival relevance and fearfulness was found to be non-significant. Based on these results it was argued that the uneven distribution of feared stimuli, which is traditionally explained by the supposed preparedness of biologically significant stimuli, may result predominantly from the perceived spatiotemporal unpredictability of these stimuli.

It also appears that different predictability perceptions exist between phobics and non-phobic individuals. Rachman and Cuk (1992) found that people who rated themselves as highly fearful of snakes or spiders perceived these animals as significantly less predictable than did control participants. They also found that decreases in self-reported fear, brought about following the observation of a modelling video, were accompanied by significant decreases in perceived unpredictability. While the exact nature of the relationship between declines in fear and unpredictability was not investigated, it is plausible that increased knowledge of the fear-eliciting animal’s movement served to decrease perceived unpredictability which then contributed to a reduction in subjective fear.

Perceptions of unpredictability are often linked to aversiveness across a range of behavioural, medical and psychological problems. People with epilepsy report serious concerns over the unpredictability of seizures (Hayden, Penna, & Buchanan, 1992), the unpredictability of multiple sclerosis results in uncertainties which permeate numerous concerns (Smeltzer, 1994), unpredictable behaviour is considered to be one of the most stressful aspects of having to deal with drug addictions in family members (Orford, Rigby, Miller, Tod, Bennett, & Velleman, 1992), and people with panic disorder report worries
regarding the unpredictability of panic symptoms (Craske, Zarate, Burton, & Barlow, 1993). Similarly, people with disorders such as schizophrenia are often associated with a high risk of social danger, with a perceived high risk of unpredictable behaviours related to social acceptance (Magliano, De Rosa, Fiorillo, Malangone, & Maj, 2004) and perceptions of danger (Fracchia, Canale, Cambria, Ruest, & Sheppard, 1976).

It appears that anxiety regarding uncertain or unpredictable events may also reflect a biologically inherited characteristic. A study by Gunner, Leighton, and Peleoux (1984), for example, found that one-year-old infants demonstrated more fearfulness to potentially frightening mechanical toys when the toys commenced playing unpredictably than when the toys commenced playing on a predictable schedule. Interestingly, the predictability of the length of time the toy played was unrelated to fearfulness. This suggests that only some aspects of the unpredictability of a stimulus may be important in eliciting fear. Kuzmak and Gelman (1986) argue that the understanding of random phenomena and the unpredictability of their outcomes occurs early in life, with their series of experiments showing that children at least as young as 4 years old could give explanations providing the appropriate characteristics of random phenomena.

There are numerous ways that unpredictability can be manipulated in experimental studies of animals (Imada & Nageishi, 1982). In a similar vein, there are several dimensions to the unpredictability and uncertainty of a stimulus which may be relevant to humans. Examples in relation to animals might be: (1) uncertainty of the identity and, therefore, the potential harmfulness of the animal; (2) unpredictability of the animal’s movements; (3) uncertainty or unpredictability of encountering an animal; (4) the unpredictability of the animal approaching or attempting to attack the person; (5) unpredictability of the length of the encounter; (6) unpredictability of the intensity of an aversive event (Arntz, van Eck, & de Jong, 1991); and (7) the unpredictability of actually suffering harm if attacked. As in laboratory research on animals, it is likely that some of these dimensions are more important in determining fear than other dimensions, and that individual differences in the order of importance of this fear-relevance may also occur.

Despite empirical support and the intuitive appeal of unpredictability as a fear-relevant variable it has received relatively little theoretical attention in relation to specific phobias. In addition, while a number of aspects of feared stimuli have been investigated in relation to anxiety (see Bennett-Levy & Marteau, 1983; Davey, 1989b; Doogan & Thomas, 1992; Ehler, Hofmann, Herda, & Roth, 1994; Murray & Foote, 1979), researchers have
failed to explore those factors which may underlie these aspects. Doogan and Thomas (1992), for example, found that adults with a high fear of dogs were significantly more likely than low-fear adults to be afraid of dogs’ barking, making sudden movements, snapping, growling, and jumping up. However, the reasons behind such fears were not investigated. Growling, for example, is most likely a feared event because it indicates aggression and therefore signals danger. Fear of sudden movement, on the other hand, may imply a fear of the unpredictability of dogs, a fear of the inability to escape if the dog decided to attack, or perhaps both. Such interpretations, however, are necessarily speculative due to the absence of any relevant empirical investigations.

A final area which deserves mention in relation to the role of unpredictability in the determination of fear is that the predictability of a stimulus may be either comforting or aversive in nature. For example, a snake may act predictably by either always fleeing from an encounter with a human or by always attacking a human when encountered. It cannot be assumed, therefore, that predictability is necessarily comforting. Indeed, unpredictability seems to occupy a dimension of aversiveness ranging from predictably good to predictably aversive with varying degrees of unpredictability in between. However, in the real world, predictably aversive objects or situations are rare. For example, very few snakes will always attack when encountered and it is also highly unlikely that an accident will occur every time a person travels in a car or aeroplane. An unpredictable aversive event can therefore be seen, in a practical and heuristic sense, as the opposite pole of a predictable event.

Summary

There is considerable laboratory and social research implicating unpredictability as a noxious environmental state. Predictability is preferred to unpredictability by both humans and other animals and under a variety of conditions. In addition, organisms almost invariably prefer predictable to unpredictable rewards (Daly, 1986). Research indicates that unpredictable aversive events engender sustained levels of anxiety while predictable aversive events may be less stressful because they also offer periods of relief when the threat cue is absent (Grillon et al., 2004). Nonetheless, predictability is a complex phenomenon, with many different aspects. It is also closely related under some circumstances to having control, in that control over a stimulus or situation may afford a measure of predictability. These complexities require understanding and failure to do so
may lead to a misinterpretation of research investigating the effects of unpredictability. Again, in some circumstances predictability is not preferred and this should be acknowledged. However, in relation to many common fears, unpredictability can generally be regarded as an unfavourable stimulus or situation characteristic and should be considered as a relevant and important determinant of fear and anxiety.

**Uncontrollability**

Another variable which appears to bear a relation to anxiety and fear is uncontrollability. Although Skinner (1996) has identified more than 100 control-related terms used in the psychological literature, control is generally defined as something like “the belief that one has at one’s disposal a response that can influence the aversiveness of an event” (Thompson, 1981, p. 89). However, it is also the case that lack of control per se is anxiety provoking for many individuals. There are a number of dimensions to lack of control in relation to specific phobias. Using animal phobias as an example, these may include: (1) the inability to exert influence over the movement, approach, or behaviour of an animal; (2) lack of control by the person over their response to an encounter with an animal; (3) the inability to control when an encounter with an animal will occur; and (4) the inability to avoid or terminate an encounter with an animal.

**Animal studies**

Control over an aversive stimulus appears to be able to reduce various physiological responses compared to lack of control (Weinberg & Levine, 1980). Weiss (1968, 1971), for example, has found that uncontrollable shocks are much more ulcerogenic for rats than escapable shocks, even after controlling for the number of shocks received. In another animal study, Drugan and Maier (1986) found that uncontrollable shocks led to the development of several pathologies including stress-induced analgesia whereas controllable shock resulted in few and more transient repercussions. Finally, a review of the available literature by Miller (1979) found that instrumental control leads to decreased anticipatory and impact arousal in relation to aversive environmental events.
Neurophysiology

Studies have looked at the neural mechanism by which uncontrollable stress leads to the various detrimental behavioural outcomes with which it is associated. Early investigations noted that escapable/controllable and inescapable/uncontrollable aversive experiences elicited opposite responses from the mesolimbic dopamine (DA) system (Cabib, & Puglisi-Allegra, 1994). In another study, neuronal activity in the noradrenergic locus coeruleus showed a dose-response curve to escape failures to inescapable shock (Pavcovich & Ramirez, 1991). More recently, however, attention has focused on the role of the dorsal raphe nucleus (Amat, Baratta, Paul, Bland, Watkins, & Maier, 2005; Amat, Paul, Zarza, Watkins, & Maier, 2006; Maier, Amat, Baratta, Paul, & Watkins, 2006), a small brainstem structure which provides serotonergic (5-HT) innervation to much of the forebrain as well as elsewhere. The role of the prefrontal cortex has also received attention, and there is a belief that it is the likely site where contingency/controllability information is processed, regulating dorsal raphe nucleus function (Amat et al., 2005). In addition, a study has found that activation of the pregenual anterior cingulate cortex (o/acc) and ventral lateral prefrontal cortex (VLPFC) accounted for 64% of the variance in the impact of perceived uncontrollability on self-reported pain perception (Salomons, Johnstone, Backonja, Shackman, & Davidson, 2007). It is believed that the prefrontal cortex may be an important mediating mechanism in the buffering effect of perceived control on the negative impact of stress by inhibiting limbic and brainstem stress-response structures (Amat et al., 2006). As neuroscience progresses as a field this area of understanding is sure to be investigated further.

Human studies

There are various other sources of support for the hypothesis that uncontrollability is an important variable in relation to specific phobias and fears. Lick and Unger (1975), for example, have reported that people with phobias experience substantially greater cognitive and physiological distress while looking at an uncaged feared animal from a considerable distance than when touching the caged animal. Although this finding may stem from the decreased potential of the caged animal to cause harm, self-reported reasons for this phenomenon related to feeling out of control when the phobic stimulus was uncaged compared to when it was caged. Other anecdotal reports have also revealed concerns about lack of control. Melville (1977), for example, reports a woman who had a
fear of flying as saying “I kept seeing everyone as puppets, all strapped to their chairs with no control over their destinies, me included” (p. 54). Also, Bandura (1983) has found that people who see themselves as unable to control a potentially aversive event view these events anxiously, imagine harmful consequences, and demonstrate phobic avoidance responses to these events.

Despite this support, experiments allowing subjects to exert varying degrees of control over stimulus situations have yielded inconsistent results concerning the causal role of control in relation to fear. Several studies have found that perceived controllability decreases the aversive nature of a stressor (Geer & Maisel, 1972; Glass, Reim, & Singer, 1971; Sartory & Daum, 1992). Sartory and Daum (1992), for example, found that spider and snake phobics who could switch off the presentation of fear-relevant slides experienced less subjective arousal and a more rapid attenuation of their phasic cardiac response than yoked phobic participants without such control. In contrast, a study by Craske, Bunt, Rapee, and Barlow (1991) found no significant effect on self-reported fear of control over exposure duration using similar procedures. There is also evidence that increases in perceived control may be associated with negative reactions (for a review see Burger, 1989). Rose, McGlynn, and Lazarte (1995), for example, found that snake phobics who had control over the distance a caged snake was brought towards them had relatively higher skin conductance responses (SCRs) than yoked subjects who were also snake phobics.

Rose et al. (1995) offered several possible reasons for the increased SCR found in their study for those participants having control. These included the idea that having control may lead to an increased perception of being evaluated and that having control increases the attention being paid to the task. Craske et al. (1991) also offered a number of possible explanations for their inability to find anxiolytic effects for control. One of these explanations concerned the subjects’ general lack of control over the exposure situation. It seems likely that some aspects of uncontrollability may be significantly more important to a phobic individual than other aspects. It is possible that, in the study by Craske et al., control over the duration of observation of the spider may not have been relevant to the actual concerns of subjects in relation to spiders. Control over the possible approach of the spider or the ability to escape, on the other hand, may have been considerably more salient.
There is much evidence to indicate that lack of control has detrimental effects on an organism, and is often perceived as an aversive condition by humans. However, the matter is more complex than this, with lack of control sometimes being less aversive than having control. In some instances, control only seems to be important when individuals have a desire for control, a concept operationalised by Burger and Cooper (1979). They propose that people’s general level of desire for control interacts with situational variables to account for behavioural differences in responses. It is argued that “differential responses covarying with desire for control will be more likely to occur in situations where the ability to control events is moderately advantageous” (p. 383). In addition, several theories of control have been put forward to make sense of the varying effects of control on cognitive, behavioural and physiological outcomes. For example, Weems and Silverman have proposed a model of control which distinguishes real control from perceived control, with combinations of these constructs defining various psychological states (Figure 7).

NOTE:
This figure is included on page 86 of the print copy of the thesis held in the University of Adelaide Library.

Figure 7. An integrative model of control (Weems & Silverman, 2006)
Theories of control

The reasons why lack of control causes anxiety and the conditions underlying these associations have been the basis of some speculation. Two of the more commonly referenced theories are the safety signal theory of control and the minimax theory.

Safety signal

There are two types of safety signals relevant to the association between control and anxiety. First, a distinct cue may signal the cessation of an aversive event, a process referred to by Mowrer (1960) as type-2 secondary reinforcement. Second, a safety signal may predict the absence of onset of an aversive event. As advanced by Seligman (1968), safety signal theory holds that when a CS predicts danger, the absence of the CS is interpreted as reliably predicting safety. Humans or animals with a controllable response therefore have more safety signals than those with an uncontrollable UCS. Seligman argues that “this prediction of safety may be at least as important for an organism as the prediction of danger” (p. 402). Similarly, Gray (1971) argues that the lack of an anticipated punishment is a reinforcing event “and confers rewarding properties on stimuli (safety signals) which occur in association with it” (p. 170). The two different types of safety signals may be regarded as involving the learning of relief and respite, respectively (Lohr, Olatunji, & Sawchuk, 2007).

Safety signal theory has been criticised by Miller, who points out that it makes no prediction about the effect of controllability on impact and makes no prediction regarding potential control, since the subject in this situation refrains from responding even though this may be possible. However, a recent review by Lohr et al. (2007) concluded that safety signals may function in the control of emotional, physiological and instrumental behaviour related to anxiety pathology and that anxiety disorders can “be construed as the relative contribution of cues that signal the onset of threat and cues that signal the potential for safety” (p. 124).

Minimax

In answering the question “How does having control over an aversive event affect human ‘stress’?”, Miller (1979) proposed that when individuals control aversive events,
they regard relief from the aversive consequences to be dependent on their own reliable response, minimising the chance of maximum future danger. However, when people have no control, they believe relief to be less stable, providing no guarantee that maximum future danger will be minimised. Ultimately, it is the stability of the factor responsible for danger which is most important to an individual, and because internal events are generally more stable than external factors, having control over aversive stimuli can be regarded as producing less stress or anxiety. Miller argues that although some external source may have been reliable and predictable in the past, a person can not necessarily count on that to continue in the future, as reliably as they could count on their own response. However, there are circumstances where internal factors may be regarded as less stable than external factors and in these instances uncontrollability should be more preferred and less arousing than controllability.

Whereas other theories of controllability hold that controllability adds nothing of benefit beyond predictability, Miller argues that controllability is important in determining the aversiveness of an outcome even when holding predictability constant. Miller also sees her theory as being future-oriented, in contrast to other theories which are present-oriented.

Control and helplessness: a reinterpretation

It is a well-established psychological principle that in situations where an animal learns that it has no control over a situation, and that whatever it does is futile, learned helplessness may develop. As a result, the animal will stay passive and not attempt avoidance or escape behaviour in the face of continuing unpleasant, harmful or damaging stimuli. Although originally based on animal studies (Seligman, 1972; Seligman & Beagley, 1975), the theory of helplessness was extended to humans shortly afterwards (Hiroto, 1974; Hiroto & Seligman, 1975; Miller & Seligman, 1975). Learned helplessness theory holds that perceived lack of control over events in one’s life may lead to a depressive state in some disposed individuals. In 1978 the model was reformulated to distinguish between universal and personal helplessness and for attributions of helplessness based on stable versus unstable, global versus specific, and internal versus external causes (Abramson, Seligman, & Teasdale, 1978). Martin Seligman, one of the pioneers of learned helplessness research, argued that people in a state of learned
helplessness adopted a particular explanatory style where they viewed problems as personal, pervasive, and permanent.

Although learned helplessness was originally conceived as underlying pathological states of depression, the hopelessness model of depression has subsequently been extended to a model of both depression and anxiety (Alloy, Kelly, Mineka, & Clements, 1990). According to this model, symptom patterns differ as a function of beliefs about the certainty or uncertainty of future outcomes and the aversiveness of the future outcomes. A number of studies have pursued the role of lack of control in anxiety disorders. For example, Chorpita and Barlow (1998) posit a major role for control in the development of anxiety. They identify numerous sources that indicate that diminished control in childhood may produce a cognitive style characterised by perceptions of events as being uncontrollable, leading to a psychological vulnerability for anxiety. Nonetheless, in a test of the Helplessness/Hopelessness model in relation to both depression and anxiety disorders, Waikar and Craske (1997) failed to find support for the idea that helplessness expectancies were related to a self-report inventory of anxiety symptomatology. However, this study used a very general helplessness measure centred on possible future life events. It may be that people with anxiety disorders are more focussed in terms of their perceptions of lack of control, with these perceptions related to their object of fear rather than to life generally.

**Relation of controllability to predictability**

One problem with the study of uncontrollability is that it often overlaps to some extent with unpredictability and many experiments have traditionally confounded these variables (for reviews, see Miller, 1979; Weinberg & Levine, 1980). In many instances, having control over the delivery or reception of an aversive stimulus also leads to increased predictability. Some theorists (e.g., Averill, 1973) believe that it is this element of predictability which is of central importance in accounting for the often anxiolytic effects of having control. In contrast, Seligman (1975), for example, has argued that having control has important consequences beyond predictability. Support for this latter proposal comes from a study by Geer and Maisel (1972) which found that having control over the presentation of aversive photographs, compared with knowledge of the time relationships of the aversive presentations, led to significantly lower SCRs.
Despite the theoretical debate, it seems that unpredictability and uncontrollability are conceptually and practically orthogonal on a number of dimensions. Using animals to illustrate this point, it is not necessarily the case that manipulating either unpredictability or uncontrollability automatically affects the other variable. For example, knowing that an animal might suddenly move towards you (unpredictability) would be independent of your perceived inability to deal with the animal if it did rapidly approach you (uncontrollability). Similarly, being able to effectively avoid a rapidly approaching animal does not make that animal less predictable in its movements. The orthogonality of these variables in such cases allows for their independent manipulation and, therefore, for more accurate conclusions to be gained concerning the causal nature of their relationship to fear. Nonetheless, it is still important to keep in mind that in some instances and under some conditions, control over the onset of a feared encounter may afford onset prediction and that this may have implications for the treatment of anxiety disorders (Zvolensky, Lejuez, & Eifert, 2000).

**Summary**

Control has been increasingly recognised as an important element in fear etiology and maintenance. In relation to some disorders, such as dental phobia, procedures for diminishing fear have been established with the explicit aim of trying to engender patients with an enhanced sense of control. However, the studies briefly reviewed above all indicate a role for control, whether perceived, desired, or real, in anxiety disorders. In relation to specific fears and phobias, self-reported concerns relating to control are common. For these reasons, control should also be seen as a highly important factor in the determination of specific fears.
CHAPTER 3 – THE COGNITIVE VULNERABILITY MODEL
OF THE ETIOLOGY OF SPECIFIC FEARS AND PHOBIAS

Based on the literature just reviewed, it appears that the variables of control, predictability, danger and disgust are all related to the expression of fear and anxiety to some extent. For the most part these studies look at these concepts in isolation from one another, with each considered as important in its own right. The purpose of this chapter, therefore, is to bring these four concepts together under the proposal that rather than being separate and unrelated they are in fact all involved together in the determination of fear.

Vulnerability schema

It is proposed that a combination of perceived dangerousness, perceived disgustingness, perceived uncontrollability, and perceived unpredictability lies at the heart of phobic fears. These fear-relevant variables are not totally independent but can be seen as contributing to a person’s perceived vulnerability. Indeed, perceptions of danger, disgust, unpredictability and uncontrollability are seen as integral to the aversive nature of vulnerability. It is proposed, therefore, that fear of animals, flying, driving, heights, storms, and many other situations, can all be conceptualised in terms of the perception of uncontrollability, danger, disgust, and unpredictability associated with them.

The term ‘vulnerability’ has lately been employed by researchers and incorporated into various models of anxiety disorders. For instance, cognitive vulnerability has become an important concept in cognitive theories of depression (Beevers, 2005; Scher, Ingram, & Segal, 2005; Timbremont & Braet, 2004) while Riskind and colleagues (Riskind, 1997; Riskind, Wheeler, & Picerno, 1997; Williams et al., 2005) have used the term ‘looming vulnerability’ in relation to their attempt to understand important characteristics of feared stimuli. However, in the former case the term vulnerability can more accurately be seen as meaning reactivity or susceptibility while in the latter case the concept of vulnerability is
narrowly confined to a very specific and somewhat obscure stimulus property. In still other research, so-called vulnerability factors are merely synonymous with predisposing factors (Wenzel, Haugen, Jackson, & Brendle, 2005). These definitions fail to capture the phenomenology of vulnerability; that is, the pervasive extent of subjective unease and associated feelings of incapacity and inability associated with a stimulus or event. Perceived vulnerability is an emotionally deep and highly motivating feeling which represents the experience of susceptibility to an outcome considered aversive. Irurita (1999) comes reasonably close in relating vulnerability to an inability to both retain control over a person’s life situation and to protect themselves against various threats to their integrity.

Only a smattering of research has attempted to examine what are here defined as the four central vulnerability perceptions in combination. Mineka and Kihlstrom (1978) provided one of the earliest attempts to relate unpredictable and uncontrollable aversive events to human psychopathologies. In their review of the literature relating to “experimental neurosis” they noted that this condition, which involves cognitive, affective, and somatic disturbances in an organism, seemed to be brought on by both the lack of control over, and inability to predict, an aversive event. It was suggested that uncontrollability and unpredictability may lead, in some complex and unspecified way, to the experience of either anxiety or depression.

There has been some support in the literature for the detrimental effects of unpredictability, uncontrollability, and negative outcome in combination. Weiss (1971), for example, found that the length of gastric lesions in rats after unsignalled shocks were significantly greater than for rats who had received signalled and, therefore, predictable shocks. For rats that also received uncontrollable shocks, the length of gastric lesions in both the signalled and unsignalled conditions were greater still, with the differential effect for shock predictability being maintained. The results indicate that the deleterious effects of uncontrollability and unpredictability in relation to an aversive stimulus are cumulative in nature.

Another study by Arntz et al. (1993), assessing the negative beliefs of spider phobics, found that 57% of the spontaneously generated spider-related beliefs referred to either the uncontrollable or unpredictable behaviour of spiders whereas 16% referred to negative evaluations of spiders. Arntz et al. also conducted a factor analysis of the spider-related beliefs from the Spider Beliefs Questionnaire (SBQ), revealing various themes. The
most prominent factor, accounting for almost 32% of the variance on the questionnaire, concerned ideas about the harm represented by spiders. The second important theme, labelled ‘hunter and prey’, included items such as “will drive me to the wall”, “cannot be shaken off once it is on me”, and “will control me” and clearly reflects a concern with feelings of uncontrollability. The third most significant factor was related to unpredictability and speed of movement. A fourth theme identified by Arntz et al. concerned ideas about the unpredictability and uncontrollability of spiders entering a person’s personal territory. These results support the hypothesis that a combination of perceived dangerousness, uncontrollability, and unpredictability are important factors in a phobic’s experience of fear.

The most compelling published evidence to date of the relationship between the cognitive vulnerability variables and fear comes from research by Armfield and Mattiske (1996) who looked at the relationship between each of the vulnerability variables and fear of spiders. Together the variables of uncontrollability, unpredictability, dangerousness and disgustingness accounted for over two-thirds of the variance in self-rated spider fear. Perceptions of uncontrollability and unpredictability had the largest correlations with spider fear. Adding further support to the significance of these results was the finding that the four vulnerability-related variables accounted for 55% of the variance in fear scores beyond the variance explained by a number of classical conditioning, informational and vicarious conditioning experiences. Although the study by Armfield and Mattiske (1996) looked at existing fear and could not establish causal direction, strong associations between the vulnerability variables and spider fear is enough to inspire further theorising along these lines.

Based on the available literature, it is proposed that common fears may be usefully conceptualised in terms of the perception of dangerousness, disgustingness, unpredictability, and uncontrollability associated with them. These variables ‘organise’ the perception of a stimulus along fear-relevant dimensions and may be seen as comprising a fear-relevant vulnerability schema. Kendall and Ingram (1987) define a schema as a representation of a person’s life experiences or knowledge that is stored in a cohesive fashion and acts to filter perceptions and guide judgements. In this case, the schema consists of the perception or sense of the uncontrollability, unpredictability, danger and disgust expected when interacting with a particular stimulus or situation.
A person’s vulnerability schema in relation to a particular stimulus is seen as being automatically and almost simultaneously activated following the perception of a fear-relevant object or stimulus. Upon encountering a stimulus the vulnerability schema is unconsciously invoked and subsequently provides a general or holistic perception related to the vulnerability associated with the stimulus. It is not necessary, therefore, for a person to consciously access any information relating to a particular stimulus in order for the person to react to that stimulus.

**Determinants of the vulnerability schema – personality traits and learning experiences**

It is proposed that there are two major determinants of a person’s perceived vulnerability to a given stimulus. The first source is individual personality traits or biological dispositions that may include such factors as autonomic lability, extroversion and neuroticism, sense of mastery, disgust sensitivity and locus of control. A growing body of research, for example, now attests to the relationship between fear and disgust sensitivity (Woody et al., 2005). In most cases, however, the investigations of personality correlates of anxiety states have looked at disorders other than specific phobias. More research is still required, therefore, in relation to the identification of the personality correlates of specific fears and perceived vulnerability.

The other likely source of a person’s perceived vulnerability are experiential factors. These factors are conceptualised broadly as any learning experiences with a particular stimulus involving those variables related to perceived vulnerability. It is proposed that a person may learn about a particular stimulus by any of the three pathways conceived of by Rachman (1976, 1977, 1990).

**Automatic affective reaction**

Once the vulnerability schema is automatically elicited two processes may be seen as following. The first is an automatic affective reaction similar to that described by
Öhman (1986; Öhman et al., 1985). The idea of such an unconscious or preattentive mechanism has received some support using backward masking studies which have found that a conditioned SCR can be elicited even though the participant is unaware of the presentation of the fear-relevant stimulus (Öhman & Soares, 1993, 1994; Soares & Öhman, 1993). These results support the idea of a preattentive or non-conscious process and have been used to explain the involuntary and supposedly irrational nature of a phobic’s response to the perception of a fear-relevant stimulus.

General cognitive evaluation

The second process which can be seen as following from the stimulus perception and activation of the automatic vulnerability schema is a controlled, cognitive processing of the stimulus and its overall significance for the individual. This takes the form of a general integrative appraisal of the stimulus and is somewhat analogous to the primary and secondary appraisals proposed by Folkman and Lazarus (1985). The general cognitive evaluation represents the final series of processes before the person’s conscious response set is initiated and may comprise a mixture of conscious, semi-conscious, and unconscious appraisals. As this cognitive processing is proposed as being influenced by the same sense of vulnerability that results in the automatic affective reaction, it is likely that the cognitive assessment of the fear-relevant stimulus is generally congruent with the preattentive reaction. A person who exhibits an instantaneous fear reaction to a stimulus would also be likely to express various cognitions that subsequently ‘explain’ their fear response.

The role of coping mechanisms in the mediation of anxiety

An important mechanism mediating a person’s anxiety response is their coping strategy or strategies. Numerous studies attest to the role of coping in mediating emotional responses (Folkman & Lazarus, 1985, 1988; Folkman, Lazarus, Gruen, & DeLongis, 1986; Girodo & Roehl, 1978; Steketee, Bransfield, Miller, & Foa, 1989; Zeidner, Klingman, & Itskovitz, 1993). There have been problems in the literature, however, concerning what coping actually involves. One definition of coping, for example, is that it is a “person’s
cognitive and behavioural efforts to manage...the internal and external demands of the person-environment transaction that is appraised as taxing or exceeding a person’s resources” (Folkman et al., 1986, p. 572). However, a number of problems undermine this definition. First, the inclusion of behavioural efforts as coping must be questioned. It seems likely that any behaviour merely represents the expression of a prior belief or idea concerning the potential consequences of such a behaviour. A person will not, for example, avoid snakes unless there is some conscious or unconscious preconception that avoidance may lead to decreased fear. Second, the definition by Folkman et al. (1986) implies that coping is a conscious strategy. However, this may only be true to a certain extent as it is possible that many people use unconscious strategies. Finally, there is a problem with the idea that coping is adopted when a person’s resources are appraised as being exceeded. A person’s resources include those that enable him or her to cope so if these are exceeded any coping strategies must necessarily be ineffective.

The problems in defining coping make analyses of coping effects difficult to carry out. It is generally assumed both within the coping literature and by the general public that the ability to cope with stressful events or objects is important in mediating emotional responses. However, relatively few studies have attempted to explore coping responses related to the development of fears and phobias, although differential effects of coping processes on fear responses have been demonstrated (Klingman, 1988; Winkel & Vrij, 1993; Rippetoe & Rogers, 1987). In one retrospective study of a large number of children by Sipes, Rardin, and Fitzgerald (1985), little evidence was found for the role of coping processes in overcoming fears. It was reported that almost 55% of children overcame their fear by “growing up” or realising that there was nothing to fear, suggesting perhaps an attenuation of perceived vulnerability. Another 22% used in vivo desensitisation or flooding. Only just over 7% of children used cognitive coping strategies in overcoming their fears.

There are a number of possible explanations for the results of they study by Sipes et al. (1985). First, it may be that cognitive coping is an ineffective means of overcoming fears. However, it may also be the case that conscious coping mechanisms are useful but that other approaches to dealing with fears are either more useful or are simply more preferred. Also, it may be that coping strategies are effective in overcoming fears and those fears identified in the study by Sipes et al. represent fears where coping actually failed to stop a fear developing. The efficacy of coping strategies prior to the formation of a fearful
response set was not evaluated. Another explanation of the results in light of the common idea that people generate coping strategies to overcome fears, is that coping represents a last ditch attempt to deal with a stressor which is incapable of being dealt with by more effective means. In particular, it may be that changes in a person’s perceived vulnerability, that is their vulnerability schema, represent important means of overcoming fears. Interestingly, Mooney, Graziano, and Katz (2001) found that internal self-control-type coping strategies accounted for 32.9% of the total variance in children’s current coping responses to night-time fears. It may be the case, therefore, that while cognitive coping strategies may not be successful in the long term with regards to defeating children’s night-time fears (Sipes et al., 1985), they are a common method of dealing with fears at any given point in time.

It may be that people with specific fears and phobias have important differences in terms of coping strategies when compared to people without these fears. Davey, Burgess, and Rashes (1995) found that people with Specific Phobia reported a greater use of physical avoidance coping strategies but decreased use of cognitive threat devaluation coping methods, compared to controls. This effect has even been found in relation to visual avoidance of feared stimuli (Tolin et al., 1999). For some people with fears and phobias, there may be no effective coping strategies for dealing with their concerns (Burns, 1980).

The role of other cognitive factors

Other important sources of influence on the general cognitive evaluation are cognitive factors such as attentional and memory biases, negative self-focused attention, patterns of anxious self-statements, and automatic questioning. It is hypothesised that these various cognitive processes may affect the general cognitive evaluation by distorting the information reaching and contained within the information processing system. It is also possible that at least some of the cognitive processes which have been found to occur in specific phobias have some effect on the automatic affective reaction. This may, once again, be through the biasing of information in relation to the stimulus.
Summary of the model

A diagram of the Cognitive Vulnerability Model as it has been described in this chapter is given in Figure 8. The model demonstrates the theory of fear development and the hypothesised process of fear elicitation, as well as how it feeds back into the vulnerability schema to affect future experiences with a fear-relevant stimulus.

Figure 8. Cognitive vulnerability model of the development and elicitation of fear
As described previously, a cognitive schema involving perceptions of danger, lack of control and predictability, as well as disgust, is developed. The vulnerability schema is based on information received about the particular stimulus, whether this be a reflection of fact, superstition, or personal account. Personality traits or dispositions act as important filters, enhancing or diminishing the importance of certain information, and laying the foundation for stimulus-specific cognitive vulnerabilities relating to control, prediction, danger or disgust. Encountering a stimulus activates the schema leading to both an automatic affective reaction in line with the thrust of the vulnerability schema, as well as a more general cognitive evaluation which may be affected by coping strategies and other cognitive factors. The end result is a coordinated fear response, with behavioural, emotional, cognitive and physiological outcomes, which may also have a social or environmental consequence, which feeds back into the vulnerability schema related to the stimulus or situation.

Implications of the model and explanation of the characteristics of specific phobias

The proposed Cognitive Vulnerability Model has several advantages over other approaches to the explanation of the etiology of specific phobias. One particularly important asset is its ability to explain the various characteristics of specific phobias. For the present, relevant phobias and fears will not be considered to include the blood-injection-injury type, which may not represent a ‘true’ specific phobia (Lumley & Melamed, 1992; Thyer, Himle, & Curtis, 1985), and various phobias within the other subtypes which may be more related to panic attacks or social phobias than to specific phobias. Fear of flying, for example, may be diagnosed as a symptom of either Panic Disorder with Agoraphobia or Specific Phobia (McNally & Louro, 1992). Also, many driving phobias are attributable to the occurrence of panic attacks while driving (Ehlers et al., 1994) and can, therefore, more accurately be seen as fears of having a panic attack while driving and not a fear of driving per se. Nonetheless, the theory is applicable to what may be called ‘true’ examples of natural environment and situational phobias as well as to animal phobias.
The characteristics of specific phobias identified earlier were their apparent irrationality or excessiveness, various modes of acquisition, differential distribution across potential fear stimuli, and the individual differences in fear acquisition despite similar experiences. It has been argued that previous and current theories have been inadequate in explaining all of these phenomena. In contrast, the proposed Cognitive Vulnerability Model offers a number of hypotheses to account for these characteristics.

(1) The excessive response characterising specific phobias is posited as stemming from the automatic affective reaction accompanying the perception of vulnerability. This response most likely represents a biologically important mechanism found in all animals that readies them for immediate survival-oriented behaviour. Support for this hypothesis has already come from the series of studies by Soares and Öhman mentioned previously (Öhman & Soares, 1993, 1994; Soares & Öhman, 1993). Although these studies were conducted in the context of testing one of the implications of Öhman’s preparedness model of the etiology of phobias, the results are also consistent with the precepts of the Cognitive Vulnerability Model.

(2) The various modes of acquisition have been explained not as causes of fears but merely as ways of gathering information about a particular stimulus. It is proposed that any means of acquiring knowledge about a stimulus may result in a perception of vulnerability in relation to an object or situation.

(3) The differential distribution of fears across potential stimuli is argued to be a result of specific differences in stimulus characteristics. In particular, the perceived unpredictability of the stimulus, its uncontrollability, and the potential and likelihood to cause harm or disgust are argued to be critical factors. The cognitive vulnerability model predicts that stimuli which are perceived as being unpredictable, uncontrollable, potentially harmful, and disgusting would have the highest proportions of fears, and those stimuli low on these vulnerability dimensions would be associated with few phobic fears.

(4) Finally, individual differences in fear expression are proposed to be caused by differences in perceived vulnerability, which are undergirded by various experiential factors and personality traits. Those people who perceive a stimulus as being highly uncontrollable, unpredictable, dangerous, and disgusting would demonstrate significant levels of fear and avoidance to that stimulus. Yet, the interaction of different experiences and different personality characteristics might lead other people to have low perceptions of vulnerability to the same stimulus.
These hypotheses provide a wealth of possible research directions aimed at disconfirming the model. While some of the components of the model have already been extensively tested, a host of new possibilities are evident. First, the relationship between the vulnerability variables and specific fears need to be confirmed for a range of stimuli and events. This should explain differences in fear acquisition and expression across people and also differences in fear propensity across various stimuli. Sub-conscious processing of vulnerability ‘perceptions’ should be evident. There is also a strong need for experimental and longitudinal research to confirm the hypothesised causality of the model. Unlike some other etiological theories of specific fears and phobias, the Cognitive Vulnerability Model makes specific, testable claims and this thesis is directed towards that very end.
PART TWO
CHAPTER 4 (PAPER 1) – COGNITIVE VULNERABILITY: A MODEL OF THE ETIOLOGY OF FEAR

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Clinical Psychology Review 2006, 26: 746–768.
Statement of authorship

COGNITIVE VULNERABILITY – A MODEL OF THE ETIOLOGY OF FEAR.
Clinical Psychology Review 2006, 26, 746–768.

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Conducted literature review, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: .................................
Linkage of paper to body of research

This first paper “Cognitive vulnerability: a model of the etiology of fear” presents a review of existing theories of the etiology of specific fear and introduces the Cognitive Vulnerability Model. Of course, this could have been achieved solely in the introductory chapters of this thesis. However, the paper serves a critical purpose in the publication process of subsequent papers. Without a published theoretical background, the studies which follow may have been considered to be lacking a conceptual underpinning. This paper therefore provides a reference point for future research. Indeed, the publishing of new theories of the etiology of anxiety disorders in scientific journals is infrequent. In relation to specific fears, only a handful of new theories have been published in the last few decades. To have published research relating to the Cognitive Vulnerability Model without having first published details of the model may not have been possible. It was therefore necessary that this paper be published or at least available in a pre-published form prior to submitting the subsequent studies for publication.
Introduction to paper and additional information

The first paper written and published for this thesis presents a review of the current state of play regarding etiological theories of fear and, following this, a description of the Cognitive Vulnerability Model of fear. Although the paper is lengthy, as a result of journal space restrictions, the literature review in the paper could not be comprehensive. Indeed, one of the paper’s reviewers commented that “the literature review is not sufficient”. Nonetheless, it would be an indulgent editor who allowed a comprehensive review of the literature to date in addition to detailing a new model of psychopathology. Such a review would require a separate paper. And yet, without a literature review the presentation of a new model of specific fear may not have been defensible and would have lacked a rationale. The paper therefore sought to balance the space devoted to reviewing the literature with that provided for describing the model, while still being cognisant of the article’s substantial size. It should be noted that large amounts of the paper have already been covered in the Introduction section (Chapters 1–3) of this thesis.
Abstract

This paper attempts to fill the partial theoretical vacuum surrounding the understanding of fear acquisition. A review of recent and contemporary theories of the etiology of fear is presented, serving as a justification for further theorising and allowing for greater understanding of those aspects of fear that remain to be adequately explained. A new model of the etiology of specific fears is subsequently put forward and the various aspects and implications of this model are discussed. How an individual perceives a stimulus is proposed as being critical in determining fear in relation to the stimulus. In particular, perceptions of the stimulus as uncontrollable, unpredictable, dangerous and disgusting create a schema of vulnerability. The cognitive vulnerability model integrates much of the extensive body of research on fears and specific phobias into a unifying theory of the etiology of fear. The model offers parsimonious explanations for the various characteristics of specific fears and phobias.
Introduction

Fear is a powerful and considerably aversive human emotion. While most people experience fear only infrequently, there are some people to whom fear and anxiety constitutes a debilitating disorder. These disorders cause significant distress and interfere appreciably with a person’s life. For this reason the study of anxiety disorders is important. It is hoped that by better understanding these psychopathologies, their causes and correlates, more effective treatments and preventative measures may be discovered.

One relatively common anxiety disorder is Specific Phobia which is defined as a marked and persistent fear that is cued by circumscribed or clearly discernible objects or situations (American Psychiatric Association, 1994). Relative to anxiety disorders such as Panic Disorder and Obsessive Compulsive Disorder, Specific Phobia has received little empirical investigation (Norton, Cox, Asmundson, & Maser, 1995). The reason for this relative neglect may stem from the, until recently, general acceptance of long-standing etiological theories of phobias. There has, however, been increasing criticism of traditional theories of phobic acquisition. This has resulted in some traditional conceptualizations of the genesis of fear being discarded, leaving a theoretical void as new and amended models try to establish themselves and gain empirical credence. In 1988 Barlow declared specific phobias to be the most familiar yet most enigmatic of the anxiety disorders. The recent conclusion by Ollendick, King & Muris (2002) that specific phobias are “multiply determined and over-determined” (p. 104) is indicative of both the complexities of specific phobias and the current lack of clear theoretical direction in the field.

There are a number of features that characterize specific phobias. Based on clinical and empirical data, these include the excessive reaction almost invariably elicited by the feared stimulus, the apparent various pathways to fear acquisition, the differential distribution of fears across potential stimuli, and the individual differences in fear expression despite often similar experiences. Unfortunately, however, previous and current theories of the etiology of specific phobias have experienced difficulties in adequately accounting for these characteristics.

The present paper introduces a new model of the etiological factors involved in fear acquisition. The model offers an alternative account of the various characteristics
associated with specific phobias without being necessarily incompatible with many previous theories. Before presenting this model, however, a critical review of the major contemporary theories will be undertaken. Such an examination reveals some of the major problems to date regarding theories of the cause of fear and specific phobias and serves as a justification for further theorizing in this area. It should be recognized up front that the literature review is intended to be selective rather than exhaustive as a full literature review lies beyond the scope of this paper. Nonetheless, it will be shown that there is a need to take cognitive factors into account when considering the ontogenesis of specific phobias. In particular, it will be argued that the perceptions of an object or situation as uncontrollable, unpredictable, dangerous, and disgusting are central to the etiology of fear. On the basis of an examination of these variables, a cognitive model of specific phobias will be advanced and the implications of this model discussed.

**Etiological theories of fear and phobia**

**Classical conditioning theory**

A number of contemporary theories concerning the etiology of specific phobias derive from the classical conditioning paradigm. The original learning conceptualization incorporated Pavlovian conditioning principles and stemmed from an influential study by Watson and Rayner (1920). It was found that by pairing a neutral stimulus with an aversive noise, a conditioned fear response could be established to the previously neutral stimulus. This conditioning explanation was extended by Mowrer’s (1939) two-factor theory of fear and avoidance which posited that once a neutral object or situation acquired fear-evoking properties it subsequently developed motivating capacities. Mowrer argued that fear reduction following avoidance acts as a reinforcer and serves to ‘stamp in’ new behavior. This theory was used to explain the avoidance behavior typifying phobic individuals.

Support for the classical conditioning theory of fear has come from a number of sources. First, the results of a multitude of experiments using laboratory animals have proved consistent with conditioning theory (Rachman, 1977, 1990). Also, observations of people involved in military combat have demonstrated that traumatic experiences often lead to the development of fears (Gillespie, 1945). Finally, several studies have found that a majority of phobic individuals consider classical conditioning experiences as being
A veritable explosion of research into the neural basis of emotion now underpins the classical conditioning account of fear acquisition. In particular, the role of both the amygdala and the hippocampus have been found to play critical and distinctive roles in fear conditioning processes (LeDoux, 1998; Maren, 2001). However, while both interesting and instructive, the relatively recent confirmation of neurobiological changes resulting from fear conditioning is, in itself, insufficient to explain the various complexities of fears and phobias as experienced by individuals.

The preparedness model

Despite the experimental support for the classical conditioning model of the etiology of phobias, several substantial problems became apparent with this model. Seligman (1971), for example, identified a number of seemingly incongruent findings within the behavioral literature. He believed that there were four dissimilarities which distinguished phobias from the conditioned fears proposed by advocates of the classical conditioning theory. These were their ease of acquisition, irrationality, uneven distribution across potentially fear-relevant stimuli, and high resistance to extinction.

On the basis of these discrepancies, Seligman (1970, 1971) proposed a new theory which moderated, without abandoning, the classical conditioning approach. The theory incorporated the use of genetic or biological explanations to account for some of the characteristics of phobias. More specifically, Seligman (1970) believed that phobias could best be understood as the result of biologically ‘prepared’ leaning and that this was supported by the observation that phobias commonly involve objects or situations that have been a threat or danger to the human species throughout its evolutionary history.

There are three major assumptions of Seligman’s (1971) preparedness theory of phobias. First, phobias stem from the experience of an initially neutral stimulus (CS) in temporal contiguity with an aversive event (UCS). Second, stimuli can be located along a continuum of preparedness for fear conditioning ranging from prepared to contraprepared. Third, CSs believed to be highly prepared for fear conditioning are those stimuli that have possessed biological significance for pretechnological people. Frequently feared stimuli
such as spiders and snakes are referred to as fear-relevant and are proposed as being highly prepared for fear conditioning (McNally & Reiss, 1982).

Öhman’s multiple-level evolutionary perspective

A number of significant contributions to contemporary preparedness theory have been made by Öhman and his colleagues (e.g., Dimberg & Öhman, 1983; Hugdahl & Öhman, 1977; Öhman, 1986; Öhman & Dimberg, 1978; Öhman, Dimberg, & Öst, 1985) who have used a Pavlovian electrodermal conditioning paradigm to test for differential responding to fear-relevant and fear-irrelevant stimuli. Based on this research, Öhman (1986) has put forward a comprehensive model of phobias as part of a broad-reaching perspective on the control of behavior.

Fitting into this multiple-level perspective is a model of emotional processing which has various implications for explaining phobic behaviors. After encountering a biologically primed or prepared stimulus, an affective reaction is believed to be elicited after a rapid, automatic, and holistic analysis of the stimulus. This reaction is seen as initiating a sequence of controlled processing procedures. In the case of phobias, it is proposed that these conscious, controlled processing mechanisms are overridden by the automatic affective response, resulting in the primary and secondary appraisals having only limited effects on efferent priming and subsequent overt responses. The primary and secondary appraisals involve evaluations of what is at stake and the availability of coping resources and options respectively. This account by Öhman (1986) has been used to explain the supposedly irrational and uncontrollable reactions of phobic individuals despite their conscious realization that the reactions are excessive.

An extension to Öhman’s work has recently been attempted by the addition of the concept of an evolved module for fear elicitation and learning (Öhman & Mineka, 2001). According to this account, the fear module is an evolutionary crafted mental, behavioral and neural system which shows selectivity in regards to inputs for fear conditioning, automatic elicitation, a resistance to conscious cognitive influences, and specific adaptive neural circuitry (Mineka & Öhman, 2002). According to Cummins and Cummins (1999), the motivation for an innate modules view is the ability to incorporate cognitive phenomena into evolutionary explanations, without which evolutionary cognitive psychology would come up short.
Alternative accounts of preparedness effects

The major advantage of preparedness theory is its ability to explain the differential associability of phobic fear responses to certain stimuli that can be construed as having been potentially dangerous to pretechnological men and women. This explanation is based on analogue studies showing that conditioned “fear” responses are acquired more easily to slides of supposedly fear-relevant stimuli than to slides of fear-irrelevant stimuli (e.g., Öhman et al., 1985).

Although preparedness theory is “already enshrined as psychological fact in most introductory psychology text books” (Davey, 1997) the research findings supporting the theory of biological preparedness have not gone unchallenged (de Jong & Merckelbach, 1997) and other mechanisms have been proposed to account for the differential acquisition of laboratory conditioned fear responses. Maltzman and Boyd (1984), for example, have argued that the significance, or “interest attracting” properties, of a stimulus and its assumed fear-relevance have traditionally been confounded in experiments and that apparent preparedness effects may have been produced because of the differential significance of fear-relevant and fear-irrelevant stimuli. The results of their study demonstrated that enhanced skin conditioned responding occurs to fear-irrelevant as well as fear-relevant stimuli when subjects perceive these as either very pleasant or very unpleasant. This result suggests that experimental findings taken to support biological preparedness may be explained by differences in the significance of the stimuli used in the experiments.

Ontogenetic or cultural preparedness has also been advanced as an explanation for the differential responding to stimuli that has been demonstrated in electrodermal conditioning studies (Bandura, 1977; Delprato, 1980; Rosenthal, 1979). According to this theory, certain cultural factors and developmental events prepare individuals to respond more to some stimuli than to others. However, initial studies of this hypothesis failed to find significant results for ontogenetic versus phylogenetic stimuli (Cook, Hodes, and Lang, 1986; Hugdahl and Kärker, 1981). McNally (1987), however, has criticized the assumed fear-relevance of the ontogenetic stimuli used in such studies. Indeed, experimental support for the cultural preparedness theory has come from studies using what is believed to be more salient ontogenetic stimuli. These studies have found no significant differences in conditioned electrodermal responses between technological and
biological fear-relevant stimuli (Hugdahl & Johnsen, 1989; Lovibond, Hanna, Siddle, & Bond, 1994).

Alternative explanations of differential fear conditioning in laboratory studies undermine both the explanatory power of preparedness theory and the genetically based mechanisms used by proponents of preparedness theory to account for differential fear acquisition. The identification of new mechanisms to explain the uneven fear distribution may, therefore, be required. However, both stimulus significance and ontogenetic preparedness theories are inadequate for this task. For example, although the cultural preparedness hypothesis explains the uneven pattern of phobic fears in the population, the reason why, for example, snakes or mice evoke fear in more people than do cats or birds is not explained. To argue that a stimulus acquires a cultural preparedness for fear because people generally fear it is tautological.

Although preparedness theory has received some empirical support using clinical populations of phobics (e.g., de Silva, 1988; de Silva, Rachman, & Seligman, 1977), a thorough review of the experimental literature by McNally (1987) has revealed a failure of preparedness theory to find support for a number of its key assumptions. One problem with the electrodermal conditioning studies used to support preparedness theory is the assumed survival-relevance of the stimuli used in the studies. For example, several studies used slides of mushrooms as representative of unprepared stimuli and slides of spiders as examples of survival-relevant stimuli. However, in a study by Merckelbach, van den Hout, Jansen, and van der Molen (1988), a group of independent judges rated fear of mushrooms as more survival-relevant than fear of spiders. This is consistent with the argument of Delprato (1980) who proposed that the threat from mushroom toxicosis would be more relevant to the survival of the human species than the threat from snakes and spiders combined. Merckelbach et al. hypothesized that stimulus features other than survival-relevance were responsible for previous results taken to support preparedness theory. Their study found that after controlling for dangerousness and unpredictability, supposed survival-relevance was not related to fearfulness.

Rachman’s reconceptualization of the classical conditioning theory

After a thorough examination of the literature, Rachman (1976, 1977, 1991) also proposed a number of arguments against accepting the traditional classical conditioning
theory of fear, which he believes, at best, can only provide a partial explanation for the genesis of some fears (Rachman, 1998). With respect to the characteristics of phobias these arguments relate to the inability of classical conditioning theory to account for (1) the failure of some people to acquire fear in fear-evoking situations, (2) the uneven distribution of fears in the phobic population, and (3) the finding that phobias and fears could apparently be acquired vicariously or through the reception of symbolic information.

In response to these apparent inconsistencies, Rachman (1977, 1990, 1998) proposed that there are three pathways to fear and that these can be seen as different ways of acquiring beliefs about the existence of fear-relevant contingencies. The three pathways are believed to be classical conditioning, vicarious acquisition through direct or indirect observations, and informational acquisition. In support of Rachman’s proposal, several studies have shown that a high percentage of phobic subjects attribute the origin of their fear to either one of these pathways or to a mixed pathway (Hekmat, 1987; Himle, Crystal, Curtis, & Fluent, 1991; Merckelbach, Arntz, & de Jong, 1991; Merckelbach, et al., 1989). The veracity of these self-reports has been given support by primate studies which have demonstrated that witnessing another monkey act fearfully towards a stimulus may lead to fear acquisition (Mineka, Davidson, Cook, & Keir, 1984; Röder, Timmermans, & Vossen, 1989).

Despite the support for Rachman’s theory, research that has also used a non-phobic control group has found either few or no differences between the learning histories of fearful and non-fearful subjects (Di Nardo, Guzy, Jenkins, et al., 1988; Ehlers, Hofmann, Herda, & Roth, 1994; Menzies & Clarke, 1993; Merckelbach, Amtz, Arrindell, & de Jong, 1992; Ten Berge, Veerkamp & Hoogstraten, 2002). In some cases the experience of pain or aversive events is related to less rather than to more fear (Phelan & Link, 2004; ven Wijk & Hogstraten, 2005). These results indicate that association-based learning experiences, despite the important status attached to them in the literature, do not effectively differentiate fearful from non-fearful individuals. The mechanisms and reasons underlying fear acquisition are, therefore, in need of explication for it is these factors, and not the experience of a learning event per se, which seem important in determining a person’s fear response. Indeed, it seems fair to conclude that learning experiences along the line of Rachman’s three pathways are not causes of fear or anxiety but merely serve as opportunities for the potential development of anxiety.
The non-associative account of fear acquisition

An intriguing variation on preparedness theory has been the non-associative account of fear acquisition, which turns preparedness theory on its head by positing not that people come to acquire fear but that people are born with innate fears and that what they learn is how to overcome these existing predispositions (Rachman, 2002). This idea is derived from Darwinian accounts of fear acquisition which propose that neither direct nor indirect learning events are necessary for the development of fear. Studies of separation anxiety in children (Bowlby, 1975) and fear of heights by babies using a ‘visual cliff’ paradigm (Gibson & Walk, 1960) provide evidence of fear expression prior to a learning experience. Clinical phobias are believed to occur later in life as a result of inbuilt fears failing to habituate. In support of this contention, studies have found that many people, when given the opportunity, report that their fear has always been present (Menzies & Clarke, 1993, 1995).

There is, however, an issue of recall error with the use of retrospective reports to obtain information on the development of fear. This is especially the case given that questions regarding phobic origins are predominantly asked of adults who must then try to recall long-distant events. For this reason prospective investigations provide better evidence of non-associative fear acquisition. The Dunedin study, a longitudinal investigation of birth cohorts of children in New Zealand, has provided some support for the non-associative theory of fear acquisition (Poulton, Davies, Menzies, Langley & Silva, 1998; Poulton, Menzies, Craske, Langley & Silva, 1999).

Despite support from both retrospective and prospective research, the non-associative account of fear acquisition has come under criticism. Davey (2002), for instance, argues that results from the longitudinal Dunedin study are also consistent with other theories. In addition, he criticizes evolutionary-based theories for their post hoc reconstructions of feared stimuli. For example, fear of insects may represent an apparently understandable evolutionary-relevant and therefore non-associative fear, however people’s awareness of the role of insects in disease contamination only commenced around the 1900s (Muris, Merckelbach, de Jong & Ollendick, 2002). Kleinknecht (2002) has raised several objections to the non-associative account of fear acquisition and has argued that a number of questions require answering before the non-associative account can be accepted as a ‘fourth pathway’ to fear. Finally, Marks (2002) has perceptively drawn attention to the erroneous dichotomy introduced by the term ‘non-associative’. He argues
that fear can not be viewed in black and white terms as being associative or non-associative. Instead, the extent of required learning to develop a fear should be seen as occupying a continuum, from requiring no learning at one end all the way to requiring a great deal of learning at the other end of the continuum. This begs the question then as to exactly what determines the requisite degree of learning, a question which the non-associative account of fear acquisition has thus far proven incapable of answering.

**Davey’s contemporary conditioning model**

In an attempt to account for both the inadequacies of the classical conditioning approach and for the implication of cognitive processes in fear acquisition, Davey (1989, 1992a) has proposed a comprehensive contemporary conditioning model of the etiology of phobias. According to this model a conditioned stimulus (CS) comes to elicit a cognitive representation of the unconditioned stimulus (UCS) through its learned association with the UCS. Davey (1992a) argues that this process depends upon a number of factors that determine the expectation that the UCS will follow the CS. These factors include information concerning situational contingency, socially and verbally transmitted information about the contingency, and pre-existing beliefs about the contingency. Davey (1989, 1992a) has used his model of human conditioning in an attempt to counter some of the traditional criticisms directed at conditioning accounts of phobias. These areas of criticism are argued to include the failure of many individuals to develop a phobia following the experience of a traumatic event, the apparent absence of trauma in clinical anamneses or recollections, the observation of incubation effects, and the uneven distribution of fears.

**Individual differences in fear acquisition**

Davey (1992a) has described two processes that may be used to explain the absence of fear responses, for some individuals, following a traumatic experience with a particular stimulus. The first process is latent inhibition, which is where exposure to a stimulus (CS) prior to conditioning is believed to cause the CS to acquire inhibitory properties that affect the associability of the CS and UCS in subsequent pairings (Klein, 1991). In support of this idea, Davey (1989) found that dental patients who experienced a traumatic or painful dental treatment, but did not acquire a dental fear, reported a history
of prior dental experiences favourable to latent inhibition. Results from other studies, however, appear inconsistent with the process of latent inhibition. Ehlers et al. (1994), for example, found that driving phobics developed their fears, on average, 10 years after they first learned to drive a car. Phobic and control subjects also experienced similar numbers of accidents and had similar outcomes in relation to these accidents.

The second process used by Davey to explain the lack of fear acquisition for some people following a traumatic experience is UCS devaluation. According to this process, individuals may use coping strategies such as denial, selective ignoring, or devaluation of the importance of a stressful event in order to cognitively neutralize an aversive UCS. Such a process can be termed ‘coping’. Several studies have provided support for the idea that coping plays a role in the mediation of emotional responses including anxiety (Folkman & Lazarus, 1985, 1988a, 1998b). Folkman and Lazarus (1988a), however, have found that the coping strategies of positive reappraisal and distancing were actually associated with an increase in worry and fear rather than a decrease for some groups of subjects. Similarly, studies of the efficacy of coping interventions for dental fears have found either no effects (Prins, 1988) or adverse effects (Harrison, Berggren, & Carlsson, 1989). In addition, a retrospective study of a large number of children by Sipes, Rardin, and Fitzgerald (1985) found that only seven per cent of children used cognitive coping strategies in order to overcome their fears.

**Apparent absence of trauma in clinical anamneses**

When phobic individuals are asked to recall the origin of their fears many report an absence of any trauma associated with the first appearance of their fear. In an attempt to explain this phenomenon, Davey (1992a) has argued that an individual may learn an association between a CS and a relatively innocuous UCS (a process called sensory preconditioning) and then, through an inflation of the aversiveness of the UCS, have the fear response to the CS considerably increased. Attempts to test the process of UCS inflation using humans in a laboratory setting have produced disappointing results. A series of studies by de Jong, Merckelbach, Koertshuis, and Muris (1994) found little support for the hypothesis that UCS inflation leads to increased skin conductance responses (SCRs) to preconditioned stimuli. Also, while White and Davey (1989) have provided some support for the process of UCS inflation using an electrodermal
conditioning procedure, this study can be criticized for using the same stimulus (a 1000 Hz tone) as both the UCS and the preconditioned CS.

Even assuming the validity of the processes proposed by Davey (1989, 1992a) there are still at least two major concerns related to the use of UCS inflation as an explanation of human fear acquisition. First, there is currently no empirical support for the process of UCS inflation in the ontogenesis of clinical phobias. Second, and most importantly, in the event that a phobic person is unable to explain the factors associated with the genesis of their fear, there appears to be no means by which any hypothesis concerning the acquisition of a phobic response via sensory preconditioning and UCS inflation can be evaluated. Using the processes advanced by Davey, an almost limitless series of speculations can be applied post hoc in order to explain any outcome. As such, these explanations are essentially untestable and, therefore, sensory preconditioning and UCS inflation appear to add little of value to an understanding of the etiology of fear and specific phobias.

**Incubation effects**

Davey (1992a) has argued that another problem with the traditional conditioning model of phobias was its inability to explain increases in anxiety (the CR) following CS-alone presentations. Davey believes that these incubation-like effects can be explained in some instances by UCS inflation occurring between successive CS presentations. Some support for the role of UCS inflation comes from a study by Jones and Davey (1990) which found retarded extinction of a differential fear CR following instructions given to subjects to rehearse the UCS. Additional support for the validity of incubation effects has come from a study by Sandin and Chorot (1989) who found resistance to CS extinction under conditions predicted by Eysenck (1976). Nicholaichuk, Quesnel, and Tait (1982; see also Bersh, 1980), however, have criticized the literature cited by Eysenck as having numerous methodological problems. In addition, they point to the fact that incubation is often inferred from retarded extinction rather than from an actual increase in response magnitude. Consistent with these criticisms, their study failed to find any evidence of incubation effects. Another problem with Davey’s (1992a) explanation of incubation effects is that, even if these effects can be produced in a laboratory, there is no evidence, to date, implicating incubation effects in the ontogenesis of specific phobias. Also,
assuming the validity of the process of incubation, there is little evidence that UCS inflation, in particular, is responsible for producing these incubation effects.

_The uneven distribution of fears_

In an attempt to explain the uneven distribution of phobic fears in the population, Davey (1992a) has argued that “any factor which increases the tendency for an individual to expect a stimulus to be associated with an aversive consequence should result in preparedness-like effects” (p. 47). Possible factors are proposed to range from cultural beliefs to biological predispositions. However, this account of the uneven fear distribution is vague. Davey also fails to discuss the mechanisms that may be underlying those factors supposedly responsible for preparedness-like effects. Finally, his endorsement of ontogenetic preparedness introduces additional problems into his theory. While ontogenetic fear-relevant stimuli have shown so-called preparedness effects similar to phylogenetic fear-relevant stimuli, this account of the uneven distribution of fears fails to adequately explain the characteristic of phobias which Seligman’s (1971) preparedness theory was originally developed to address. That is, if there is no difference between the associability of, for example, spiders and guns to a fear response, why are there so many spider phobias and so few gun phobias? As in other areas, Davey’s contemporary conditioning theory has problems in adequately accounting for this particular characteristic of specific phobias.

_From conditioning theories to cognitive theories of fear acquisition_

The preceding literature review has briefly highlighted some of the major problems associated with etiological theories based on a conditioning approach. Many of these problems can be seen as stemming from their inability to account for either the cognitive features involved in phobias, the particular features characterizing phobic disorders, or both of these factors. Although the neo-conditioning theories, which derive from and attempt to moderate classical conditioning theory, have been widely accepted as adequate etiological theories of phobias, there is another approach to the conceptualization of fear acquisition. This approach, although far from unified, reflects a cognitive orientation.
**Bandura’s self-efficacy theory**

One of the major cognitive theories of specific phobias has been put forward by Bandura (1977, 1983) who proposed that a person’s self-efficacy or perceived ability to perform specific, effective courses of action, as well as their expectations about the likely outcomes of such actions, are major determinants of action. In relation to phobias it is argued that a person’s self-efficacy in performing an action related to the phobic stimulus is an important causal factor in the ability to actually perform that action. Several studies have provided support for the self-efficacy theory of phobic behavior (Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy, & Howells, 1980; Bandura, Reese, & Adams, 1982; Williams & Watson, 1985).

Despite the support for self-efficacy theory, there are a number of problems with its use in the explanation of the etiology of specific phobias. First, studies investigating self-efficacy theory have failed to establish the direction of causality between self-efficacy cognitions and behavior. For example, experimental manipulations of self-efficacy have tended to use procedures such as modelling which, according to social-learning theory itself, would be likely to affect phobic behavior. Second, the validity of self-efficacy as a cause of behavior has yet to be established. Third, the concentration of self-efficacy theory on phobic behaviors ignores the importance of anxiety and fear which are, by definition, critical features of specific phobias. Finally, self-efficacy theory is incapable of explaining some of the characteristics associated with specific phobias, such as the uneven distribution of feared stimuli. For these reasons self-efficacy theory currently represents an inadequate conceptualization of the genesis of phobic fears.

**Maladaptive cognitions - Beck and Emery’s theory**

A number of cognitive theorists have proposed that maladaptive cognitions are significant factors in the etiology and maintenance of phobic disorders (Beck, 1976; Beck & Emery, 1985; Ellis, 1962; Guidano & Liotti, 1983; Meichenbaum, 1977). Beck and Emery (1985) have proposed a comprehensive theory relating to the role of maladaptive cognitions in specific phobias. They posited that anxious people are mentally focused on threat as a result of the activation of cognitive schemas concerned with danger and harm. These schemas are argued to play a crucial role in the etiology and maintenance of phobic fears. Beck and Emery propose that an upset in the regulatory functions of the cognitive
system may lead an individual to indiscriminately interpret an environmental event as being dangerous. In addition, they argue that one of the key components of this interpretation is the magnification of the amount of risk and degree of harm in the feared situation.

Beck and Emery (1985) argue that a sense of vulnerability lies at the core of anxiety disorders. Vulnerability is defined by them as a person’s perception of themself as “subject to internal or external dangers over which his [or her] control is lacking or is insufficient to afford...a sense of safety” (p. 67). Upon encountering a potentially harmful stimulus a number of processes are believed to come into play. Beck and Emery adopt the coping model of Lazarus (1966) to describe this sequence of processes. First, an individual is believed to make a primary appraisal of the situation, which takes the form of an initial impression of the potential threat to their domain. If the situation is appraised as noxious, successive reappraisals are made concerning such questions as whether the situation represents an immediate threat to vital interests and whether it involves possible physical injury. While making a primary appraisal, a person is posited as simultaneously making a secondary appraisal concerning their resources for dealing with the threat. The relation of the person’s perceived coping resources to the perceived danger of the situation is believed to determine the response of the person to the situation.

The central idea of Beck and Emery’s (1985) theory is that phobias result from a systematically biased interpretation of the danger associated with a stimulus. Some support for this argument may be seen as coming from a study by Thorpe and Salkovskis (1995) which found high correlations between harm cognitions concerning spiders and both fear and avoidance of spiders. There are, however, methodological problems in this study and what Thorpe and Salkovskis label as ‘harm cognitions’ include a number of harm-irrelevant cognitions. In addition, Thorpe and Salkovskis (1995) found that the specific belief “I would come to physical harm” was endorsed by only 24 per cent of the people with phobias prior to actual exposure to a spider. Similarly, de Jong and Muris (2002) found that after controlling for the perceived disgustingness of spiders the beliefs of people that they would be harmed by a spider was not statistically significant. These results are consistent with a study on agoraphobics where people, despite mounting anxiety brought on by having to perform a series of scary tasks, expressed thoughts related to danger on less than one per cent of occasions (Williams, Kinney, Harap & Liebmann, 1997).
Beck and Emery (1985) also rely to a considerable extent on the concept of learned avoidance and preparedness in order to explain the etiology of specific phobias. However, the process of learned avoidance has trouble explaining, for example, fear of snakes where a person may not have actually encountered a snake. The belief that phobias may stem from the learned avoidance of an already feared stimulus also fails to explain both the origin of any pre-existing fear and why avoidance would lead to the heightened experience of anxiety characterising specific phobias. In addition, there is currently conflicting research in relation to the validity of preparedness theory (see McNally, 1987), which Beck and Emery also advance in an attempt to explain the individual differences found in fear acquisition.

**Other Cognitive Research**

Despite the problems in applying cognitive theory to specific phobias, there have been a large number of investigations into the various cognitive factors related to anxiety and phobias. Such cognitive concepts include negative self-focused attention (Sarason, 1975; Wine, 1971), patterns of anxious self-statements (Cacioppo, Glass, & Merluzzi, 1979; Huber & Altmaier, 1983), memory bias (MacLeod & McLaughlin, 1995; Rapee, McCaullum, Melville, Ravenscroft, & Rodney, 1994; Watts & Coyle, 1993; Watts, Trezise, & Sharrock, 1986), anxious cognitive schemas (Beck, 1976), attentional bias (Martin, Harder, & Jones, 1992; Mogg, Mathews, & Weinman, 1989; Watts, McKenna, Sharrock, & Trezise, 1986), deficits in storage and retrieval processes (Mueller, 1980), perceived loomingness (Riskind, Kelley, Harman, Moore, & Gaines, 1992), automatic questioning (Kendall & Ingram, 1987), and cognitive asymmetry in negative and positive self-statements (Schwartz, 1986). However, despite the large number of cognitive concepts and mechanisms found to be related to anxiety and fear, it remains for the direction of causality between these mechanisms and anxiety disorders to be established.

Another problem with cognitive approaches to the investigation of specific phobias is their tendency to abstract the various cognitive phenomena, whether structures, propositions, operations, or products (see Kendall & Ingram, 1987), from the stimuli which give rise to them. Cognitive research, therefore, often loses track of what is significant about the specific stimuli that lead to cognitive distortions. In relation to specific phobias, the question which needs to be addressed, and which must be subsumed within a broader theoretical framework, is what makes some stimuli more likely to be feared than others?
The answer to this question must be a necessary supplement to the reason why some individuals experience fear to certain stimuli whereas others do not, despite similar experiences. It is proposed, therefore, that to account for the various characteristics of specific phobias it is necessary to explain both stimulus differences in fear propensity and individual differences in fear acquisition.

Variables crucial to explaining the etiology and characteristics of specific fear

Danger

In attempting to describe why a stimulus, such as a particular animal, tends to evoke a higher proportion of fear responses in the population than another animal, the degree of danger or harm the animal represents is an obvious explanation. The importance of danger or harmfulness is emphasized by almost all theories of the etiology of specific phobias and has occupied a prominent place in those theories reviewed so far. Several findings support the hypothesized role of danger in the etiology of phobias. Taylor and Rachman (1994), for example, found that people with snake fears significantly overpredicted the degree of danger associated with a snake, suggesting a potential cognitive mechanism for differences between high and low fear individuals in the perception of danger. Also, Lipsitz, Barlow, Mannuzza, Hofmann and Fyer (2002) found that 39 per cent of their participants with specific phobia stated that their fear was focussed on potential danger or harm.

However, danger-relevance, by itself, provides an insufficient explanation of some clinical phobias. For example, many harmless animals such as mice, cockroaches, and moths may elicit substantial fear-responses from some people. In addition, studies demonstrate that there are significant differences in the fear ratings of animals even after controlling for harmfulness (e.g., Bennett-Levy & Marteau, 1983).

It appears, therefore, that stimulus properties other than danger or harm are important in fear acquisition. This is not to say, however, that perceived danger is likely to be an unimportant factor in determining some fears. Many highly feared stimuli, such as
snakes, spiders, and dogs may represent the propensity for considerable aversive outcomes. However, by itself, this explanation of differential fear acquisition is limited.

**Disgust**

Disgust is a basic emotion that has come to attract considerable interest from clinical psychologists (McNally, 2002). Although the emotion of disgust is believed to have originated as a food-related emotion it has subsequently been transformed and greatly expanded in human cultural evolution (Rozin, Haidt, & McCauley, 2000). Davey and colleagues have proposed that the disgust-evoking properties of some animals may be an important causative factor in fear acquisition, independent of their potential danger (Davey, 1992b, 1993, 1994; Davey, Forster, & Mayhew, 1993; Jain & Davey, 1992; Matchett & Davey, 1991; Ware, Jain, Burgess, & Davey, 1994). In an investigation of spider fears, Davey (1992b) found evidence inconsistent with a straight-forward danger-defence model of animal fears. For example, fear of spiders was found to covary not only with fear of animals labelled fear-evoking (e.g., rats, snakes, and lizards), but also with fear of animals generally considered disgust-evoking, such as caterpillars, maggots, and slugs. It was proposed on the basis of these findings that several common animal fears may derive from a disease-avoidance rather than a predator-defence process (Davey, 1992b; Matchett & Davey, 1991). The disgust-evoking status of a particular animal was hypothesized to stem from the association of the animal with either (1) disease, (2) dirty or disease-ridden places or putrefying food, or (3) natural disgust-eliciting stimuli such as faeces or mucous.

Despite the plausibility of both disgust as a factor in fear acquisition and disgust-sensitivity as a potential personality characteristic which discriminates between fearful and nonfearful responses to some animals, there are several problems in the disease-avoidance literature which need to be addressed. First, the measures of both disgust and disgust sensitivity used by Davey have questionable validity. Disgust sensitivity to animals, for example, has been operationalized by a scale which measures how much a person would be prepared to eat contaminated yet desirable food (e.g., Davey, 1994; Davey et al., 1993). Although Merckelbach, de Jong, Arntz, & Schouten (1993) found that spider phobics exhibited more disgust sensitivity than controls using this measure, the specificity of this scale raises doubts concerning its validity as an accurate measure of disgust sensitivity to animals. Although a more valid and reliable Disgust Scale has been
developed (see Haidt, McCauley, & Rozin, 1994), few studies using this measure or the updated scales based upon this work have yet been published. Tolin, Lohr, Sawchuk and Lee (1997) however, found that spider and blood/injury phobics scored higher on five of the subscales of the Disgust Scale, in comparison to controls.

The measurement of disgust has also been problematic. Ware et al. (1994), for example, conducted a principle components analysis of the fear ratings of a number of animals and extracted two factors which they labelled as predatory animals and fear-relevant animals, despite the existence of alternative and perhaps more relevant labels such as exotic and common, or large and small. Yet, on the basis of the labels they applied, and after unjustifiably equating fear-relevant animals with disgust-evoking animals, Ware et al. (1994) went on to declare that it was “clear that fear of animals from the fear-relevant category is significantly associated with disgust” (p. 62). This conclusion is unwarranted considering that disgust itself was not actually measured in the study. In addition, the correlations between disgust sensitivity and predatory animal fears, and disgust sensitivity and fear-relevant animal fears, were both small and not significantly different from one another. However, Davey (1994) subsequently claimed that fear of fear-relevant animals was found to be highly correlated with disgust sensitivity whereas fear of predatory animals was uncorrelated with disgust sensitivity. It can be seen, therefore, that the study of disgust as a variable in fear acquisition has been inadequately carried out and that the interpretations arising from this research may even be, in some cases, misleading.

Empirical support for the disease-avoidance model of fear acquisition has been mixed. For example, Davey (1993) found that even in a group of subjects who were given only disease-relevant information about an unknown animal, predicted fear was significantly more related to the subjects’ perception of possible attack than to their perception that they would become infected if bitten. Another study by Arntz, Lavy, van den Berg, and van Rijsoort (1993) found that disgust of spiders does not appear to play a very prominent role in spider phobias. However, this conclusion was based on disgust of spiders being operationalized via a single question (“When there is a spider in my vicinity, I believe that the spider is dirty”) and may, therefore, need replicating using a more substantial measure.

Despite the problems in the disease-avoidance literature, evidence suggests that disgustingness may represent, at least in relation to some animals, a considerably aversive property. Tucker and Bond (1997), for example, have found that gender and disgust
sensitivity predicted fear of harmless animals. Also, Davison and Neale (1994) have described the case of a woman who became terrified of frogs after mowing over some in her backyard. This fear stems not from a danger ascribed to frogs but to the disgust or revulsion and subsequent distress involved in chopping up frogs with the lawn mower. Other research suggests that disgust is not so much related to fear but to avoidance (Woody & Tolin, 2002). Indeed, disgust has been found to be a stronger predictor of spider avoidance than has anxiety (Woody, McLean & Klassen, 2005).

**Unpredictability**

While a person’s perception of a negative or aversive outcome may be important in fear acquisition, there are other mechanisms that also appear to be important in explaining the genesis of anxiety and fear. One variable that appears to contribute to both the development and maintenance of anxiety and fear is unpredictability (Zvolensky, Eifert, Lejuez, Hopko & Forsyth, 2000), which may be closely related to uncertainty. Both of these variables imply a lack of knowledge concerning some aspect of a stimulus, such as its identity, movement, or location. A number of studies across a wide range of areas have demonstrated a relationship between both unpredictability and uncertainty and anxiety and fear (Booth-Butterfield, Booth-Butterfield, & Koester, 1988; Craske, Zarate, Burton, & Barlow; 1993; Foa, Steketee, & Rothbaum, 1989; Kennedy & Silverman, 1985; Lox, 1992; Roberts, 1993).

One important aspect of unpredictability in relation to animals appears to pertain to an animal’s movement. In a study by Lick, Candiotte, and Unger (1978), a group of phobic subjects who were led to believe that the movement of their fear-relevant animal was unpredictable manifested significantly higher levels of cognitive and physiological fear than phobic subjects who believed the animal’s actions to be predictable. Another study has found that the perceived spatiotemporal unpredictability, as well as the perceived dangerousness and survival relevance, of a number of objects was significantly correlated with fearfulness towards those items (Merckelbach et al., 1988). However, the correlation between survival relevance and fearfulness was found to be non-significant after perceived unpredictability was partialed out. Based on these results, it was suggested that the uneven distribution of feared stimuli, which is traditionally explained by the supposed preparedness of biologically significant stimuli, may result predominantly from the perceived spatiotemporal unpredictability of these stimuli.
It also appears that differential predictability perceptions exist between phobics and non-phobic individuals. Rachman and Cuk (1992) found that subjects who rated themselves as highly fearful of snakes or spiders perceived these animals as significantly less predictable than did control subjects. They also found that decreases in self-reported fear, brought about following the observation of a modelling video, were accompanied by significant decreases in perceived unpredictability. While the exact nature of the relationship between declines in fear and unpredictability was not investigated, it is plausible that increased knowledge of the fear-eliciting animal’s movement served to decrease perceived unpredictability which then contributed to a reduction in subjective fear.

It appears that anxiety regarding uncertain or unpredictable events may also reflect a biologically inherited characteristic. A study by Gunner, Leighton, and Peleoux (1984), for example, found that one year old infants demonstrated more fearfulness to potentially frightening mechanical toys when the toys commenced playing unpredictably than when the toys commenced playing on a predictable schedule. Interestingly, the predictability of the length of time the toy played was unrelated to fearfulness. This suggests that only some aspects of the unpredictability of a stimulus may be important in eliciting fear.

It appears that there are several dimensions to unpredictability and uncertainty. Examples in relation to animals would be (1) uncertainty of the identity and, therefore, the potential harmfulness of the animal; (2) unpredictability of the animal’s movements; (3) uncertainty or unpredictability of encountering an animal; (4) the unpredictability of the animal approaching or attempting to attack the person; (5) unpredictability of the length of the encounter; (6) unpredictability of the intensity of an aversive event (Amtz, van Eck, & de Jong, 1991); and (7) the unpredictability of actually suffering harm if attacked. It is likely that some of these dimensions are more important in determining fear than other dimensions and that individual differences in the order of importance of this fear-relevance may also occur.

Despite empirical support and the intuitive appeal of unpredictability as a fear-relevant variable it has received relatively little theoretical attention in relation to specific phobias. In addition, while a number of aspects of feared stimuli have been investigated in relation to anxiety (see Bennett-Levy & Marteau, 1983; Davey, 1989; Doogan & Thomas, 1992; Ehlers et al., 1994; Murray & Foote, 1979), researchers have failed to explore those factors which may underlie these aspects. Doogan and Thomas (1992), for example, found
that adults with a high fear of dogs were significantly more likely than low-fear adults to be afraid of dogs’ barking, making sudden movements, snapping, growling, and jumping up. However, the reasons behind such fears were not investigated. Growling, for example, is most likely a feared event because it indicates aggression and therefore signals danger. Fear of sudden movement, on the other hand, may imply a fear of the unpredictability of dogs, a fear of the inability to escape if the dog decided to attack, or perhaps both. Such interpretations, however, are necessarily speculative due to the absence of any relevant empirical investigations.

A final area which deserves mention in relation to the role of unpredictability in the determination of fear is that the predictability of a stimulus may be either comforting or aversive in nature. For example, a snake may act predictably by either always fleeing from an encounter with a human or by always attacking a human when encountered. It cannot be assumed, therefore, that predictability is necessarily comforting. Indeed, unpredictability seems to occupy a dimension of aversiveness ranging from predictably good to predictably aversive with varying degrees of unpredictability in between. However, in the real world, predictably aversive objects or situations are rare. For example, very few snakes will always attack when encountered and it is also highly unlikely that an accident will occur every time a person travels in a car or aeroplane. An unpredictable aversive event can therefore be seen, in a practical and heuristic sense, as the opposite pole of a predictable event.

Uncontrollability

Another variable which appears to bear a relation to anxiety and fear is uncontrollability. Control can be defined as “the belief that one has at one’s disposal a response that can influence the aversiveness of an event” (Thompson, 1981, p. 89). It is possible, however, that lack of control per se may be anxiety provoking for many individuals. It is also possible that there are a number of dimensions to lack of control in relation to specific phobias. Using animal phobias as an example, these may include (1) the inability to exert influence over the movement, approach, or behavior of an animal; (2) lack of control by the person over their response to an encounter with an animal; (3) the inability to control when an encounter with an animal will occur; and (4) the inability to avoid or terminate an encounter with an animal.
Control over an aversive stimulus appears to be able to reduce various physiological responses compared to lack of control (Weinberg & Levine, 1980). Weiss (1968, 1971), for example, has found that uncontrollable shocks are much more ulcerogenic for rats than escapable shocks, even after controlling for the number of shocks received. In another animal study, Drugan and Maier (1986) found that uncontrollable shocks led to the development of several pathologies including stress-induced analgesia whereas controllable shock resulted in few and more transient repercussions. Finally, a review of the available literature by Miller (1979) found that instrumental control leads to decreased anticipatory and impact arousal in relation to aversive environmental events.

There are various other sources of support for the hypothesis that uncontrollability is an important variable in relation to specific phobias. Lick and Unger (1975), for example, have reported that subjects experience substantially greater cognitive and physiological distress while looking at an uncaged feared animal from a considerable distance than when touching the caged animal. Although this finding may stem from the decreased potential of the caged animal to cause harm, self-reported reasons for this phenomenon related to feeling out of control when the phobic stimulus was uncaged compared to when it was caged. Other anecdotal reports have also revealed concerns about lack of control. Melville (1977), for example, reports a woman who had a fear of flying as saying “I kept seeing everyone as puppets, all strapped to their chairs with no control over their destinies, me included” (p. 54). Also, Bandura (1983) has found that people who see themselves as unable to control a potentially aversive event view these events anxiously, imagine harmful consequences, and demonstrate phobic avoidance responses to these events.

Despite this support, experiments allowing subjects to exert varying degrees of control over stimulus situations have yielded inconsistent results concerning the causal role of control in relation to fear. Several studies have found that perceived controllability decreases the aversive nature of a stressor (Geer & Maisel, 1972; Glass, Reim, & Singer, 1971; Sartory & Daum, 1992). Sartory and Daum (1992), for example, found that spider and snake phobics who could switch off the presentation of fear-relevant slides experienced less subjective arousal and a more rapid attenuation of their phasic cardiac response than yoked phobic subjects without such control. In contrast, a study by Craske, Bunt, Rapee, and Barlow (1991) found no significant effect on self-reported fear of control over exposure duration using similar procedures. There is also evidence that increases in
perceived control may be associated with negative reactions (for a review see Burger, 1989). Rose, McGlynn, and Lazarte (1995), for example, found that snake phobics who had control over the distance a caged snake was brought towards them had relatively higher skin conductance responses (SCRs) than yoked subjects who were also snake phobics.

Rose et al. (1995) offered several possible reasons for the increased SCR found for those subjects having control. These included the idea that having control may lead to an increased perception of being evaluated and that having control increases the attention being paid to the task. Craske et al. (1991) also offered a number of possible explanations for their inability to find anxiolytic effects for control. One of these explanations concerned the subjects’ general lack of control over the exposure situation. It seems likely that some aspects of uncontrollability may be significantly more important to a phobic individual than other aspects. It is possible that, in the study by Craske et al., control over the duration of observation of the spider may not have been relevant to the actual concerns of subjects in relation to spiders. Control over the possible approach of the spider or the ability to escape, on the other hand, may have been considerably more salient.

The relationship of uncontrollability to unpredictability

One problem with the study of uncontrollability is that it often overlaps to some extent with unpredictability and many experiments have traditionally confounded these variables (for reviews, see Miller, 1979; Weinberg & Levine, 1980). In many instances, having control over the delivery or reception of an aversive stimulus also leads to increased predictability. Some theorists (e.g., Averill, 1973) believe that it is this element of predictability which is of central importance in accounting for the often anxiolytic effects of having control. In contrast, Seligman (1975), for example, has argued that having control has important consequences beyond predictability. Support for this latter proposal comes from a study by Geer and Maisel (1972) which found that having control over the presentation of aversive photographs, compared with knowledge of the time relationships of the aversive presentations, led to significantly lower SCRs.

Despite the theoretical debate, it seems that unpredictability and uncontrollability are conceptually and practically orthogonal on a number of dimensions. Using animals to
illustrate this point, it is not necessarily the case that manipulating either unpredictability or uncontrollability automatically affects the other variable. For example, knowing that an animal might suddenly move towards you (unpredictability) would be independent of your perceived inability to deal with the animal if it did rapidly approach you (uncontrollability). Similarly, being able to effectively avoid a rapidly approaching animal does not make that animal less predictable in its movements. The orthogonality of these variables in such cases allows for their independent manipulation and, therefore, for more accurate conclusions to be gained concerning the causal nature of their relationship to fear. Nonetheless, it is still important to keep in mind that in some instances and under some conditions, control over the onset of a feared encounter may afford onset prediction and that this may have implications for the treatment of anxiety disorders (Zvolensky, Lejuez, & Eifert, 2000).

Perceived vulnerability

Based on the literature just reviewed, it is proposed that a combination of perceived dangerousness, perceived disgustingness, perceived uncontrollability, and perceived unpredictability lies at the heart of phobic fears. These fear-relevant variables are not totally independent but can be seen as contributing to a person’s perceived vulnerability. Indeed, perceptions of danger, disgust, unpredictability and uncontrollability are seen as integral to the aversive nature of vulnerability. It is proposed, therefore, that fear of animals, flying, driving, heights, storms, and many other situations, can all be conceptualized in terms of the perception of uncontrollability, danger, disgust, and unpredictability associated with them.

The term ‘vulnerability’ has lately been employed by researchers and incorporated into various models of anxiety disorders. For instance, cognitive vulnerability has become an important concept in cognitive theories of depression (Beevers, 2005; Scher, Ingram, & Segal, 2005; Timbremont & Braet, 2004) while Riskind and colleagues (Riskind, 1997; Riskind, Wheeler, & Picerno, 1997; Williams, Shahar, Riskind, & Joiner Jr, 2004) have used the term ‘looming vulnerability’ in relation to their attempt to understand important characteristics of feared stimuli. However, in the former case the term vulnerability can more accurately be seen as meaning reactivity or susceptibility while in the latter case the concept of vulnerability is narrowly confined to a very specific and somewhat obscure stimulus property. In still other research, so-called vulnerability factors are merely
These definitions fail to capture the phenomenology of vulnerability, that is the pervasive extent of subjective unease and associated feelings of incapacity and inability associated with a stimulus or event. Perceived vulnerability is an emotionally deep and highly motivational feeling which represents the experience of susceptibility to an outcome considered aversive. Irurita (1999) comes reasonably close in relating vulnerability to an inability to both retain control over a person’s life situation and to protect themselves against various threats to their integrity.

Only a smattering of research has attempted to examine the various vulnerability perceptions in combination. Mineka and Kihlstrom (1978) provided one of the earliest attempts to relate unpredictable and uncontrollable aversive events to human psychopathologies. In their review of the literature relating to “experimental neurosis” they noted that this condition, which involves cognitive, affective, and somatic disturbances in an organism, seemed to be brought on by both the lack of control over, and inability to predict, an aversive event. It was suggested that uncontrollability and unpredictability may lead, in some complex and unspecified way, to the experience of either anxiety or depression.

There has been some support in the literature for the detrimental effects of unpredictability, uncontrollability, and negative outcome in combination. Weiss (1971), for example, found that the length of gastric lesions in rats after unsignaled shocks were significantly greater than for rats who had received signalled and, therefore, predictable shocks. For rats that also received uncontrollable shocks, the length of gastric lesions in both the signalled and unsignaled conditions were greater still, with the differential effect for shock predictability being maintained. The results indicate that the deleterious effects of uncontrollability and unpredictability in relation to an aversive stimulus are cumulative in nature.

Another study by Arntz et al. (1993), assessing the negative beliefs of spider phobics, found that of the spider-related beliefs spontaneously generated by subjects, 57 per cent referred to either the uncontrollable or unpredictable behavior of spiders whereas 16 per cent referred to negative evaluations of spiders. Arntz et al. also conducted a factor analysis of the spider-related beliefs from the Spider Beliefs Questionnaire (SBQ), revealing various themes. The most prominent factor, accounting for almost 32 per cent of the variance on the questionnaire, concerned ideas about the harm represented by
spiders. The second important theme, labelled *hunter and prey*, included items such as “will drive me to the wall”, “cannot be shaken off once it is on me”, and “will control me” and clearly reflects a concern with feelings of uncontrollability. The third most significant factor was related to unpredictability and speed of movement. A fourth theme identified by Arntz et al. concerned ideas about the unpredictability and uncontrollability of spiders entering a person’s personal territory. These results support the hypothesis that a combination of perceived dangerousness, uncontrollability, and unpredictability are important factors in a phobic’s experience of fear.

The most compelling published evidence to date of the relationship between the cognitive vulnerability variables and fear comes from research by Armfield and Mattiske (1996) who looked at the relationship between each of the vulnerability variables and fear of spiders. Together the variables of uncontrollability, unpredictability, dangerousness and disgustingness accounted for over two-thirds of the variance in self-rated spider fear. Perceptions of uncontrollability and unpredictability had the largest correlations with spider fear. Adding further support to the significance of these findings was that the vulnerability variables accounted for 55 per cent of the variance in fear scores beyond the variance explained by a number of classical conditioning, informational and vicarious conditioning experiences. Although the study by Armfield and Mattiske (1996) looked at existing fear and could not establish causal direction, strong associations between the vulnerability variables and spider fear inspired further theorising along these lines.

**A cognitive model of the etiology of fear**

**Vulnerability schema**

Based on the available literature, it is proposed that common fears may be usefully conceptualized in terms of the perception of dangerousness, disgustingness, unpredictability, and uncontrollability associated with them. These variables ‘organize’ the perception of a stimulus along fear-relevant dimensions and may be seen as comprising a fear-relevant or vulnerability schema. Kendall and Ingram (1987) define a schema as a representation of a person’s life experiences or knowledge that is stored in a cohesive fashion and acts to filter perceptions and guide judgements. In this case, the schema...
consists of the perception or sense of the uncontrollability, unpredictability, danger and
disgust expected when interacting with a particular stimulus or situation.

A person’s vulnerability schema in relation to a particular stimulus is seen as being
automatically and almost simultaneously activated following the perception of a fear-
relevant object or stimulus. Upon encountering a stimulus the vulnerability schema is
unconsciously evoked and subsequently provides a general or holistic perception related
to the vulnerability associated with the stimulus. It is not necessary, therefore, for a person
to consciously access any information relating to a particular stimulus in order for the
person to react to that stimulus.

Determinants of the vulnerability schema

It is proposed that there are two major determinants of a person’s perceived
vulnerability. The first source is individual personality traits or biological dispositions that
may include such factors as autonomic lability, extroversion and neuroticism, sense of
mastery, disgust sensitivity and locus of control. A growing body of research, for example,
now attests to the relationship between fear and disgust sensitivity (Woody et al., 2005). In
most cases, however, the investigations of personality correlates of anxiety states have
looked at disorders other than specific phobias. More research is still required, therefore,
in relation to the identification of the personality correlates of specific fears and perceived
vulnerability.

The other likely source of a person’s perceived vulnerability is experiential factors.
These factors are conceptualized broadly as any learning experiences with a particular
stimulus involving those variables related to perceived vulnerability. It is proposed that a
person may learn about a particular stimulus by any of the three pathways conceived of by

Automatic affective reaction

Once the vulnerability schema is automatically elicited two processes may be seen
as following. The first is an automatic affective reaction similar to that described by
Öhman (1986; Öhman et al., 1985). The idea of such an unconscious or preattentive
mechanism has received some support using backward masking studies which have found
that a conditioned SCR can be elicited even though the subject is unaware of the presentation of the fear-relevant stimulus (Öhman & Soares, 1993, 1994; Soares & Öhman, 1993). These results support the idea of a preattentive or non-conscious process and have been used to explain the involuntary and supposedly irrational nature of a phobic’s response to the perception of a fear-relevant stimulus.

**General cognitive evaluation**

The second process which can be seen as following from the stimulus perception and activation of the automatic vulnerability schema is a controlled, cognitive processing of the stimulus and its overall significance for the individual. This takes the form of a general integrative appraisal of the stimulus and is somewhat analogous to the primary and secondary appraisals proposed by Folkman and Lazarus (1985). The general cognitive evaluation represents the final series of processes before the person’s conscious response set is initiated and may comprise a mixture of conscious, semi-conscious, and unconscious appraisals. As this cognitive processing is proposed as being influenced by the same sense of vulnerability that results in the automatic affective reaction, it is likely that the cognitive assessment of the fear-relevant stimulus is generally congruent with the preattentive reaction. A person who exhibits an instantaneous fear reaction to a stimulus would also be likely to express various cognitions that subsequently ‘explain’ their fear response.

**The role of other cognitive factors**

Other important sources of influence on the general cognitive evaluation are cognitive factors such as attentional and memory biases, negative self-focused attention, patterns of anxious self-statements, and automatic questioning. It is hypothesized that these various cognitive processes may affect the general cognitive evaluation by distorting the information reaching and contained within the information processing system. It is also possible that at least some of the cognitive processes which have been found to occur in specific phobias have some effect on the automatic affective reaction. This may, once again, be through the biasing of information in relation to the stimulus.
A summary of the cognitive vulnerability model

A schematic representation of the etiological factors discussed in relation to the cognitive vulnerability model is shown in Figure P1.1. To summarize, a stimulus automatically and unconsciously triggers its respective vulnerability schema. The schema includes perceptions of the uncontrollability and unpredictability of the stimulus along with its potential and likelihood of causing a negative outcome, which may relate to both danger and disgust. The content of this cognitive schema is based on learning experiences associated with a particular stimulus and is moderated by various personality differences. Immediately following the activation of the vulnerability schema two parallel processes are proposed to occur. The first is a rapid automatic affective reaction which may cause an individual to exhibit immediate fear responses. The other process is a relatively slower cognitive appraisal which incorporates various other evaluations and appraisals. A variety of other cognitive factors, such as attentional biases, impinge upon the general cognitive appraisal and, to a lesser extent, may serve to exacerbate the pre-attentive automatic reaction. The response set stemming from this process includes an emotional/cognitive response, a physiological response, and a behavioral response. The interpretation of the outcome of the interaction feeds back into the vulnerability schema and the moderating cognitive processes.

A comparison with Barlow’s multi-level theory

While the Cognitive Vulnerability Model presents a novel approach and synthesis of the literature on the etiology of specific phobias it does present similarities with some other theories, such as the Triple Vulnerability Theory put forward by Barlow (2000, 2003). Barlow (1988) originally proposed that anxious apprehension in people with existing biologically and psychologically vulnerabilities increased the intensity of an alarm response during a frightening experience. Later, Barlow (2003) posited that a sense of unpredictability and uncontrollability lay at the core of anxiety and hypothesized an interacting set of three diatheses or vulnerabilities relevant to the development of anxiety. These are generalized biological or genetic vulnerabilities, generalized psychological vulnerabilities and specific psychological vulnerabilities. The third set of vulnerabilities was introduced to account for the development of some specific anxiety disorders, such as sexual dysfunction.
Despite its reference to psychological vulnerabilities there are important differences between Barlow’s theory and the current theory. For example, Barlow still leans heavily on behavioural theory and elsewhere he describes the causes of phobias as being a combination of biological and evolutionary vulnerability and the learning pathways of direct conditioning, observational learning and informational transition (Barlow & Durand, 2004). However, the main difference between Barlow’s Triple Vulnerability Theory and the current Cognitive Vulnerability Model is that Barlow sees unpredictability and uncontrollability as focussed largely on possible future threat or danger, leading to anxious apprehension. A perceived inability to influence personally salient events and outcomes arises from the evocation of anxious propositions. In the
Cognitive Vulnerability Model, unpredictability and uncontrollability, as well as
dangerousness and disgustingness, are aversive outcomes in and of themselves, not only
relating directly to the fear response set but also feeding back into the stimulus or event
perceptions.

An explanation of the characteristics of specific phobias

The proposed Cognitive Vulnerability Model has several advantages over other
approaches to the explanation of the etiology of specific phobias. One particularly
important asset is its ability to explain the various characteristics of specific phobias. For
the present, discussion will be confined to the animal type of specific phobias. The reason
for this is that the blood-injection-injury type may not represent a ‘true’ specific phobia
(Lumley & Melamed, 1992; Thyer, Himle, & Curtis, 1985) and various phobias within the
other subtypes may be more related to panic attacks or social phobias than to specific
phobias. Fear of flying, for example, may be diagnosed as a symptom of either panic
disorder with agoraphobia or specific phobia (McNally & Louro, 1992). Also, many
driving phobias are attributable to the occurrence of panic attacks while driving (Ehlers et
al., 1994) and can, therefore, more accurately be seen as fears of having a panic attack
while driving and not a fear of driving per se. For these reasons, the animal subtype of
specific phobias represents a more cohesive grouping than the other specific phobia
subtypes. Nonetheless, the theory is applicable to what may be called ‘true’ examples of
natural environment and situational phobias as well as to animal phobias.

The characteristics of specific phobias identified earlier were their apparent
irrationality or excessiveness, various modes of acquisition, differential distribution across
potential fear stimuli, and the individual differences in fear acquisition despite similar
experiences. It has been argued that previous and current theories have been inadequate
in explaining all of these phenomena. In contrast, the proposed cognitive vulnerability
theory offers a number of hypotheses to account for these characteristics.

(1) The excessive response characterizing specific phobias is posited as stemming
from the automatic affective reaction accompanying the perception of vulnerability. This
response most likely represents a biologically important mechanism found in all animals
that readies them for immediate survival-oriented behavior. Support for this hypothesis has
already come from the series of studies by Soares and Öhman mentioned previously
Although these studies were conducted in the context of testing one of the implications of Öhman’s preparedness model of the etiology of phobias, the results are also consistent with the precepts of the Cognitive Vulnerability Model.

(2) The various modes of acquisition have been explained not as causes of fears but merely as ways of gathering information about a particular stimulus. It is proposed that any means of acquiring knowledge about a stimulus may result in the perception of vulnerability in relation to an object or situation.

(3) The differential distribution of fears across potential stimuli is argued to be a result of specific differences in stimulus characteristics. In particular, the perceived unpredictability of the stimulus, its uncontrollability, and the potential and likelihood of it to cause a negative outcome, whether harm or revulsion, are argued to be critical factors. The cognitive vulnerability model predicts that animals which are perceived across various dimensions as being unpredictable, uncontrollable, potentially harmful, and disgusting would have the highest proportions of fears, and those stimuli low on these vulnerability dimensions would be associated with few phobic fears.

(4) Finally, individual differences in fear expression are proposed to be caused by differences in perceived vulnerability, which are undergirded by various experiential factors and personality traits. Those people who perceive an animal as being highly uncontrollable, unpredictable, dangerous, and disgusting would demonstrate significant levels of fear and avoidance to that animal. Yet, the interaction of different experiences and different personality characteristics might lead other people to have low perceptions of vulnerability to the same animal.

These hypotheses provide a wealth of possible research directions aimed at disconfirming the model. While some of the components of the model have already been extensively tested, a host of new possibilities are evident. First, the relationship between the vulnerability variables and specific fears need to be confirmed for a range of stimuli and events. This should explain differences in fear acquisition and expression across people and also differences in fear propensity across various stimuli. Sub-conscious processing of vulnerability ‘perceptions’ should be evident. There is also a strong need for experimental and longitudinal research to confirm the hypothesised causality of the model. Unlike some other etiological theories of specific fears, the Cognitive Vulnerability
Model makes specific, testable claims and research is currently underway to test the validity of the new theory.

Conclusion

The basic proposition presented in this article is that perceptions of a stimulus as uncontrollable, unpredictable, dangerous and disgusting are essential aspects in the etiology and maintenance of fear. The Cognitive Vulnerability Model draws on a considerable body of research that implicates the vulnerability variables in the determination of anxiety, fear and phobia. Although much of this research is not directly aimed at testing the relationship of the vulnerability variables to specific fears there is considerable empirical support for a role of these variables in the mediation of fear and anxiety response sets across a large variety of situations.

The Cognitive Vulnerability Model offers important theoretical implications for clinical intervention. Already it is widely acknowledged that giving people a sense of control and predictability is important in helping to alleviate fear and in some areas, such as dental fear, treatment for fear is in part directed at engendering an improved sense of both predictability (de Jongh, Adair, & Meijerink-Anderson, 2005) and control (Milgrom, Vignesha, & Weinstein, 1992; Bare & Dundes, 2004). The current model offers a theoretical background for this practice and incorporates perceptions of control and predictability with those of danger and disgust into a model of cognitive vulnerability whereby the focus is a person’s perceptions of a stimulus, the phenomenology of an event. It is how a stimulus is perceived that determines fear rather than the stimulus per se.

Previous theories have struggled to adequately address the etiological issues of fear as well as the various modes of acquisition, the differential distribution across potential fear stimuli, and the individual differences in fear acquisition. Some theories fall short in addressing these aspects of specific fear while other theories have received only minimal, or conflicting support. Interestingly, the recent Textbook of Anxiety Disorders, put out under the auspices of the American Psychiatric Association, lists only conditioning, preparedness, multiple pathways and non-associative theories as possible etiological theories, with cognitive factors predominantly assigned to a role in the maintenance of phobias (Harvey & Rapee, 2002). It is concluded that there are multiple pathways to the
onset of specific phobia but that further investigation is required. This highlights the inability of current etiological theories to adequately grapple with the complexities of specific fears and phobias.

Although the cognitive vulnerability model rests on the foundations of other cognitive theories of the etiology of fear and draws on ideas propounded by such notables as Beck and Emery (1985) and Öhman, the model offers an entirely new approach to synthesizing the available disparate literature and offers new testable hypotheses which address some of the core puzzles of specific fears. The model is parsimonious and intuitively applicable. Although the model is in its infancy and has yet to be put to extensive testing, it serves as an important step in providing direction to future theorizing and a basis for further research.


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CHAPTER 5 (PAPER 2) – UNDERSTANDING ANIMAL FEARS: A COMPARISON OF THE COGNITIVE VULNERABILITY AND HARM-LOOMING MODELS

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BMC Psychiatry

BMC Psychiatry 2007, 7: 68.
Statement of authorship

UNDERSTANDING ANIMAL FEARS: A COMPARISON OF THE COGNITIVE VULNERABILITY AND HARM-LOOMING MODELS.

BMC Psychiatry

Armfield J.M. (Candidate)

Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: ..................................
Linkage of paper to body of research

One of the major problems faced by etiological theories of specific phobias and fears is the need to explain the uneven distribution of fears in a population. It is the case that some stimuli or situations are more feared than others, but why is this the case? Such a fundamental question must be adequately addressed by any theory of the etiology of fear as it gets to the crux of what makes people afraid. The Cognitive Vulnerability Model deals with this issue by proposing that differences in fear towards specific stimuli or situations are a direct result of differences in perceptions of these stimuli or situations. The paper is an essential explication of this proposition. Is it so that the more a specific stimulus or situation is perceived as uncontrollability, unpredictable, dangerous and disgusting the more it is feared in the population?
Introduction to paper and additional information

While no theories of the etiology of fear have ever adequately accounted for the uneven distribution of fear in the population, the current paper found very high correlations between fear of animals and perceptions of them as being uncontrollable, unpredictable, dangerous and disgusting. It appears to be the case that the uneven distribution of fear can be convincingly explained by the perceptual characteristics of the feared stimuli themselves. The paper therefore provides strong support for the Cognitive Vulnerability Model.

Despite the theoretical importance of the paper, a series of problems surrounding the submission and review process led to a number of delays in publishing this paper. Ultimately, the paper was accepted for publication by BMC Psychiatry where it was judged by one reviewer to be an article of importance in its field.

Ostensibly, Paper 2 looks at both individual differences in fear propensity and differences across feared stimuli in fear propensity. The first of the aims was essentially to replicate and extend a study by Armfield and Mattiske (1996) which looked only at spiders. There are a number of reasons why spiders in particular were employed as the target stimulus in that study. First, a number of studies have found that, relative to other fears, a sizeable proportion of the general population experience fear of spiders (Bennett-Levy & Marteau, 1983; Agras, Sylvester, & Oliveau, 1969). In addition, approximately one-third of all hospitalisations in Australia for bites and stings are a result of spider bite and this amounts to approximately 6.5 cases per 100,000 population each year (Bradley, 2008). However, non-hospitalised cases are believed to be much more prevalent, with approximately 1-1.8% of the Australian population believed to suffer a bite or sting in any four week period (Australian Bureau of Statistics, 2003, 2006). The prevalence of spider bites and spider fear in the population means that the study of this type of fear is important in its own right. In addition, given its prolificacy in the population, fear of spiders is made highly amenable to study. Also, because a large number of studies have used spiders as the fear-relevant stimulus, further studies using spiders allows for comparisons with the existing literature. Finally, and partially as a result of the above point, fear of spiders has increasingly come to represent the prototypical fear in fear research. However, the assumption that findings relating to spiders are generalisable to other animals and may be
extendable to other objects and situations entirely may not be valid. It was therefore seen as important to replicate the results of the study by Armfield and Mattiske (1996) using other animals.

The second aim of the paper, however, was to investigate the uneven fear distribution. It can be seen from Figure 9, for example, that there was a strong relationship found between fear and perceived uncontrollability for the eight different animals examined in the study. It was important that these associations were established as they represent one of the primary contributions of the Cognitive Vulnerability Model to understanding the etiology of specific fear.

When the study was originally written, the dual aims mentioned above were the focus of the paper. The approach was to test the ability of the Cognitive Vulnerability Model to account for variations in the distribution of fears above and beyond any other possible explanations. However, as a result of rewriting the manuscript to address reviewers’ concerns and recommendations, the paper began to move towards a direct comparison of the Cognitive Vulnerability Model and the Loomingness Model put

Figure 9. The relationship between fear and perceived uncontrollability for eight different animals.
Latent inhibition, or prior familiarity, was also assessed in the current study. Based primarily on laboratory research conducted with animals, it would be expected that familiarity would be negatively related with measures of fear. Such a prediction concords with current theories of latent inhibition. However, it was hypothesised for this study that any significant relationships between familiarity and fear would stem not from the processes of habituation or reduced predictiveness but from the differential perceptions of uncontrollability, unpredictability, dangerousness, and disgustingness associated with each stimulus. That is, familiarity with an animal would be accompanied by various vulnerability perceptions of the animal which, in turn, would be related to fear. However, the pattern of these relationships would be complex. Familiarity with animals which are ‘objectively’ unpredictable, uncontrollable, dangerous, and disgusting would be more likely to result in increased fear while familiarity with animals which are less likely to be perceived in such ways should result in less fear. However, familiarity with any given stimulus would lead to varying perceptions of the animal depending upon the specific experiences. It is not necessarily the case that familiarity automatically leads to reduced fear as posited by advocates of latent inhibition. Given these complexities, it was predicted that there would be no relationship between familiarity and fear.

Learning experiences with each of the animals was also assessed. While the “three pathways” model proposed by Rachman (1977, 1990) has been much vaunted as an explanation of fear acquisition, there are numerous problems with this account. Several studies have failed to find a relationship between fear and the experience of classical conditioning, vicarious, and informational learning events (e.g., Armfield & Mattiske, 1996; Ehlers, Hofmann, Herda, & Roth, 1994). It is postulated that the differential experience of “conditioning” events is insufficient to account for the development of fears.
However, one potential problem with previous studies examining learning history is that they have used a “yes/no” response format to investigate the relationship of potential conditioning experiences to fear. Such an approach fails to take into account gradations in the seriousness of an event. For example, people who have had a car accident might include both people who have had only a minor accident and those people who have lost family members or suffered severe injuries from a crash. Clearly, responses to these two extremes would be expected to differ. The current study, therefore asked the subjects to rate the extent or seriousness of the possible conditioning experiences with each of the animals. Despite this, and although classical conditioning theory would predict a positive correlation between the extent of the conditioning event and subsequent fear, no relationships were expected in the current study.

The incorporation of measures of the Cognitive Vulnerability Model, the harm-looming model, latent inhibition, learning history and negative evaluation for eight different animals made for a relatively complex study. In addition, both self-rated fear and avoidance were used as dependent variables. Ultimately, the use of behavioural avoidance was dropped from the study because it resulted in twice the number of analyses and because it was heavily criticised by reviewers who believed that only a Behavioural Avoidance Test (BAT), where participants are asked to approach an actual stimulus or situation (normally in vivo), can properly index avoidance. It is interesting that although the pattern of results was similar for self-rated fear and self-rated avoidance, for some variables associations were stronger with fear while for other variables associations were stronger with avoidance. In the final regression analyses, after controlling for gender, loomingness and negative evaluation, the vulnerability variables accounted for more of the variance in fear for the high ($R^2$ 0.35–0.50) and low fear animals ($R^2$ 0.20–0.51) than for avoidance of high ($R^2$ 0.18–0.30) and low fear animals ($R^2$ 0.17–0.32).

Figure 10. The paper was featured by *BMC Psychiatry* as a research highlight
Abstract

**Background:** The Cognitive Vulnerability Model holds that both clinical and sub-clinical manifestations of animal fears are a result of how an animal is perceived, and can be used to explain both individual differences in fear acquisition and the uneven distribution of fears in the population. This study looked at the association between fear of a number of animals and perceptions of the animals as uncontrollable, unpredictable, dangerous and disgusting. Also assessed were the perceived loomingness, prior familiarity, and negative evaluation of the animals as well as possible conditioning experiences. **Methods:** 162 first-year University students rated their fear and perceptions of four high-fear and four low-fear animals. **Results:** Perceptions of the animals as dangerous, disgusting and uncontrollable were significantly associated with fear of both high- and low-fear animals while perceptions of unpredictability were only significantly associated with fear of high-fear animals. Conditioning experiences were not related to fear of any animals. In multiple regression analyses, loomingness did not account for any of the variance in fear beyond that accounted for by the cognitive vulnerability variables. However, the vulnerability variables accounted for between 20% and 51% of the variance in fear of low- and high-fear animals beyond that accounted for by perceptions of the animals as looming. Perceptions of dangerousness, uncontrollability and unpredictability were highly predictive of the uneven distribution of animal fears. **Conclusions:** This study provides support for the Cognitive Vulnerability Model of the etiology of fear and brings into question the utility of the harm-looming model in predicting animal fear.
Background

Fear of animals is prevalent in many countries. In Australia, studies have found up to 40% of children suffer from fear of animals such as spiders and snakes [1] while in the United States of America 22% of older adults report fear of snakes and 13% report fear of dogs [2]. Specific Phobias, considered to be fears involving associated functional impairments [3], are less common but may still have a relatively high prevalence in some populations. In Israel, for example, 31% of a military population reported fear of animals, with approximately 20% of these people indicating phobic symptoms [4]. Reported fear of animals varies by age, sex, cultural background and geographic location of respondents. In many countries, dangerous animals such as snakes, spiders, sharks, wasps and crocodiles or alligators are relatively common. Although deaths from these animals are now rare, in Australia for example, in any year about 3000 people will be bitten by a snake [5] with bites from spiders being about four times more likely [6]. In India, poisonous snakes are estimated to kill 50,000 Indians a year [7]. Rare events such as deaths from shark or crocodile attacks and more common events such as people being mauled or killed by domesticated dogs [8] invariably attract considerable media attention in Western countries. All these factors serve to keep the danger of animals in peoples’ minds.

Although fears and phobias of dangerous animals may be readily understandable, fear of non-dangerous animals is poorly accounted for in the literature. However, Armfield [9] has argued that fear is not merely a reaction to danger but that perceptions of control, predictability, and disgust are also crucial determinants of an individual’s fear response. These variables are believed to be conceptually connected, with perceptions of uncontrollability, unpredictability, dangerousness, and disgustingness comprising a set of vulnerability cognitions which are central to the etiology of fear for a given stimulus.

The Cognitive Vulnerability Model neatly explains two traditionally vexing questions regarding the characteristics of fears and specific phobias. First, why is it that some people fear a given stimulus when others do not, despite apparently similar learning histories? According to the Cognitive Vulnerability Model, it is the perceptions of a stimulus as uncontrollable, unpredictable, dangerous and disgusting which directly
determine fear of that stimulus. While learning experiences may help shape these vulnerability-related perceptions they are not causal per se.

The second question addressed by the Cognitive Vulnerability Model is what causes the uneven distribution of feared stimuli and situations in the population? Although the idea of biological preparedness [10], an inbuilt biological predisposition to fear some stimuli, was introduced to address this issue and is now widely regarded as a psychological truism [11], it does suffer from problems and is the source of some debate in the literature [12]. For example, the exact biological mechanisms underlying the notion of preparedness have never been identified, alternative hypotheses can readily explain preparedness-like effects obtained from laboratory experiments [9, 13, 14], and many of the key assumptions of the preparedness theory have not been supported [13]. De Jong and Merckelbach [12] have concluded that there is no convincing evidence to support the preparedness theory, while McNally has pointed out the difficulties inherent in testing possible evolutionary scenarios for preparedness effects [14]. In contrast to preparedness theory, the Cognitive Vulnerability Model predicts that the uneven fear distribution within a population is a direct result of differences in the perceived uncontrollability, unpredictability, dangerousness and disgustingness of the specific stimuli or situations. For instance, the higher prevalence of fears and phobias related to animals such as spiders, snakes, frogs and sharks in comparison to moths, rabbits or cats is precisely a result of these animals being perceived as being more uncontrollable, unpredictable, dangerous and disgusting.

Only limited support for the Cognitive Vulnerability Model of the etiology of fear is currently available. In an early study, Armfield and Mattiske [15] found strong correlations between the four vulnerability perceptions and fear of spiders. They also found that the vulnerability-related perceptions accounted for a significant amount of the variance in spider fears beyond that accounted for by a number of classical conditioning, vicarious, and informational learning events. Additionally, experimental studies manipulating perceptions of the uncontrollability, unpredictability and dangerousness of spiders were found to effect self-rated spider fear [18, 19]. Support for the relationship between fear and the vulnerability variables also comes from a series of studies by Riskind and colleagues [16-18]. Riskind et al. [16] combined two items each for danger, probability of harm, imminence, uncontrollability, and unpredictability into a global index of threat cognitions. Although the independent effects of these variables were not
explored, the Threat Cognitions Index (TCI), formed from the combination of these variables, was found to be highly correlated with fear of spiders. Similarly, Riskind et al. [18] found scores on the TCI to be significantly higher for high spider-fearful individuals than for low spider-fearful subjects.

Despite the consistency of the findings of Riskind et al. [16, 18] with those of Armfield and Mattiske [15], the studies by Riskind and his colleagues were designed to investigate the “harm-lingoming” model of fears and specific phobias originally proposed in an unpublished manuscript by Riskind [19]. Riskind has posited that the perception of “loomingness” is essential to the understanding of fear with fear stemming from a person’s anticipation that a danger is rapidly moving closer [16]. This anticipation is assumed to involve perceptions of both velocity and acceleration [18, 20]. It is claimed that individuals fear stimuli in direct proportion to their perception of such forward motion in these stimuli and not simply to the extent that the objects or events are perceived as heralding aversive consequences.

There is now an extensive body of research investigating the harm-lingoming model and the more recent extension dealing with looming maladaptive style [21, 22]. Overall, the results of most of these studies have been consistent with the underlying premises of the harm-lingoming model. However, a closer examination of some of this work reveals some methodological and interpretive concerns. For example, in an initial series of studies by Riskind et al. [16], the findings which are taken to support the harm-lingoming model are also consistent with the idea that the relationship between loomingness perceptions and fear is spurious, resulting from high correlations between threat cognitions (comprising the vulnerability variables) and both spider fear and perceptions of loomingness. In addition, the series of studies is characterised by various methodological and reporting problems, statistical analyses are selectively reported and some potentially important analyses are not conducted. Also, the items that comprise a number of the measures (e.g., uncontrollability, unpredictability, and danger) are not described, and the significant effect for loomingness found in Study 3 of the paper may well stem from the demand characteristics resulting from the use of a repeated measures design.

Demand characteristics may also affect the study by Riskind and Maddux [23], which attempted to experimentally manipulate both perceptions of loomingness and self-efficacy in relation to spiders. A more serious concern with this study, however, is the dubious relevance of its findings to the harm-lingoming model. In an attempt to manipulate
perceived loomingness, subjects were shown film clips of a spider moving towards them, remaining stationary, and moving away from them. The manipulation check on the Motion conditions consisted of two questions which asked about the speed and the physical mobility of the spider. However, although these questions do indeed relate to perceptions of motion, discussion of the statistical analyses were frequently couched in terms of perceptions of loomingness. This is despite the fact that perceptions of loomingness were not measured in the experiment. Therefore, the conclusion by Riskind and Maddux that “experimentally induced perceptions of looming motion…influenced perceptions of fear” (p. 82) may be inaccurate. A similar problem affects the series of studies by Riskind and Wahl [24] where the reasons underlying the results can not be attributed to differences in the perception of loomingness because this concept was not, in fact, measured.

Another study taken to support the harm-looming model has been reported by Riskind and Maddux [17]. However, while perceived loomingness was moderately correlated with fear of HIV situations, the study also found perceived lack of control, perceived danger, perceived likelihood of harm, and unpredictability of the HIV to correlate moderately with fear of HIV situations. When collapsed into a global index of threat cognitions these variables, which effectively comprise the four central perceptual characteristics of the Cognitive Vulnerability Model, predicted 41\% of the variance in HIV fear scores. Loomingness, however, only predicted 4.5\% of the variance in fear of HIV after controlling for threat cognitions. These results are similar to those reported by Riskind et al. [16] where the perceived loomingness of spiders accounted for only 2.8\% and 4.3\%, in studies 1 and 2 respectively, of the variance in spider fear scores beyond the contribution of the threat cognitions measured in these studies. It is the case, therefore, that the relationships between perceptions of loomingness, the vulnerability-related perceptions, and fear require further investigation in order to tease apart the direction and importance of these effects.

While the harm-looming model continues to attract considerable attention in the literature on the etiology of fear, several other theories and models are also prominent. Neo-conditioning theories of fear acquisition assume an important place for the concept of latent inhibition [25, 26] and have been used to account for the failure of many people to develop a fear following a traumatic experience with a stimulus situation. In general, people come to a new stimulus with a history of associations involving that stimulus [27]
and it is believed that these associations are influential in determining the occurrence or non-occurrence of subsequent conditioning. Laboratory studies have demonstrated that when a stimulus is presented alone on a number of occasions, the ease with which fear (or indeed any other response) can subsequently be conditioned is impaired [28-30]. This effect of prior exposure is also known as latent inhibition [31].

Latent inhibition is well documented in the animal conditioning literature, having been demonstrated with a variety of animals using a number of indices of conditioning [29]. However, the results of human conditioning studies have generally proven equivocal. While some studies have demonstrated an effect for pre-exposure on subsequent fear [34-36] other studies have failed to find this effect [32, 33]. Siddle and Remington [34] reconcile these findings by arguing that much of the research that has failed to demonstrate latent inhibition effects has not used appropriate control procedures necessary to establish stimulus specific and associative effects for pre-exposure. However, even when such procedures have been followed the effects produced have been weak relative to those found in the animal literature [34].

Non-experimental studies have also failed to find a strong relationship between prior familiarity and fear. Doogan and Thomas [35], for example, found that significantly more high dog fear than low dog fear subjects reported having had little or no previous experience with dogs, however, there were no differences in past experience between high and low fear children. The reason for the differences between adults and children are difficult to explain. Indeed, and while the study results may be explainable by the non-associative account offered by Menzies and colleagues [36-38], there appears to be little direct support for the proposal that latent inhibition can explain the absence of fears in people who have experienced a traumatic event with a stimulus but not acquired a fear of that stimulus. Nonetheless, some theories give a prominent role to the hypothesised effects of stimulus pre-exposure on fear acquisition so further investigation of this phenomenon is warranted.

One variable which is rarely studied in relation to fear is negative evaluation. It is possible that some animals are perceived negatively whereas other animals are seen more positively. The possible dimensions of evaluation are many. Animals might be seen as more or less ugly, intelligent, useless, soft, aggressive, desirable, spiteful, etc. Negative evaluation is a potentially important variable in fear research due to the possibility that many of the relationships found between fear and other variables are in fact spurious. If
there is a relationship between fear and negative perceptions (generally) of the feared stimulus, the finding of a relationship between, for example, fear and unpredictability may occur merely because unpredictability is perceived as a negative characteristic. For this reason there is a need to examine the relationship between fear and other variables after controlling for the potentially confounding effect of negative evaluation.

Armfield and Mattiske [15] found strong associations between perceptions of uncontrollability, unpredictability, dangerousness and disgustingness and fear of spiders. However, while it is often assumed that findings relating to spiders are generalisable to other animals and may be extended to other objects and situations entirely, there is no reason why any findings regarding fear of spiders are immediately generalisable even to other animals, let alone to other types of fears. Even if the four cognitive vulnerability variables are, in fact, related to the fear of various animals, it may be that the associations between the vulnerability perceptions and fear are a function of the specific animal under investigation. That is, the perceptions of particular stimuli may vary along the dimensions of uncontrollability, unpredictability, dangerousness, and disgustingness such that any particular stimulus demonstrates a specific vulnerability profile. Although there are a number of reasons for studying spiders, there remains a need to investigate the relationship between the vulnerability variables and fear of other animals. This is especially so for relatively low-fear animals, which are for the most part ignored in animal fear research.

The current study tested several hypotheses. First, it was predicted that each of the vulnerability variables (uncontrollability, unpredictability, danger, and disgust) would be significantly positively correlated with subjective fear of a number of different types of animals. Second, it was hypothesised that the four vulnerability variables would account for a significant amount of the variance in fear of each of the animals beyond that accounted for by perceived loomingness and after controlling for gender, negative evaluation, and prior familiarity. Finally, it was proposed that perceptions of unpredictability, uncontrollability, dangerousness, and disgustingness across a number of animals would exhibit significant positive correlations with fear of those animals. That is, the Cognitive Vulnerability Model would be able to explain the uneven distribution of fear across a number of animals.
Method

A total of 162 first-year university students in Adelaide volunteered for participation in the study. Sixty-five subjects were male and 96 were female, with one subject not identifying his/her gender. The ages of all participants ranged from 17 to 47 with a mean of 22.9 years ($SD = 7.6$).

The participants’ thoughts concerning a number of aspects of eight different animals were assessed using a questionnaire largely derived from Armfield and Mattiske [15]. The eight animals selected for study represented four animals traditionally found to elicit high fear responses and four animals that generally elicit little fear. The specific animals were selected on the basis of studies by Davey [39] and Bennett-Levy and Marteau [40]. Using a United Kingdom population, Davey examined self-reported fears to common indigenous animals. The five most feared animals were snakes, wasps, rats, cockroaches, and spiders. The six least feared animals were rabbits, guinea pigs, squirrels, fish, cats, and ducks. In an attempt to cross-validate the choice of animals for the present study, these findings were compared to those of Bennett-Levy and Marteau who looked at fear and avoidance of 29 harmless animals and found the six most feared animals to be rats, cockroaches, jellyfish, spiders, slugs, and grass snakes. The only overlap with the least feared animals found by Davey was for rabbits and cats. As a result of these findings, snakes, rats, cockroaches, and spiders were selected as high-fear animals while rabbits, guinea pigs, cats and ducks were chosen to represent low-fear animals. All these animals are found in Australia.

Two versions of the questionnaire were used, each looking at four animals (two high-fear and two low-fear). One version investigated spiders, ducks, rabbits, and cockroaches while the other version used cats, snakes, rats, and guinea pigs. The two versions were used in order to reduce the amount of time required for completing the questionnaire. Participants were randomly allocated one of the two questionnaire versions.

The variables measured were subjective fear, perceptions of dangerousness, disgustingness, uncontrollability, and unpredictability, loomingness, negative evaluation, familiarity, and learning history. All the variables were measured using self-endorsing items with possible response scores ranging from 1 to 7. Each item required a rating for all
four animals used in each questionnaire. The internal reliability coefficients for each scale for each animal are given in Table P2.1. Most scales demonstrated reasonable reliability, however negative evaluation showed relatively low internal consistency and the Loomingness scale had poor internal consistency in relation to the low-fear animals.

Following Geer [41], the participants were asked to indicate how much anxiety or fear they felt towards the different animals. A score of 1 was assigned to the response None, and the values 2 to 7 assigned respectively to points on the scale described as Very Little, A Little, Some, Much, Very Much, and Terror. This scale has been extensively cited [42] and has been found to have excellent psychometric properties and to be related to other personality measures [41].

Perceptions of dangerousness were assessed using four questions. Two of these questions referred to the potential dangerousness of the animal while the other two questions measured the subject’s perceived likelihood of actually being harmed. In an attempt to obtain a general measure of perceived dangerousness for each animal the questions either referred to situations where the specific breed or genus of the animal was unknown or were related to thoughts concerning the majority of these animals. The four items used to measure disgust in this study consisted of a short version of an eight-item scale employed by Armfield and Mattiske [15]. This measure has two sub-scales relating to disgust-eliciting features such as appearance and feel and disgust in relation to disease or dirtiness. Two items related to each of these sub-scales. Perceptions of uncontrollability were assessed using three questions relating to general feelings of control when interacting with the particular animal. These questions were selected from a larger measure designed by Armfield and Mattiske [15] on the basis of an analysis of optimum reliabilities for minimum items. All subjects also completed a three-item measure of unpredictability of movement for each animal. Higher scores on each of the four scales indicated increased perceptions of dangerousness, disgustingness, uncontrollability and unpredictability respectively. A list of the questions for each vulnerability-related perception is given in Appendix A.

Loomingness was measured using the five-item scale developed and employed by Riskind et al. [16]. An example item is “How slow or fast would a ______ move towards you?” This scale has been found to have good internal reliability ($\alpha = .93$) and has subsequently been used in annotated format in other studies. Interestingly, the internal reliability coefficients of the Loomingness scale obtained for all animals in this study were
appreciably less than those previously reported. Indeed, even using only two items from
the loomingness scale, Riskind et al. [18] found a high internal consistency (\(\alpha = .93\)) for
the loomingness measure. Reliability coefficients in this study ranged from .35 to only .67
(Table P2.1).

Participants were asked four questions designed to measure negative evaluations
of each animal. These evaluation items were obtained from the Semantic Differential Scale
developed by Osgood, Suci, and Tannenbaum [43]. The four items were selected
according to their relevance to possible evaluations of animals and comprised judgements
of the intelligence, usefulness, cruelness, and friendliness of the animals. An estimate of
the negative evaluation of each animal was obtained by taking the mean of the scores for
each item. High scores represented a negative evaluation, low scores a positive
evaluation, and scores in the middle of the possible range represented a neutral
evaluation.

Table P2.1

Reliability coefficients for all scales for all animals

<table>
<thead>
<tr>
<th>Animal</th>
<th>Danger(^a)</th>
<th>Disgust(^b)</th>
<th>Looming.(^b)</th>
<th>Negative (\alpha)</th>
<th>Uncont.(^c)</th>
<th>Unpred.(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-fear animals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td>0.86</td>
<td>0.78</td>
<td>0.67</td>
<td>0.67</td>
<td>0.81</td>
<td>0.73</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>0.79</td>
<td>0.78</td>
<td>0.62</td>
<td>0.53</td>
<td>0.78</td>
<td>0.81</td>
</tr>
<tr>
<td>Snakes</td>
<td>0.80</td>
<td>0.84</td>
<td>0.65</td>
<td>0.69</td>
<td>0.93</td>
<td>0.77</td>
</tr>
<tr>
<td>Rats</td>
<td>0.81</td>
<td>0.88</td>
<td>0.53</td>
<td>0.66</td>
<td>0.88</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Low-fear animals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks</td>
<td>0.68</td>
<td>0.68</td>
<td>0.53</td>
<td>0.53</td>
<td>0.66</td>
<td>0.75</td>
</tr>
<tr>
<td>Rabbits</td>
<td>0.70</td>
<td>0.72</td>
<td>0.48</td>
<td>0.56</td>
<td>0.66</td>
<td>0.72</td>
</tr>
<tr>
<td>Cats</td>
<td>0.71</td>
<td>0.76</td>
<td>0.35</td>
<td>0.69</td>
<td>0.77</td>
<td>0.75</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>0.72</td>
<td>0.80</td>
<td>0.56</td>
<td>0.53</td>
<td>0.67</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Note: All reliability coefficients represent standardised item alpha
\(a\) 4 items in scale; \(b\) 5 items in scale; \(c\) 3 items in scale
Familiarity was assessed by asking the participants how much personal experience they had had with each animal, with responses ranging from Considerable experience to No personal experience.

Six types of learning events were assessed, which may be classifiable as classical, vicarious, and informational conditioning experiences. These items required ratings of the worst harm/pain/illness ever inflicted on oneself, seen or heard about being inflicted upon another, the degree of mother’s and father’s fear, and the most fear ever seen being demonstrated by another person. This method of eliciting historical and experiential factors in the development of animal fears has been commonly used [44, 45]. Unlike the Phobic Origin Questionnaire developed by Öst and Hugdahl [46] which used a yes/no response classification, the current study required subjects to make ratings on a 7-point scale representing either degree of harm (None inflicted to Extremely serious) or degree of fear (No fear to Terrified). An option of Unknown was provided for ratings of mother’s and father’s fear.

Procedure

Ethical approval was obtained for the study and participants were informed that their participation was voluntary, that they would not be individually identifiable and that they were free to both discontinue their participation at any time and to decline to answer any particular question. Participants were tested in a group format in a university setting and were given brief information regarding the questionnaire, being told that it concerned beliefs that may or may not be related to animals. In an attempt to reduce demand characteristics, the participants were not informed that the questionnaire related to fears of animals. In addition, items relating to uncontrollability, unpredictability, dangerousness, disgustingness, loomingness, negative evaluation, and familiarity were presented in a mixed order prior to the questions relating to fear and learning history.

Analysis

Descriptive statistics were calculated for the fear, negative evaluation, perceptions of dangerousness, disgustingness, uncontrollability, unpredictability, loomingness, and familiarity associated with each of the eight animals. Pearson R correlations were used to assess the association between fear of each animal and the Independent Variables (IVs),
including possible conditioning experiences. Two series of hierarchical multivariate regression models were constructed for fear of each animal. For one series, the cognitive vulnerability variables were entered as the last step, after controlling for perceived loomingness and other possible confounders. In the other series, perceived loomingness was entered as the last step after controlling for the cognitive vulnerability variables and other possible confounders. Statistical significance was assessed via the change in $R^2$. Finally, aggregate data were used to determine the linear associations between the fear of animals and the various IVs. Because of the large number of analyses, the criterion alpha for rejecting the null hypothesis was set at 0.01 to reduce the risk of Type 1 error.

Results

The descriptive statistics for the high-fear animals on all the measures are presented in Table P2.2. In general, mean fear for these animals ranged from a rating of 3.00 for cockroaches, to 4.47 for snakes. Snakes were rated as being the most dangerous, uncontrollable, unpredictable, and looming of the animals. Cockroaches were perceived as the most disgusting animal and were evaluated more negatively than the other high-fear animals, although they were rated as the least dangerous, uncontrollable, and unpredictable. Spiders were the most familiar of the high-fear animals (mean = 4.76) while snakes and rats were the least familiar (means = 2.73 and 2.81 respectively).

As expected, all the low-fear animals were feared less than the high-fear animals (Table P2.3). All fear ratings were between None and Very Little on average. Of the low-fear animals, ducks were the most feared (mean = 1.67) while rabbits were the least feared. Guinea pigs were perceived as the most disgusting and unpredictable of the low-fear animals and were evaluated the most negatively. Ducks were rated as the most uncontrollable of the low-fear animals and cats obtained the highest rating of loomingness and dangerousness.
Table P2.2

Descriptive statistics for all measures for high-fear animals

<table>
<thead>
<tr>
<th></th>
<th>Spider(^a)</th>
<th>Cockroach(^a)</th>
<th>Snake(^b)</th>
<th>Rat(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
</tr>
<tr>
<td>Fear</td>
<td>4.00  1.77</td>
<td>3.00  1.86</td>
<td>4.47  1.83</td>
<td>3.44  1.94</td>
</tr>
<tr>
<td>Dangerousness</td>
<td>3.93  1.49</td>
<td>2.16  1.11</td>
<td>5.04  1.22</td>
<td>3.20  1.31</td>
</tr>
<tr>
<td>Disgustingness</td>
<td>4.94  1.47</td>
<td>6.01  1.18</td>
<td>4.14  1.66</td>
<td>5.10  1.70</td>
</tr>
<tr>
<td>Uncontrollability</td>
<td>3.44  1.85</td>
<td>2.71  1.68</td>
<td>4.89  1.82</td>
<td>3.57  1.86</td>
</tr>
<tr>
<td>Unpredictability</td>
<td>4.57  1.43</td>
<td>4.16  1.66</td>
<td>4.95  1.42</td>
<td>4.49  1.33</td>
</tr>
<tr>
<td>Loomingness</td>
<td>4.34  1.22</td>
<td>3.82  1.11</td>
<td>4.83  1.18</td>
<td>4.23  1.00</td>
</tr>
<tr>
<td>Negative evaluation</td>
<td>3.98  1.11</td>
<td>4.81  1.05</td>
<td>4.23  1.13</td>
<td>4.17  1.17</td>
</tr>
<tr>
<td>Familiarity</td>
<td>4.76  1.69</td>
<td>3.99  1.87</td>
<td>2.73  1.87</td>
<td>2.81  1.79</td>
</tr>
</tbody>
</table>

\(^a\) For all measures, \(n = 88\)

\(^b\) For all measures, \(n = 90\)

Table P2.3

Descriptive statistics for all measures for low-fear animals

<table>
<thead>
<tr>
<th></th>
<th>Duck(^a)</th>
<th>Rabbit(^a)</th>
<th>Cat(^b)</th>
<th>Guinea Pig(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
</tr>
<tr>
<td>Fear</td>
<td>1.67  0.91</td>
<td>1.40  0.74</td>
<td>1.51  0.84</td>
<td>1.52  0.93</td>
</tr>
<tr>
<td>Dangerousness</td>
<td>1.78  0.75</td>
<td>1.60  0.72</td>
<td>1.98  0.80</td>
<td>1.83  0.87</td>
</tr>
<tr>
<td>Disgustingness</td>
<td>3.09  1.08</td>
<td>3.02  1.11</td>
<td>2.16  1.71</td>
<td>3.61  1.37</td>
</tr>
<tr>
<td>Uncontrollability</td>
<td>1.84  0.92</td>
<td>1.55  0.81</td>
<td>1.71  0.98</td>
<td>1.73  0.98</td>
</tr>
<tr>
<td>Unpredictability</td>
<td>3.37  1.29</td>
<td>3.26  1.38</td>
<td>3.22  1.40</td>
<td>3.41  1.34</td>
</tr>
<tr>
<td>Loomingness</td>
<td>3.39  0.85</td>
<td>3.43  0.87</td>
<td>3.78  0.78</td>
<td>3.19  0.92</td>
</tr>
<tr>
<td>Negative evaluation</td>
<td>3.24  0.91</td>
<td>3.50  1.05</td>
<td>2.96  1.23</td>
<td>3.80  0.97</td>
</tr>
<tr>
<td>Familiarity</td>
<td>4.40  1.94</td>
<td>4.69  1.91</td>
<td>6.11  1.55</td>
<td>3.16  2.11</td>
</tr>
</tbody>
</table>

\(^a\) For all measures, \(n = 88\)

\(^b\) For all measures, \(n = 90\)
All the low-fear animals were rated as less dangerous, disgusting, uncontrollable, and unpredictable than the high-fear animals and were evaluated less negatively. Although the low-fear animals were rated as less looming than the high-fear animals there was little difference between cats (a low-fear animal) and cockroaches (a high-fear animal). Finally, although cats were rated as the most familiar of any of the eight animals, spiders (a high-fear animal) were rated as more familiar than the remaining low-fear animals, and cockroaches were rated as more familiar to participants than were guinea pigs.

All of the vulnerability variables were significantly correlated with fear of each of the high-fear animals (Table P2.4). Uncontrollability consistently exhibited the highest correlations with fear while unpredictability had the lowest correlations with fear. Perceived dangerousness, disgustingness, and uncontrollability were also significantly correlated to fear of each of the low-fear animals. Once again, perceptions of uncontrollability had the highest correlations with fear of each of the animals. However, the only significant correlation between unpredictability and fear for the low-fear animals was for cats. For ducks, rabbits, and guinea pigs perceptions of unpredictability were not significantly related to fear.

Table P2.4

The relationship between fear of each animal and dangerousness, disgustingness, uncontrollability and unpredictability

<table>
<thead>
<tr>
<th>Animal</th>
<th>Dangerousness</th>
<th>Disgustingness</th>
<th>Uncontrollability</th>
<th>Unpredictability</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-fear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td>0.70**</td>
<td>0.58**</td>
<td>0.85**</td>
<td>0.40**</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>0.46**</td>
<td>0.49**</td>
<td>0.82**</td>
<td>0.32*</td>
</tr>
<tr>
<td>Snakes</td>
<td>0.71**</td>
<td>0.60**</td>
<td>0.83**</td>
<td>0.57**</td>
</tr>
<tr>
<td>Rats</td>
<td>0.77**</td>
<td>0.66**</td>
<td>0.88**</td>
<td>0.58**</td>
</tr>
<tr>
<td>Low-fear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks</td>
<td>0.60**</td>
<td>0.30*</td>
<td>0.72**</td>
<td>0.24</td>
</tr>
<tr>
<td>Rabbits</td>
<td>0.62**</td>
<td>0.34**</td>
<td>0.74**</td>
<td>0.25</td>
</tr>
<tr>
<td>Cats</td>
<td>0.47**</td>
<td>0.32*</td>
<td>0.73**</td>
<td>0.35**</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>0.38**</td>
<td>0.40**</td>
<td>0.51**</td>
<td>0.13</td>
</tr>
</tbody>
</table>

* p < 0.01; ** p < 0.001
Perceptions of loomingness were significantly, albeit moderately, correlated with fear of each of the high-fear animals (Table P2.5). However, the only significant correlation between loomingness and fear for the low-fear animals was for rabbits. It was expected that people who are afraid of an animal may evaluate the animal negatively, perhaps as a consequence of their fear. Consistent with this prediction, negative evaluation was significantly correlated with fear of the high-fear animals. However, the only animal showing a significant correlation between fear and negative evaluation for the low-fear animals was ducks. In general, there were few significant relationships between prior familiarity with an animal and fear of that animal. However, for both snakes and rats familiarity exhibited a statistically significant negative correlation with the fear measure. That is, the more familiarity with the animal, the less fear indicated.

Table P2.5

The relationship between fear of each animal and loomingness, negative evaluation and familiarity

<table>
<thead>
<tr>
<th>Animal</th>
<th>Loomingness</th>
<th>Negative Evaluation</th>
<th>Familiarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-fear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td>0.41”</td>
<td>0.40”</td>
<td>-0.20</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>0.31*</td>
<td>0.42”</td>
<td>0.17</td>
</tr>
<tr>
<td>Snakes</td>
<td>0.41”</td>
<td>0.58”</td>
<td>-0.42”</td>
</tr>
<tr>
<td>Rats</td>
<td>0.41”</td>
<td>0.57”</td>
<td>-0.41”</td>
</tr>
<tr>
<td>Low-fear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks</td>
<td>0.08</td>
<td>0.43”</td>
<td>-0.02</td>
</tr>
<tr>
<td>Rabbits</td>
<td>0.28*</td>
<td>0.16</td>
<td>-0.09</td>
</tr>
<tr>
<td>Cats</td>
<td>0.11</td>
<td>0.17</td>
<td>-0.10</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>0.23</td>
<td>0.19</td>
<td>-0.19</td>
</tr>
</tbody>
</table>

* $p < 0.01$; ** $p < 0.001$
Table P2.6 shows the Pearson $R$ correlations between fear and potential conditioning experiences for each animal. Overall, there were very few statistically significant associations. Only one association between fear of high-fear animals and possible learning experiences reached statistical significance, while no significant associations were evident for low-fear animals.

Table P2.6

Correlations between fear of each animal and ratings of possible conditioning experiences

<table>
<thead>
<tr>
<th>Animal</th>
<th>Exp. 1</th>
<th>Exp. 2</th>
<th>Exp. 3</th>
<th>Exp. 4</th>
<th>Exp. 5</th>
<th>Exp. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-fear animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td>-0.09</td>
<td>0.06</td>
<td>0.09</td>
<td>0.01</td>
<td>-0.11</td>
<td>0.01</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>0.24</td>
<td>0.11</td>
<td>0.06</td>
<td>0.01</td>
<td>-0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>Snakes</td>
<td>0.05</td>
<td>0.04</td>
<td>0.05</td>
<td>0.04</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>Rats</td>
<td>-0.04</td>
<td>0.09</td>
<td>0.12</td>
<td>0.11</td>
<td>0.22</td>
<td>0.25*</td>
</tr>
<tr>
<td>Low-fear animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks</td>
<td>0.10</td>
<td>0.08</td>
<td>0.13</td>
<td>0.17</td>
<td>0.15</td>
<td>0.06</td>
</tr>
<tr>
<td>Rabbits</td>
<td>0.07</td>
<td>0.05</td>
<td>0.18</td>
<td>0.21</td>
<td>0.11</td>
<td>0.17</td>
</tr>
<tr>
<td>Cats</td>
<td>0.18</td>
<td>0.12</td>
<td>0.15</td>
<td>0.24</td>
<td>0.21</td>
<td>0.14</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>0.24</td>
<td>0.20</td>
<td>0.25</td>
<td>0.13</td>
<td>0.15</td>
<td>0.16</td>
</tr>
</tbody>
</table>

* $p < 0.01$

In order to test the effects of the vulnerability variables on after controlling for the other variables a series of hierarchical multiple linear regression analyses were conducted. For each animal, the vulnerability variables were entered as a block at Step 3, following the forced entry of gender and negative evaluation at Step 1 and loomingness at Step 2. Due to its non-significant effect on fear of most of the animals used in this study, Familiarity was not used in the regression equations. In addition to testing for the independent effects of the vulnerability variables on each animal, the independent effect of loomingness was also determined. Once again, a series of hierarchical multiple linear regression analyses were conducted, this time with gender and negative evaluation at Step 1, uncontrollability, unpredictability, dangerousness, and disgustingness at Step 2, and
loomingness at Step 3. These analyses were done for each animal using fear as the DV. Because of the correlations between many of the variables, checks for multicollinearity were carried out as recommended by Tabachnick and Fidell [47]. However, no evidence of multicollinearity was found among the variables.

A summary of the full series of multiple regressions is given in Table P2.7. For each animal, the vulnerability variables accounted for a significant amount of variance in fear beyond that accounted for by gender, negative evaluation and loominess. Loominess, however, did not account for a significant amount of variance in fear, for any animal, beyond the variance accounted for by gender, negative evaluation, and the vulnerability-related variables. In general, there was either no effect or only a small independent effect for loominess beyond that for the other variables.

Table P2.7

$R^2$ Change for independent contributions of loominess and the vulnerability variables to fear of each animal

<table>
<thead>
<tr>
<th>Animal</th>
<th>Vulnerability variables$^a$</th>
<th>Loominess$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-fear animals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td>0.50***</td>
<td>0.00</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>0.47***</td>
<td>0.00</td>
</tr>
<tr>
<td>Snakes</td>
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<td>0.00</td>
</tr>
<tr>
<td>Rats</td>
<td>0.35***</td>
<td>0.01</td>
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<tr>
<td>Low-fear animals</td>
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<td></td>
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<tr>
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<td>0.00</td>
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<tr>
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<td>0.00</td>
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<tr>
<td>Cats</td>
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<tr>
<td>Guinea Pigs</td>
<td>0.20***</td>
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</tbody>
</table>

$^a R^2$ Change after controlling for Gender, Negative Evaluation, and Loominess

$^b R^2$ Change after controlling for Gender, Negative Evaluation, Uncontrollability, Unpredictability, Dangerousness, and Disgustingness
Aggregated data were plotted to examine the linear associations between fear of the animals used in this study and perceptions of the animals as dangerous, disgusting, unpredictable, uncontrollable, looming, negatively evaluated and familiar. The associations with fear were strongest for unpredictability ($R^2 = 0.98$) and uncontrollability ($R^2 = 0.94$) while dangerousness and loomingness were also good predictors of fear (Table P2.8). The relationships of disgustingness and negative evaluation with fear did not reach statistical significance at the 0.05 criterion alpha. The associations between familiarity and fear were not statistically significant.

Table P2.8

Fear of animals and ratings of dangerousness, disgustingness, uncontrollability, unpredictability, loomingness, negative evaluation and familiarity

<table>
<thead>
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<th>$R^2$</th>
<th>$p$</th>
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<td>0.001</td>
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<td>Disgustingness</td>
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<td>0.058</td>
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<td>0.993</td>
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<tr>
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<td>0.062</td>
<td>0.683</td>
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<tr>
<td>Familiarity</td>
<td>0.24</td>
<td>0.222</td>
<td>-0.486</td>
</tr>
</tbody>
</table>
Discussion

It was hypothesised that perceptions of an animal as uncontrollable, dangerous, disgusting, and unpredictable would be significantly related to fear of the animal. This prediction follows directly from the assumptions of the Cognitive Vulnerability Model [9]. This study found moderate to very high correlations between the four cognitive vulnerability variables and fear of high-fear animals. In addition, all the variables except unpredictability exhibited significant associations with fear of low-fear animals.

One of the main objectives of this study was to determine whether the perceptions of an animal as uncontrollable, unpredictable, dangerous and disgusting would explain a significant amount of variance in fear beyond the variance accounted for by the perceived loomingness of the animals. Riskind and colleagues have received much attention in regards to their looming vulnerability formulation of anxiety and the concept of a ‘looming maladaptive style’ [48]. In this study it was found that while the perceived loomingness of animals accounted for no more than 1% of the variance in fear for most animals beyond the variance explained by the vulnerability variables, the vulnerability variables accounted for between 20% and 51% of fear beyond that accounted for by perceived loomingness. The results provide strong support for the Cognitive Vulnerability Model of the etiology of fear and bring into question the utility of the harm-looming model. It is highly plausible that the concept of loomingness is in fact merely an aspect of an object’s or animal’s perceived unpredictability. There may also be a sense of loss of control in regards to a rapidly approaching stimulus. While loomingness may tap into perceptions of unpredictability and uncontrollability, it appears that the four cognitive vulnerability variables make a significantly more substantial contribution to explaining fear of animals than recourse to the concept of perceived loomingness.

One result from this study that should be noted, however, and which may bear on the poor relationship between loomingness and fear, is that the internal reliability coefficients of the five-item Loomingness scale for all animals investigated in this study were much less than those reported previously. The discrepancies between previous studies and the current study are difficult to reconcile, but might go some way towards accounting for the weaker relationships between loomingness and fear found here.
Although classical conditioning theory would predict that increased familiarity with a stimulus would lead to a reduced likelihood of fear of the stimulus, no relationship between familiarity and subjective fear was found in the current study. Interpreted in light of the Cognitive Vulnerability Model this is understandable in that any significant relationships between familiarity and fear would stem not from the processes of habituation or reduced predictiveness but from the differential perceptions of uncontrollability, unpredictability, dangerousness, and disgustingness associated with each stimulus. That is, familiarity with an animal would be accompanied by various vulnerability perceptions of the animal that, in turn, would be related to fear. However, the pattern of these relationships would be complex. Familiarity with animals which might be considered as objectively unpredictable, uncontrollable, dangerous, and disgusting would be more likely to result in increased fear while familiarity with animals which are less likely to be perceived in such ways should result in less fear. However, familiarity with any given stimulus would lead to varying perceptions of the animal depending upon the specific experiences. It is not necessarily the case, therefore, that prior familiarity would automatically lead to reduced fear.

One of the enduring problems in fear research is the inability to account for the uneven fear distribution in the population. Population-based fear surveys demonstrate that some objects or situations are feared more than others [49]. An early attempt to account for this phenomenon used conditioning theory. According to this theory, those objects or situations most feared were also most liable to cause injury or pain and occurred most often. The high prevalence of fear of dangerous animals or situations seemed to lend credence to this argument. However, some researchers pointed out that many more injuries or painful experiences resulted from electric shocks, getting hit on the thumb by a hammer or falling down stairs than were received through spider or snake bites [13], let alone through such highly feared situations as nuclear war or terrorist attack. In the current study, the lack of significant associations between fear of animals and the experience of conditioning or learning events is testimony to the problems with the conditioning theory of fear acquisition. The reality is that many people have never had an adverse experience with the object of their fear or phobia [38].

Preparedness theory has been developed to explain the uneven fear distribution by recourse to the idea of biological preparedness or an inherent predisposition to learn to fear some stimuli more than others [10]. The theory holds that animals or situations which
in pre-technological times have been associated with pain or injuries are more likely to be feared in the population today as a result of the increased propensity for fear learning to occur to these stimuli. Hence, dangerous animals, water, heights, and other stimuli perilous to pre-technological people should be more feared than modern day dangers such as guns, electricity outlets, or hammers. There is some support for this theory with the finding that perceptions of the dangerousness of animals in this study were significantly related to fear of the animal. However, the strongest predictors of fear, and therefore the best predictors of the uneven fear distribution, at least in terms of animals, were perceptions of the unpredictability and uncontrollability of the animals, accounting for 98% and 94% respectively of the variance in the distribution of animal fears. While the animals used in this study had a reasonable spread across the fear continuum it would be interesting to undertake similar analyses using an even larger number of animals.

One of the weaknesses of this study is its reliance on the often used method of self-report. For example, judgements of familiarity and fear ratings are based on subjective reporting and these have several inherent weaknesses, including the possibility for memory biases and cognitive distortions. Adding behavioural assessments in future studies would be beneficial, although as the number of animals or situations being assessed increases this could clearly pose problems with behavioural assessment methodologies.

Although this study ostensibly deals with normative fears and no attempt was made to diagnose or classify any fearful people as having a Specific Phobia, the applicability of the Cognitive Vulnerability Model is not limited to sub-clinical manifestations of fear. The Cognitive Vulnerability Model positions fear as a unidimensional structure with the designation phobia merely occupying an extreme position along the continuum. Perceptions of a given feared stimulus as uncontrollable, unpredictable, dangerous and disgusting are just as important in the etiology and maintenance of acute phobic fear as in sub-clinical fears. An understanding of these fundamental relationships will have important implications not just in understanding the causes of fear but for the treatment of phobic individuals. Cognitive-behavioural therapies should ideally focus on a person’s perception of the uncontrollability, unpredictability, dangerousness and disgustingness of the feared stimulus. By addressing these core components of the vulnerability schema underlying the fear, reduction in fear should occur more rapidly and be longer lasting.
Conclusions

In summary, this study found strong support for the proposition that the variables of uncontrollability, unpredictability, dangerousness and disgustingness are highly related to subjective fear of animals and that these variables strongly predict the uneven fear distribution of animals. Familiarity with animals and previous conditioning experiences were not related to fear of the animals. Finally, perceptions of the loomingness of the animals, although related to fear, failed to explain variance in fear of the animals beyond that accounted for by the vulnerability variables of uncontrollability, unpredictability, dangerousness and disgustingness. This study underlines the utility of investigating cognitive processes in relation to the fear experience and provides strong support for the Cognitive Vulnerability Model of the etiology of fear.

Competing interests

None declared.
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Appendix A

Disgust

I think that _____ would feel pleasant to touch.

If I touched a _____ it would be important for me to wash my hands afterwards.

I think that _____ are dirty or unclean animals.

I would be revolted or disgusted if a _____ came into contact with my skin.

Uncontrollability

I believe that I would be able to deal effectively with a _____ by myself when encountered.

If a _____ was nearby I would not feel in control of the encounter.

I do not believe that I would lose control over my actions in any way (e.g. panic or freeze) if a _____ came as rapidly as it could towards me.

Unpredictability

I find most _____ to be predictable in their movements.

I think that the movement of _____ can be guessed in advance.

I never know what a _____ is going to do.

Dangerousness

How potentially dangerous do you think that most _____ are to you?

I believe that if I came into contact with an unknown _____ I would be harmed.

I think that the majority of _____ are harmless to me.

I think that if I encountered an unknown _____ I would not be harmed in any way.
CHAPTER 6 (PAPER 3) – MANIPULATING PERCEPTIONS OF SPIDER CHARACTERISTICS AND PREDICTED SPIDER FEAR: EVIDENCE FOR THE COGNITIVE VULNERABILITY MODEL OF THE ETIOLOGY OF FEAR

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Statement of authorship

MANIPULATING PERCEPTIONS OF SPIDER CHARACTERISTICS AND PREDICTED SPIDER FEAR: EVIDENCE FOR THE COGNITIVE VULNERABILITY MODEL OF THE ETIOLOGY OF FEAR.

Journal of Anxiety Disorders

Armfield J.M. (Candidate)

Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: .................................
While most of the research in this thesis uses a cross-sectional survey design, the Cognitive Vulnerability Model proposes causal effects, arguing that perceptions of stimulus characteristics ‘cause’ the fear response. However, while cross-sectional studies may provide relevant or important insights into relationships presupposed by causal models, they can not of themselves demonstrate causality. It was therefore always deemed necessary to carry out a randomised experimental study to see if manipulating perceptions of a stimulus would lead to differences in self-rated fear. Whether the specific stimulus involves lying in a dental chair, encountering a dog, or taking off in an airplane, if people can be convinced to change their perception of a stimulus or situation as uncontrollable, unpredictable, dangerous and disgusting then this should lead to a change in their level of fear. If there had been no change, if this critical test had been failed, it would have impacted seriously on the scope of the model and would have required either a revision of some of the fundamental components of the model or a reworking of how vulnerability-related perceptions impact on fear.
Introduction to paper and additional information

When originally submitted, Paper 3 was included with what is now Paper 4 in the same manuscript. The reason for this was that originally only one causal study was planned however after the imaginal scenario failed to elicit strong effects it was decided to strengthen the salience of the study by adding an in vivo element. The manuscript was originally submitted to Behaviour Research and Therapy where the Editor stated that the “reviewers noted several strengths to your manuscript including the experimental manipulation of perceived predictability, controllability, and dangerousness”. However, the paper was rejected for publication for the major reasons that it was (1) too long; (2) lacking an adequate description of the Cognitive Vulnerability Model; and (3) the measures of uncontrollability, unpredictability, dangerousness and disgustingness did not have “evidence for their psychometric validity or reliability properties”. The first of these problems was countered by splitting the manuscript into two separate studies, represented in this thesis by Papers 3 and 4. The second problem was rectified when the model (Paper 1) was published in Clinical Psychology Review. Unfortunately little could be done for the third criticism. Because there were no existing measures of the vulnerability perceptions for animals it was a necessary task to create the measures afresh. While a question such as “Do you think snakes are dangerous?” might seem to have obvious face validity in assessing perceptions of the danger of snakes, they can be easily criticised for not having proven psychometric credentials. Nonetheless, the manuscript was resubmitted to the Journal of Anxiety Disorders where it was accepted with few changes required.
Abstract

The present study reports on an attempt to experimentally manipulate perceptions of uncontrollability, unpredictability and dangerousness related to an imaginal encounter with a spider in order to determine whether there is an effect on self-rated predicted spider fear. Experimental manipulations involved differing information in relation to both the spider and the imaginal task. The control, predictability and dangerousness manipulations all had significant main effects on task-related spider fear (TRSF). Measures of the perception of the spiders as uncontrollable, unpredictable and dangerous were also significantly associated with TRSF and accounted for 42% of the variance in predicted fear beyond that accounted for by the experiment manipulations. Results are discussed in terms of their implications for better understanding the etiology and maintenance of fear. The overall findings are consistent with the Cognitive Vulnerability Model, with cognitive perceptions of an object or situation seen as causal determinants of the fear associated with the stimulus.
Introduction

It is now widely acknowledged that cognitive factors must be taken into account to adequately understand anxiety disorders. However, the legacy of behaviorist theories remains influential in regards to specific phobias. For example, it is still commonly assumed that the processes underlying these disorders and their treatment are non-cognitive, leading to behavioral techniques being considered the psychological treatments of choice (Brown, Abrahams & Helbert, 2003). This is perhaps not surprising given that much of our knowledge of fear and emotion is based on an extensive animal literature which has subsequently been tested and applied to humans (Delgado, Olsson & Phelps, 2006).

Despite the scientific predilection for neo-behavioral etiological theories, hundreds of studies have now investigated cognitive aspects of specific phobias and subclinical fears. One area of study relates to perceptions of stimulus characteristics. Armfield and Mattiske (1996), for example, found that fear of spiders was strongly associated with perceptions of spiders as dangerous, uncontrollable, unpredictable and disgusting. These stimulus characteristics, termed cognitive vulnerability perceptions, were found to account for more than half of the variance in spider fear beyond that accounted for by a number of classical conditioning, informational and vicarious conditioning experiences. Indeed, the majority of negative beliefs of spider phobics have been found to center on the uncontrollable and unpredictable behavior of spiders, as well as the possibility of harm (Arntz, Lavy, van den Berg, & van Rijsoort, 1993). Consistent with these studies, Riskind, Kelley, Harman, Moore, & Gaines (1992) found that beliefs about the danger, probability of harm, imminence, uncontrollability, and unpredictability of spiders were highly correlated with fear of spiders.

Armfield (2006) has proposed a model of the etiology of specific fears which asserts that an individual’s fear of a given stimulus is a result of cognitive perceptions of the stimulus as uncontrollable, unpredictable, dangerous and disgusting, and that these contribute to an overall perception of vulnerability related to any given stimulus (Rather than place emphasis on the occurrence of an adverse learning event, it is the perception of the stimulus, based on the learning experiences, which is seen as pre-eminent in fear determination. While not a repudiation of prior learning experiences, human cognitions
are placed at the forefront of fear determination rather than viewing them as merely a symptom of fear.

The Cognitive Vulnerability Model (CVM) advanced by Armfield (2006) can be differentiated from a number of other cognitive models advanced to date. Beck and Emery’s (1985) seminal work, for instance, focuses principally on danger cognitions yet advances learning theory and biological preparedness as the primary factors in ‘causing’ fear. Riskind’s (1997; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000) looming vulnerability model proposes that a looming maladaptive style focussed on the temporal and spatial progression of potential threat lies at heart of anxiety responses. This looming vulnerability model differs from the CVM due to its emphasis on the importance of the dynamic process of increasing imminence of danger rather than on other stimulus perceptions. Barlow’s (2000, 2003) Triple Vulnerability Theory shares more conceptual similarities to the CVM, proposing that a sense of unpredictability and uncontrollability related to possible future threat lie at the core of anxiety. In contrast, however, the CVM proposes that unpredictability and uncontrollability are negative states in and of themselves, and along with perceptions of dangerousness and disgustingness comprise a vulnerability schema related to a given stimulus or situation.

Studies using human populations have found deleterious effects for lack of control versus control on responses to aversive stimuli or events (Milgrom, Vignehsa, & Weinstein, 1992; Sanderson, Rapee, & Barlow, 1989). Likewise, a small number of experiments allowing subjects to exert varying degrees of control over stimulus situations have found that perceived controllability decreases the aversive nature of a stressor (Geer & Maisel, 1972; Glass, Reim & Singer, 1971; Sartory & Daum, 1992). It has been argued that, for both animals and humans, behavioral control over a stressor is one of the most potent determinants of the behavioral, physiological and neural impact of that stressor (Maier & Watkins, 1998).

In contrast to controllability, which affords a person the ability to influence an event, predictability refers to knowledge of the spatial or temporal characteristics of an object or situation. Although these constructs overlap in some instances and some experiments have previously confounded these variables (Miller, 1979; Weinberg & Levine, 1980), it has been argued they can be considered as conceptually discrete on a number of dimensions (Armfield, 2006).
There has been considerable empirical support for the idea that unpredictable events are experienced as more aversive than predictable events. Perceived unpredictability is highly correlated with fear of a variety of stimuli and events (Armfield & Mattiske, 1996; Merckelbach, van den Hout, Jansen, & van der Molen, 1988; Normoyle & Lavrakas, 1984). Also, both unpredictable shocks (Katz, 1984; Katz & Wykes, 1985) and animal movements (Lick, Candiotte, & Unger, 1978) have been found to be more distressing and aversive than their predictable counterparts. Finally, predictable administrations of carbon dioxide enriched air are preferred more by people with panic disorder than are unpredictable administrations (Lejuez, Eifert, Zvolensky, & Richards, 2000).

The proposition that dangerousness is related to fear appears intuitively straightforward. From an evolutionary perspective, it makes sense that people should be afraid of those things which threaten to inflict harm or injury. Indeed, some researchers see fear and danger as being intimately related. Marks (1987), for example defines fear as “an emotion produced by the perception of present or impending danger” (p. 3). A plethora of studies demonstrate the existence of the relationship between dangerousness and fear. For example, expectations of pain and harm are related to fear in a number of situations (see e.g., Arntz, van Eck, & Heijmans, 1990; Blakely, 1994; Menzies & Clarke, 1995) and factor analytic studies of feared outcomes consistently report factors centered on physical harm (Campbell & Rapee, 1994; Lovibond & Rapee, 1993).

There is evidence that the cognitive vulnerability-related perceptions of dangerousness, uncontrollability, and unpredictability are related to the experience of spider fear (Armfield & Mattiske, 1996). Yet, the direction of this relationship remains to be convincingly demonstrated. Although vulnerability-related perceptions may lead to the determination of a fear response set, it is also conceivable that people imbue a feared stimulus with these properties post hoc in order to ‘make sense’ of their fear. To test for cause-effect relationships, the experimental manipulation of these variables is required. The current study, therefore, investigated the effect of manipulating people’s perceptions of the uncontrollability, unpredictability, and dangerousness of a hypothetical encounter with a spider on self-rated anticipated fear.

In line with the Cognitive Vulnerability Model (Armfield, 2006), it was hypothesized that subjects who experienced greater uncontrollability, greater unpredictability, and more danger would rate the spider encounter as being more
frightening than would subjects who perceived the spider as being less uncontrollable, less unpredictable, and less dangerous, respectively.

**Method**

**Participants**

The participants comprised 169 undergraduate university students from Adelaide, South Australia. All subjects were recruited via a university employment service and were provided a small financial remuneration for their time. Subjects participated voluntarily and were informed of their rights to withdraw from the study at any time and to decline to answer any question. Participants were 111 females and 58 males and their mean age was 21.3 years (SD = 5.9).

**Design**

The study used a 2 x 2 x 2 between-subjects, fully factorial experimental design with the independent variables being uncontrollability (high, low), unpredictability (high, low), and dangerousness (high, low). Subjects were randomly allocated to one of the eight experimental conditions formed from the three factors. The factors were manipulated by varying the information given to the subjects regarding the nature of the task and the characteristics of the spider.

**Materials**

A handout (including a questionnaire) was administered for each of the eight conditions resulting from the crossing of the uncontrollability, unpredictability, and dangerousness factors. The handout contained a measure of pre-existing spider fear, the manipulations and manipulation checks, and a measure of task-related fear.

*Pre-existing Spider Fear (PSF)* was assessed using a five-item self-rating questionnaire with all items measured on a 7-point scale. Two of the items had the response scale reversed to counteract possible response bias. The mean of the individual ratings was taken as the Pre-existing Spider Fear score, with a score of 1 indicating no fear.
and 7 indicating extreme fear. The questionnaire tapped the various dimensions of subjective fear, negative evaluation, vigilance, approach behavior, and avoidance behavior. Despite this diverse coverage of fear-related areas the internal reliability of the questionnaire was high (standardised $\alpha = .91$) and the corrected item-total correlations ranged from .67 to .80.

The Task Related Spider Fear (TRSF) measure was originally developed by Armfield (1995) and contains six items measured on a 7-point scale. The items measure subjective anxiety, desired avoidance, and physiological reactivity. Two filler items measure concern about being bitten and worry about unexpected movement are not used in calculating the total TRSF score as they relate to reactions to the experimental manipulations. The internal reliability of the (four item) scale was high (standardised $\alpha = .91$) with corrected item-total correlations ranging from .75 to .82. In an unpublished study, Armfield (1995) found the scale to correlate highly ($r = .79$) with the S-Anxiety scale of the State-Trait Anxiety Inventory (Form Y; Spielberger, 1983) and it proved capable of discriminating low fear from high fear people.

**Procedure**

Participants completed the questionnaire in small groups. After completing the PSF measure, subjects were presented with a vignette which they were asked to imagine as vividly as possible. The participants were told:

“You are led into a small room and in the middle of the room is a table with a small glass aquarium (approx. 50 x 30 cm) positioned in the middle of it. The aquarium is divided into an upper and a lower section. The lower section is empty. On one side of the upper section, the divider has an outline of a hand drawn on it. The other side of the divider is hinged and will drop down when a release mechanism is pulled.

On the hinged side of the divider, in the upper section, is a spider which has a glass jar placed over it. Your task in this experiment is to place your hand within the outline of the hand drawn on the divider. When your hand is flat on the divider the jar will be removed from above the spider and you will be required to keep your hand in this position for 10 seconds.”

Information relating to the spider was given following the section concerning the imaginary task. The participants in all conditions were informed that a spider of the genus *Ixeuticus robustus* would be used. A life-size photograph of the spider, as viewed from above, was presented beside this information. *Ixeuticus robustus* is now known as the
Black House Spider (*Badumna insignis*) of Australia, and is both generic in appearance and unlikely to be as well known as some other more infamous Australian spiders.

The participants were given different information concerning the uncontrollability, unpredictability, and dangerousness of the situation depending upon the condition to which they were assigned. Particularly important information was presented in bold-faced text in order to increase the impact of this information.

Subjects in the Low Uncontrollability condition (LUNC) were told:

“If the spider moves towards your hand you are advised to cause the spider to drop into the bottom section of the aquarium by pulling the release mechanism.”

Participants in the High Uncontrollability condition (HUNC), on the other hand, were told:

“If the spider moves towards your hand you are requested to leave your hand flat on the divider until you are advised that the 10 seconds is over.”

In both conditions, therefore, the subjects were required to leave their hand on the divider, however people in the LUNC group had the option of pulling the release mechanism giving them greater control over both the experimental situation and the approach of the spider.

Participants in the High Dangerousness condition (HDAN) were informed that:

“The spider used in this experiment has relatively large fangs and, if it bites you, is capable of causing localised pain and swelling. However, the spider does not pose any substantial danger to you.”

Participants in the Low Dangerousness group (LDAN) were told that:

“The spider used in this experiment has relatively small fangs which are incapable of penetrating human skin. Therefore, the spider does not pose any danger to you at all.”

Subjects were given information about the predictability of the spider under the heading “How will the spider behave?” Participants in the High Unpredictability condition (HUNP) were told:

“When the spider perceives threat its natural response is either to freeze or to move quickly, running in an unpredictable manner. If the spider does move, it characteristically does so suddenly, giving no indication that it is about to move. Therefore, it is possible that the spider may move unexpectedly when you put your hand in the aquarium.”

Subjects in the Low Unpredictability condition (LUNP) were informed:

“When the spider perceives threat its natural response is to freeze and remain completely immobile in an attempt to escape detection. If the spider does
move, it characteristically arches its body in the air for 1 or 2 seconds beforehand. Therefore, although it is very unlikely that the spider will move when you put your hand in the aquarium, if it does move this should be fairly easy to predict."

After the manipulation information, all subjects were required to answer six questions. Participants were told that the “questions are provided as a check to ensure that you have understood the imaginary task correctly”. The first three questions related specifically to the task (e.g., “Where are you requested to place your hand?”) while each of the other three questions related to one of the manipulations (e.g., “If the spider moves towards your hand what are you required to do?”). Finally, after completing the TRSF measure, the subjects completed manipulation checks for each of the independent variables.

Results

Preliminary Analyses

Subjects were randomly assigned to one of the eight experimental conditions. The mean number of cases in each cell was 21.13 and ranged from 19 to 23. A Chi Square Test using the Monte Carlo resampling method (based on 10,000 sampled tables) indicated that there was no statistically significant difference in the number of people randomly allocated to each condition, $\chi^2 (7) = 0.52, p = 1.00$. The mean level of pre-existing spider fear in each of the experimental conditions was 4.60 with scores for each condition ranging from 3.87 to 4.96. A one-way analysis of variance (ANOVA) indicated no statistically significant difference in spider fear between the groups.

Scenario Comprehension

Answers to comprehension questions were scored as either fully correct, partially correct, or incorrect. For questions 1–6, the percentages of subjects who answered each question correctly ranged from 89.3% to 99.4%. Only 15.4% ($n = 26$) of subjects answered one or more questions incorrectly. It is therefore likely that the participants generally understood the information that was presented to them.
Manipulation Checks

The means and standard deviations of perceived uncontrollability, unpredictability and dangerousness for all experimental manipulations are shown in Table P3.1. Perceptions of uncontrollability associated with the task were higher for the HUNC than for the LUNC group, for the HUNP than the LUNP group, and the LDAN compared to the HDAN group. The perceived unpredictability of the spider in the task was higher in both the HUNP and LDAN conditions than in the LUNP and HDAN conditions respectively, but differed little between the LUNC and HUNC conditions. Finally, perceptions of the dangerousness of the spider in the task was higher for the HDAN than for the LDAN group with only a small difference between both the LUNC and HUNC groups and the LUNP and HUNP groups.

Table P3.1

Means and standard deviations of perceived uncontrollability, unpredictability, and dangerousness for all experimental manipulations

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>Uncontrollability</th>
<th>Unpredictability</th>
<th>Dangerousness</th>
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<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Uncontrollability</td>
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<tr>
<td>Low (LUNC)</td>
<td>4.03</td>
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<td>4.51</td>
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<tr>
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<td>3.90</td>
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<td>5.17</td>
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<td>Dangerousness</td>
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<tr>
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<td>4.83</td>
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<tr>
<td>High (HDAN)</td>
<td>4.28</td>
<td>1.81</td>
<td>4.30</td>
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</table>
For each manipulation check, a fully factorial three factor (2 x 2 x 2) ANOVA was computed to test for direct and interaction effects of the independent variables of uncontrollability (High, Low), unpredictability (High, Low), and dangerousness (High, Low). Estimated marginal means (EMMs), which are adjusted for other variables in the analysis, and measures of effect size using Partial Eta Squared statistics were calculated for all main and interaction effects.

**Uncontrollability.** Statistical analysis revealed a significant main effect for the uncontrollability manipulation on perceptions of uncontrollability, $F(1, 160) = 7.529$, $p = .007$, with subjects in the HUNC condition rating the spiders as more uncontrollable (EMM = 4.74) than participants in the LUNC condition (EMM = 4.03). The effects of the Unpredictability and Dangerousness manipulations on perceived uncontrollability were not statistically significant, nor were the two-way and three-way interaction effects. The Uncontrollability manipulation account for almost 5% of the variance in perceived uncontrollability ($\eta^2 = .045$).

**Unpredictability.** Using perceived unpredictability of the spider as the dependent variable the Unpredictability manipulation had a statistically significant effect, with subjects in the HUNP condition (EMM = 5.18) reporting the spider to be more unpredictable than subjects in the LUNP condition (EMM = 3.92), $F(1, 160) = 35.06$, $p < .001$. There was no significant difference between HUNC and LUNC subjects in the rating of the spider as unpredictable. Surprisingly, however, subjects in the HDAN condition (EMM = 4.30) perceived the spider as significantly less unpredictable than did subjects in the LDAN condition (EMM = 4.80), $F(1, 160) = 5.70$, $p = .018$. The Unpredictability manipulation account for 18% of the variance in perceived unpredictability ($\eta^2 = .180$) while the Uncontrollability manipulation accounted for approximately 3% of the variance in perceived unpredictability ($\eta^2 = .034$).

**Dangerousness.** The three-way ANOVA conducted with perceived dangerousness as the dependent variable showed a significant main effect for the Dangerousness manipulation, $F(1, 160) = 32.53$, $p < .001$. Participants in the HDAN condition, in comparison to subjects in the LDAN condition, rated the spider as more dangerous, EMMs = 3.60 and 2.30 respectively. The dangerousness manipulation accounted for almost 17% of the variance in perceived dangerousness ($\eta^2 = .169$). There was no significant difference in perceptions of dangerousness across the LUNC and LUNP
conditions or across the HUNC and HUNP conditions, nor were any of the interaction effects statistically significant.

**Hypothesis Testing**

Task Related Spider Fear (TRSF) ratings for the different levels of uncontrollability, unpredictability, and dangerousness are given in Figure P3.1. To assess the significance of the independent effects of the experimental manipulations, a three factor (2 x 2 x 2) between-subjects ANCOVA was conducted with the IVs being the uncontrollability, unpredictability, and dangerousness manipulations. Pre-existing Spider Fear (PSF) was used as a covariate as it had a significant bivariate correlation with TRSF ($r = 0.73$, $p < .001$). It is recommended that covariates be selected for analysis of covariance to obtain maximum adjustment of the dependent variable and thereby enhance prediction of the dependent variable (Tabachnick & Fidell, 1996). As expected, PSF had a significant association with TRSF, $F(1, 160) = 195.59$, $p < .001$. Uncontrollability also had a statistically significant effect on TRSF with people in the HUNC group (EMM = 5.30) predicting more fear than people in the LUNC group (EMM = 4.90), $F(1, 160) = 6.50$, $p = .012$. In addition, subjects in the HDAN group (EMM = 5.32) expected more fear than did those subjects in the LDAN group (EMM = 4.88), $F(1, 160) = 8.05$, $p = .005$. Finally, the unpredictability manipulation was also statistically significant, with the estimated marginal means of the HUNP and LUNP groups being 5.27 and 4.93 respectively $F(1, 160) = 4.61$, $p = .033$. None of the two-way the three-way interactions were statistically significant in the model. The strength of the association between the uncontrollability, unpredictability and dangerousness manipulations and the TRSF were relatively small ($\eta_s = .039$, .028 and .048 respectively) compared to the association between PSF and TRSF ($\eta = .550$). The overall model accounted for 58.6% of the variance in TRSF.
Additional Analyses

An additional series of analyses were conducted using perceptions of uncontrollability, unpredictability, and dangerousness, as derived from the manipulation checks, as the independent variables in analyses. Pearson $r$ bivariate correlations between TRSF and perceived uncontrollability, unpredictability, and dangerousness were .60, .52, and .44 respectively, all $ps < .001$.

A hierarchical multiple regression analysis was carried out with TRSF as the dependent variable, the uncontrollability, unpredictability, and dangerousness conditions entered as a block at Step 1, and the perceptions of uncontrollability, unpredictability, and dangerousness entered as a block at Step 2. While the experimental manipulations accounted for a significant 6.5% of the variance in TRSF, $F(3, 164) = 3.78, p = .012$, perceptions of spiders, as determined from the manipulation checks, accounted for a significant 42.0% of the variance in TRSF beyond that accounted for by the manipulations, $F(3, 161) = 43.83, p < .001$. 

Figure P3.1. Task related fear for low and high uncontrollability, unpredictability, and dangerousness groups in Study 1
Discussion

Consistent with this study’s hypotheses, a significant effect was found for manipulations of uncontrollability, unpredictability and dangerousness in relation to predicted spider fear. However, the manipulations accounted for only about 6.5% of the variance in anticipated spider fear, which is relatively small given the strong association between pre-existing spider fear and predicted fear of the spider task.

There are several possible explanations for the small association between the experimental manipulations and predicted fear. One possibility is that there is, in fact, little relationship between these variables and fear. Indeed, while a number of studies have uncovered significant relationships between fear and perceptions of control, predictability and danger, other studies have found non-significant results and others still have revealed results opposite to those found in the current study. For example, there is evidence suggesting an association between perceptions of control and negative reactions evidenced by increases in electrodermal responding (McGlynn, Rose, and Lazarte, 1994; Rose, McGlynn, and Lazarte, 1995), although Dawson, Schell, and Filion (1990) argue that identifying a skin conductance response (SCR) as either an ‘anxiety’ response or an ‘attentional’ response is impossible.

In relation to the relative effects of predictable and unpredictable stimuli, some studies have failed to find a difference between animals exposed to predictable or unpredictable shock in terms of either behavioral consequences (Sudha & Pradhan, 1993) or resulting physical pathology (Garrick, Minor, Bauck, Weiner, & Guth, 1989). In addition, several studies have found predictable shocks to be more deleterious for rats than unpredictable shocks (e.g., Brady, Thornton, & DeFisher, 1962; Friedman, Ader, & Glasgow, 1965). These inconsistencies have resulted in much debate over the relative aversiveness of unpredictable and predictable stimuli. Researchers have variously argued that unpredictability is more aversive than predictability (Badia, Harsh, & Abbot., 1979), that predictable events are more aversive than unpredictable events (Arthur, 1986) and that unpredictable aversive events are more stressful than predictable aversive events but only when exposure duration is not prolonged and the parameters of stress are relatively severe (Abbott & Badia, 1986; Abbott, Schoen, & Badia, 1984). Clearly, more research is required to adequately determine how unpredictable stimuli or events are perceived. In
particular, more research is required into the relationship between unpredictability and fear, an area that has received little attention to date.

There are also problems with the idea that the extent of peoples’ fear is related to the dangerousness of a stimulus. Although few studies have directly examined the relationship between danger and fear, there is considerable circumstantial evidence that the relationship between these variables is not straight-forward. For example, although fear surveys reveal that objectively dangerous situations and stimuli are among the most feared, many people are unafraid of these particular stimuli. Fear surveys also reveal fears to some stimuli which are not generally considered to be harmful. Additionally, some people seek out and experience considerable pleasure from potentially dangerous experiences (Thorson & Powell, 1990) and some studies have found that extent of pain or injury is unrelated to subsequent fear (e.g., Kuch, Cox, Evans, & Shulman, 1994).

Other factors may also explain the relatively small effect sizes found for the experimental manipulations in this study. It is possible, for example, that the manipulations were not strong enough to result in large differences in anticipated fear. It was seen that although the high uncontrollability, unpredictability and dangerousness groups perceived the spider as significantly more uncontrollable, unpredictable and dangerous respectively, these differences were not large. If the manipulations had had a larger effect on the subjects’ perceptions a more substantial effect on predicted spider fear may have resulted. This idea is supported by the finding that perceptions of dangerousness, uncontrollability, and unpredictability all correlated moderately or highly with predicted fear and accounted for approximately 48% of the variance in the TRSF beyond the effect of the experimental manipulations.

The inability of the manipulations to strongly affect subjects’ perceptions of the spider may well have stemmed from the particular scenario used. Participants were asked to imagine how they would feel in what may have been seen as a contrived experimental situation. Such a scenario is remote from the actual events of encountering a spider in real life. It is possible, therefore, that the subjects were unable to readily imagine how they would feel in the particular situation and that their ratings were more influenced by the reference point of their pre-existing fear than by information relating to the manipulations. This explanation is consistent with the finding that there was a strong relationship between pre-existing fear and task-related fear.
An alternative explanation for the relatively small effects of the uncontrollability, unpredictability, and dangerousness manipulations on predicted fear relates not to the specific imaginal scenario but to the use of an imaginal scenario per se. Other experimental studies which have yielded positive results have employed either in vivo exposure to the feared stimulus (e.g., Glass et al., 1971) or exposure to a picture of the feared stimulus (Sartory & Daum, 1992). It is possible that these procedures produce more salient manipulations than those forthcoming from the current imaginal procedure.

A limitation of this study is that while the Cognitive Vulnerability Model positions the four vulnerability-related perceptions of uncontrollability, unpredictability, dangerousness and disgustingness as being central to the determination of specific fears, this paper has only addressed the first three of these perceptions. To include a disgustingness manipulation would have resulted in increasing the number of experimental cells from 8 to 16, which would have compromised the study’s power to detect significant differences given the available sample size. Nonetheless, it would be both interesting and useful in future studies to employ a disgust manipulation to gauge the effectiveness of altering these perceptions on subsequent fear.

As previously noted, this study employed a highly specific and abstract task related to an imagined encounter with a spider, and this necessarily restricts the generalisability of the study results to the real world. Despite this, the results of this study have clinical implications in so far as treatments aimed at altering a person’s perception of the feared object or situation may be beneficial in reducing fear. For example, both cognitive therapy and cognitive behavior therapy are directed at tackling distorted beliefs with the aim of reducing psychopathology. According to the Cognitive Vulnerability Model, the four stimulus perceptions of uncontrollability, unpredictability, dangerousness and disgustingness are crucial elements to focus on in any attempt to alleviate an individual’s phobia or subclinical fear. Affording people a sense of control over their encounter with a feared object or situation as well as enhancing their perception of the encounter as predictable and decreasing the perceptions of danger and disgustingness would likely lead to reduced anxiety and fear. In relation to controllability, such an outcome has already been demonstrated by Brockway and Heath (1998) who found that an informational control manipulation reduced both fear and perceived risk.

Although the effects of the manipulations in this study were not large, the magnitude of the effect sizes should be viewed in the context of the subjects’ pre-existing
spider beliefs. The Cognitive Vulnerability Model holds that peoples’ perceptions of, for example, spiders are represented in a neurologically based cognitive network (Armfield, 2006). Such beliefs and feelings are seen as relatively enduring and not readily amenable to change. The current study, however, attempted to manipulate the subjects’ perceptions of the interaction with the spider by providing a small amount of specific information about the spider and the task. In some cases, as with the dangerousness manipulation, the nature of the study meant that the difference between the high and low conditions was not large. Ethical considerations disallow the use of potentially dangerous spiders. Similarly, all subjects must be informed that they can withdraw from the study at any time. The control this condition affords, plus other ethical impositions placed on the manipulation of control, clearly impose limits on the effectiveness of both the uncontrollability and dangerousness manipulations. In fact, given the practical limitations on the experimental manipulations, imposed from within and from without, the significance of this study's findings might be considered more impressive than initial observation suggests.

One of the main strengths of this study is the development of a systematic methodology for manipulating perceived uncontrollability, unpredictability and dangerousness. This approach provides an important means to examine these factors in studying the causal mechanisms of phobic fear. Indeed, the opportunity exists to build off this work to help define new ways of examining, quantifying, and studying phobic fear within the context of assessment and exposure-based treatment. This research has been the first to examine in the one experimental study the effects of uncontrollability, unpredictability, and dangerousness on fear. To understand the causes of fear, it is necessary to study the effects of multiple variables simultaneously. Only by pursuing this methodology can the exact relationships between the various variables and fear be teased apart. This study's findings, albeit using fear in a contrived laboratory experiment, provides further support for Cognitive Vulnerability Model of the etiology of fear and for the relationship between the cognitive vulnerability-related perceptions and fear.
References


CHAPTER 7 (PAPER 4) – AN EXPERIMENTAL STUDY OF THE ROLE OF VULNERABILITY RELATED PERCEPTIONS IN SPIDER FEAR: COMPARING AN IMAGINAL AND IN VIVO ENCOUNTER

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Statement of authorship

PERCEIVED UNCONTROLLABILITY, UNPREDICTABILITY, DANGEROUSNESS AND SPIDER FEAR: A COMPARISON OF AN IMAGINAL AND IN VIVO ENCOUNTER.

Journal of Anxiety Disorders

Armfield J.M. (Candidate)

Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: .......................................................... Date: ..................................
Linkage of paper to body of research

This paper follows on directly from Paper 3 in that it is an attempt to determine if the associations between fear and the stimulus perceptions of uncontrollability, unpredictability and dangerousness are causal. As mentioned previously, the idea of causality is a fundamental component of an etiological theory of fear. People are considered to be afraid of any given thing because something has made them be that way. Whether it is witnessing a shark attack on television, being involved in a car crash, or experiencing a traumatic dental operation, it is generally believed that there are factors which have ‘caused’ a person’s fear. While Paper 3 used an in vitro or imaginal situation and asked participants to imagine how they would feel in that situation, in the study reported in Paper 4 participants were actually put in the situation they had previously been asked to imagine. This effectively extends the results from Study 3 yet remains true to the core enquiry into the validity of the Cognitive Vulnerability Model in relation to the etiology of fear.
Introduction to paper and additional information

This paper was originally submitted with Paper 3 as a two-study manuscript to Behaviour Research and Therapy. However, based on reviewers’ recommendations of that manuscript, the paper was split and resubmitted. The manuscript was extensively rewritten and resubmitted to Behaviour Research and Therapy with more of a focus on testing the division between in vivo and imaginal exposure, using the Cognitive Vulnerability Model as a framework for the experimental manipulations. Like Paper 3, the manuscript was resubmitted to Journal of Anxiety Disorders where it was accepted for publication, being described by one Reviewer as “a thoughtful, parsimonious, and well-written manuscript with interesting implications for the field of anxiety and fear”.

219
Abstract

The effect of manipulating perceptions of the uncontrollability, unpredictability and dangerousness of a spider was assessed using both an imaginal and in vivo task involving an encounter with a spider. Participants were randomly assigned to one of eight conditions formed by the crossing of factors. Experimental manipulations of uncontrollability, unpredictability and dangerousness all had a significant effect on task related spider fear in the in vivo exposure task. Results indicated a greater effect on task related fear for in vivo exposure ($R^2 = .258$) compared to imaginal exposure ($R^2 = .053$). Perceptions of spiders as uncontrollable, unpredictable and dangerous accounted for much of the variance in spider fear beyond that accounted for by the experimental manipulations. The idea that perceptions of spiders as uncontrollable, unpredictable and dangerous are causally related to spider fear was supported with in vivo exposure being a stronger modality for fear modification than imaginal exposure.
Introduction

Despite the phenomenological division between reality and imagination (Neisser, 1967) both of these perceptual realms appear to share some of the same neural processes. For instance, in Lang’s (1979) influential information-processing model of emotional imagery, it is proposed that imagining a stimulus or situation evokes an emotional response to the extent that propositions leading to that response have been activated. Research certainly supports the belief that fearful imagery is associated with emotional and psychophysiological sequelae. Physiological changes, such as cardiac acceleration and increased blood pressure, accompany imaginal exposure to a variety of fear-relevant scenarios (Boudewyns & Hyer, 1990; Gerew, Romney, & Leboeuf, 1989; Marzillier, Carroll, & Newland, 1979; Zohar et al., 1989). In addition, people with anxiety report greater fear intensity and demonstrate greater visceral arousal when listening to or imagining their own phobic situations than when imagining neutral or other-phobia scenes (Cook, Melamed, Cuthbert, McNeil, & Lang, 1988; Grayson, 1982; Marks & Huson, 1973; McNeil, Vrana, Melamed, Cuthbert, & Lang, 1993; Sutherland & Harrell, 1987).

According to Frijda (1988) emotions are elicited by events appraised as real with their intensity corresponding to the degree to which this is the case. For this reason, viewing or imagining a feared situation, even though it may pose no objective danger or relevance to an individual, may elicit a substantial fear response. This proposition underlies the recent development of virtual reality exposure (VRE), which has been shown to be effective with both anxiety disorders generally (Krijn, Emmelkamp, Olafsson, & Biemond, 2004) and with specific phobias in particular (Côté & Bouchard, 2005; Emmelkamp et al., 2002). Frijda (1988) believes that imagination possesses similar properties to reality, being capable of eliciting or abating strong emotions by transforming symbolic knowledge into emotionally effective stimulation. However, he points out that symbolic information, by itself, would be expected to have only a weak impact on emotions whereas pictures and the experience of a real situation would evoke stronger emotions.

While exposure to real situations may be more potent than imaginary scenarios in eliciting emotions, imaginal exposure offers significant advantages over in vivo techniques
in terms of both convenience and flexibility (Rentz, Powers, Smits, Cougle, & Telch, 2003). Cognitive imagery modification is also experienced as considerably less aversive than in vivo exposure (Hunt, Bylsma, Brock, Fenton, Goldberg, Miller, Tran & Urgelles, 2006). Because of this, numerous studies have employed imaginal scenarios to examine aspects of fears (e.g., Buxbaum, 1980; Cutts & Barrios, 1986; Evans, 1983; Riskind & Maddux, 1994; Rogers, 1985; Sancho & Hewitt, 1990). In addition, questionnaires used to measure various types of fear often require ratings of predicted fear in hypothetical scenarios (e.g., Corah, 1969).

The validity of using imaginal exposure is not often analysed. Indeed, it may be that the use of imaginal scenarios fails to generate (predicted) responses indicative of those that would be elicited by in vivo exposure to a feared stimulus. Armfield (2006a), for example, looked at predicted fear of spiders in an imaginal task and found a significant effect for experimental manipulations of uncontrollability, unpredictability, and dangerousness on self-rated spider fear. However, the manipulations accounted for only 6.5% of the variance in predicted fear. One hypothesised explanation for this modest effect size was that the imaginal scenario used in the study may have had limited saliency. It is possible that the predicted emotions elicited by the imaginal scenario were an invalid index of those feelings which would have been elicited through actual exposure to the fear-relevant situation. If the study participants had been exposed to a real task, in contrast to an imaginal task, the manipulations may have been more effective.

The Cognitive Vulnerability Model of the etiology of fear proposes that perceptual characteristics of uncontrollability, unpredictability and dangerousness are causal in the determination of fear (Armfield, 2006b). Although spider fearful people are known to have more vivid thoughts of spiders and longer lasting skin and body sensations than non-fearful people (Pratt, Cooper, & Hackmann, 2004) it may be that actual exposure of spider fearful people to a spider-related task would result in more intense and more accurate fear ratings than imaginal exposure. It is proposed, therefore, that exposure to a fear-relevant in vivo scenario, in comparison to an imaginal scenario, will be more effective in promoting valid fear ratings as a response to manipulations of uncontrollability, unpredictability and dangerousness associated with an interaction with a spider.

The current study had two main objectives. First, to test hypotheses of the effect of perceived uncontrollability, unpredictability, and dangerousness on fear during an in vivo encounter with a spider. Second, to provide a comparison of imaginal and in vivo
exposure scenarios in order to test the idea that in vivo exposure will result in stronger associations between fear and the manipulations of uncontrollability, unpredictability and dangerousness.

Method

Participants

The participants were 88 students attending university in Adelaide, South Australia. Recruitment was via a university-based employment system and participants were offered a small remuneration as reimbursement for their time. At the time of recruitment all participants were informed that the study predominantly involved the completion of questionnaires. There were 59 females and 28 males (one subject did not indicate their gender) and the mean age of the participants was 20.9 ($SD = 5.6$).

Design

The study involved two phases, each of which used a $2 \times 2 \times 2$ between-subjects fully factorial design. The independent variables were Uncontrollability (High, Low), Unpredictability (High, Low), and Dangerousness (High, Low). Subjects were randomly allocated to one of the eight experimental conditions in the initial phase and remained in that condition for Phase 2. The Uncontrollability factor was manipulated by varying the information given to the subjects regarding the nature of the task. The Unpredictability and Dangerousness factors were manipulated by giving the participants differing information concerning the characteristics of the spider.

Materials

In Phase 1 of the study, the subjects received a questionnaire containing a measure of pre-existing spider fear and task related spider fear as well as information relating to the manipulations and the manipulation checks. There were eight formats of the handout, each corresponding to one of the eight conditions of the study.
Pre-existing Spider Fear (PSF) was assessed via five items measured on a 7-point scale. To counteract possible response bias, two of the items had the response scale reversed. The PSF scale ranged from a score of 1 indicating no fear to 7 indicating extreme fear. The questionnaire assessed the dimensions of subjective fear, negative evaluation, vigilance, approach behaviour, and avoidance behaviour. Previous work has found the scale to possess high internal consistency, with a Cronbach’s alpha of 0.90 (Armfield, 2006a).

The Task Related Spider Fear (TRSF) measure contains four items measured on a 7-point scale. The items relate to subjective anxiety, desired avoidance, and physiological reactivity. Two additional items which appeared in the scale, but were not used in calculating the total TRSF score, were filler items and related to reactions to the experimental manipulations. The two filler items measured concern about being bitten and worry about unexpected movement. Armfield (2006a) has previously found the internal reliability of the (four item) scale to be high (standardised $\alpha = .91$).

In Phase 2, the subjects again received a similar handout containing the TRSF scale and the manipulation checks. In addition, subjects were administered the Believability Scale (BS) which was constructed for this study. The BS comprised two questions (“How convinced were you that you would actually be required to perform the task with the spider?” and “Did you have any suspicions about the task not being real?”) measured on a 7-point scale, with the response scale of one item reversed. Scores on the BS ranged from 1 to 7 with 1 indicating complete believability and 7 indicating complete disbelief.

**Procedure**

**Phase 1**

In Phase 1 participants were given one of the eight handouts and completed the PSF measure before being presented with information relating to the manipulation. Initially, participants were given information concerning the nature of the task and the apparatus to be used in the task (“a small glass aquarium”) was described in detail. The participants were then told the name of the spider to be used (*Ixeticus Robustus*) and a top-down photograph of the spider was provided.

Participants were given different information about the task requirement according to whether they were in the High Uncontrollability (HUNC) or Low Uncontrollability
(LUNC) condition. In the Low Uncontrollability condition (LUNC) participants were told: “If the spider moves towards your hand you are advised to cause the spider to drop into the bottom section of the aquarium by pulling the release mechanism.” Participants in the High Uncontrollability condition (HUNC), on the other hand, were told: “If the spider moves towards your hand you are requested to leave your hand flat on the divider until you are advised that the 10 seconds is over.” In both conditions, therefore, the participants were required to leave their hand on the divider. However people in the LUNC group had the option of pulling the release mechanism giving them greater perceived control over both the experimental situation and the approach of the spider.

Participants were given specific information about both the dangerousness of the spider and the likely unpredictability of its movement. In the High Dangerousness condition (HDAN) people were informed that: “The spider used in this experiment has relatively large fangs and, if it bites you, is capable of causing localised pain and swelling. However, the spider does not pose any substantial danger to you.” Participants in the Low Dangerousness group (LDAN) were told that: “The spider used in this experiment has relatively small fangs which are incapable of penetrating human skin. Therefore, the spider does not pose any danger to you at all.”

Finally, participants were given different information about the movement of the spider depending upon whether they were in the High Unpredictability (HUNP) or Low Unpredictability (LUNP) group. Participants in the High Unpredictability condition (HUNP) were told: “When the spider perceives threat its natural response is either to freeze or to move quickly, running in an unpredictable manner. If the spider does move, it characteristically does so suddenly, giving no indication that it is about to move. Therefore, it is possible that the spider may move unexpectedly when you put your hand in the aquarium.” Participants in the Low Unpredictability condition (LUNP) were informed: “When the spider perceives threat its natural response is to freeze and remain completely immobile in an attempt to escape detection. If the spider does move, it characteristically arches its body in the air for 1 or 2 seconds beforehand. Therefore, although it is very unlikely that the spider will move when you put your hand in the aquarium, if it does move this should be fairly easy to predict.”

Participants subsequently answered six questions relating to the task and the manipulations (designed as a scenario comprehension check), filled out the TRSF, and completed the manipulation checks.
Phase 2

After completing the handout in Phase 1, participants were informed that they
would be required to actually perform the task introduced as hypothetical in Phase 1.
People were led to a nearby room where they were shown the experimental apparatus.
The apparatus was an aquarium constructed from .8 mm sheet Perspex and was 600 mm
long, 300 mm wide, and 300 mm high. A Perspex sheet divided the aquarium
horizontally, 150 mm from the base. The horizontal divider comprised two sections: the
front half of the divider was fixed while the rear half was hinged from the back. A 280 x
280 mm piece of felt with a black outline of a left hand was placed on the non-hinged half
of the divider (another piece of felt with the outline of a right hand was used for left
handed people).

For individuals in the LUNC condition a button was provided which, when
pressed, operated a servo-mechanism causing the rear half of the horizontal divider to
swing down. The LUNC participants had this procedure briefly explained to them. A 12V
power supply was attached to the apparatus for subjects in this condition. The release
mechanism was removed from sight in the HUNC condition.

An inverted semi-opaque domed plastic container (75 mm deep, 105 mm base
diameter, 65 mm top diameter) was positioned towards the rear of the hinged half of the
horizontal divider. The container covered a highly detailed fake spider closely matching in
appearance the spider pictured in the questionnaire from Phase 1. A fake spider was used
in order to control for the amount of physical locomotion, a variable which could have
introduced confounding with the Unpredictability manipulation. Participants were not
discouraged in any way from looking at the spider either through the container or from
underneath through the Perspex.

After viewing the apparatus and having the task briefly explained, the participants
were asked to complete the second questionnaire before they supposedly proceeded with
the experiment. The handout initially informed the participants: “You have now been
asked to actually perform the experimental task described to you earlier. Remember, you
are entirely free to discontinue your participation in this experiment if you desire.
However, before you decide whether or not to participate in the final section of this
experiment, please read the following information which summarises both the information
provided about the spider and the task required. You will then be asked to once again
complete a short questionnaire about how you feel about and perceive the task.”
Participants were given a summary of the information from the first handout with points relating specifically to the manipulation information and then completed the TRSF scale followed by the manipulation checks.

Upon completing the questionnaire all participants were immediately informed that they did not have to perform the expected experimental task and were fully debriefed as to the purpose of the study and the reason for the deception. Upon returning to the initial testing room they completed the Believability Scale and were reimbursed for their participation. Psychological counselling was made available upon request to all participants.

Results

Participant Assignment

Participants were randomly assigned to each of the eight experimental conditions with the only criterion being that the number of subjects in each condition was the same. There were 11 subjects in each cell formed by the crossing of the manipulations. There was no difference in the proportion of males and females in each cell, $\chi^2 (7) = 1.57, p = .98$. The mean level of PSF in each of the conditions was 4.24 with mean scores in each experimental condition ranging from 3.56 to 4.73. To test for significant differences in PSF across the eight groups a one-way ANOVA was conducted. This revealed that there was no statistically significant difference between the groups, $F(7, 80) = .56, p = .78$.

Scale Statistics

The descriptive statistics and internal reliability for all scales and manipulations for Phase 1 and Phase 2 are presented in Table P4.1. As can be seen there was generally little difference between the scales used for Phases 1 and 2.
Table P4.1

Means, standard deviations, and internal reliability coefficients for all scales and manipulation checks.

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<td>Manipulation Checks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncontrollability</td>
<td>4.46</td>
<td>1.61</td>
<td>.66</td>
<td>4.28</td>
</tr>
<tr>
<td>Unpredictability</td>
<td>4.48</td>
<td>1.49</td>
<td>.75</td>
<td>4.55</td>
</tr>
<tr>
<td>Dangerousness</td>
<td>2.82</td>
<td>1.66</td>
<td>.84</td>
<td>2.89</td>
</tr>
</tbody>
</table>

Note: α = internal consistency measured by Cronbach’s alpha.

Phase 1

Scenario Comprehension

During Phase 1, the participants were asked six questions to check that they had adequately understood the information in the handout. The responses were scored as fully correct, partially correct (showing some but incomplete knowledge), or incorrect. For questions 1–6, the percentages of subjects who answered the question correctly ranged from 85.1% to 100.0%. This suggests that the information in the handout was, for the most part, accurately comprehended.

Manipulation Checks

For each manipulation in Phase 1 of the study, a 2 x 2 x 2 ANOVA was computed with the manipulation check as the dependent variable (DV). The independent variables (IVs) for each manipulation check were Uncontrollability (High, Low), Unpredictability (High, Low), and Dangerousness (High, Low). The means and standard deviations for all conditions are given in Table P4.2. Subjects in the HUNC condition perceived the spider as more uncontrollable than did subjects in the LUNC condition, $F(1, 80) = 19.10, p <$
.01. The differences between subjects in the High and Low Unpredictability and Dangerousness conditions on perceived uncontrollability were in the same direction, only smaller. However, as expected, the Unpredictability and Dangerousness manipulations did not have a significant effect on perceived uncontrollability. There was little difference in perceptions of unpredictability between the HUNC and LUNC conditions, however subjects in the HUNP condition ($M = 5.11$) perceived the spider as more unpredictable than did subjects in the LUNP condition ($M = 3.84$), $F(1, 80) = 20.86, p < .001$. Surprisingly, subjects in the LDAN condition also rated the spider as more unpredictable than did subjects in the HDAN condition, $F(1, 80) = 8.28, p < .05$. As expected, perceptions of danger were significantly higher for HDAN subjects than for LDAN subjects, $F(1, 80) = 14.09, p < .001$. Differences in perceived danger were smaller and not statistically significant between subjects in the HUNC and LUNC conditions and almost non-existent between participants in the HUNP and LUNP conditions.

Table P4.2

Means and standard deviations (in parentheses) of perceived uncontrollability, unpredictability, and dangerousness for all conditions in Phase 1.

<table>
<thead>
<tr>
<th>Stimulus perceptions</th>
<th>Uncontrollability</th>
<th>Unpredictability</th>
<th>Dangerousness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental condition</strong></td>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
<td><strong>High</strong></td>
</tr>
<tr>
<td>Uncontrollability</td>
<td>4.92 (1.47)</td>
<td>3.99 (1.62)</td>
<td>4.50 (1.48)</td>
</tr>
<tr>
<td>Unpredictability</td>
<td>4.58 (1.45)</td>
<td>4.33 (1.77)</td>
<td>5.11 (1.33)</td>
</tr>
<tr>
<td>Dangerousness</td>
<td>4.48 (1.67)</td>
<td>4.43 (1.57)</td>
<td>4.17 (1.17)</td>
</tr>
</tbody>
</table>
Hypothesis Testing

TRSF scores for each level of the Uncontrollability, Unpredictability, and Dangerousness factors are presented in Figure P4.1. Greater uncontrollability, unpredictability and dangerousness were associated with higher TRSF scores. A 2 x 2 x 2 between-subjects fully factorial ANCOVA was conducted to test the significance of these differences. The IVs were Uncontrollability, Unpredictability, and Dangerousness with the covariates being Gender and Pre-existing Spider Fear. Gender was included in the analysis due to the frequently reported finding that females experience more fear of spiders than males (e.g., Armfield & Mattiske, 1996; Liddell, Locker, & Burman, 1991). Participants in the HUNC condition predicted more fear than did subjects in the LUNC condition, $F(1, 77) = 5.02, p = .028$. Although subjects in the HUNP condition predicted more fear than did people in the LUNP condition, this difference was not statistically significant. Finally, participants in the HDAN condition predicted greater fear than subjects in the LDAN condition and this effect was significant, $F(1, 77) = 4.59, p = .035$. PSF had a significant effect on TRSF scores, $F(1, 77) = 61.68, p < .001$. The effect of Gender on TRSF was not significant although it did approach the criterion alpha of .05. No interaction effects were statistically significant.

Additional Analyses

An additional analysis was undertaken using perceptions of uncontrollability, unpredictability, and dangerousness (assessed via the manipulation checks) as IVs and the TRSF scale as the DV. Pearson $r$ bivariate correlations revealed significant correlations between the TRSF scale and unpredictability perceptions ($r = .55, p < .001$), dangerousness perceptions ($r = .52, p < .001$) and uncontrollability perceptions ($r = .61, p < .001$). In order to compare the differential effectiveness of the manipulations and the three perceived stimulus characteristics to predict scores on TRSF a hierarchical multiple regression analysis was carried out. The three manipulations were entered as a block at Step 1 while the vulnerability perceptions were entered as a block at Step 2. Although the manipulations had a significant effect on task related fear, the results showed that manipulations accounted for a non-significant 5.3% of the variance in TRSF scores, $F(3, 84) = 1.56, p = .21$. In contrast, the vulnerability perceptions accounted for a significant 52.6% of the variance in TRSF scores beyond that accounted for by the manipulations, $F(3, 81) = 33.75, p < .001$. 
Phase 2

Manipulation Checks

As in Phase 1, a 2 x 2 x 2 ANOVA was computed for each manipulation check. The IVs for each ANOVA were, once again, Uncontrollability (High, Low), Unpredictability (High, Low), and Dangerousness (High, Low). The means and standard deviations for all conditions are given in Table P4.3. Subjects in the HUNC and HUNP conditions perceived the task as more uncontrollable than did subjects in the LUNC and LUNP conditions respectively, $F(1, 80) = 27.37, p < .001$ and $F(1, 80) = 8.31, p = .005$. There was little apparent difference between HDAN and LDAN groups in perceived uncontrollability and this was not statistically significant, $F(1, 80) = .02, p = .89$. Participants in the HUNP condition perceived the spider as more unpredictable than did participants in the LUNP condition ($Ms = 5.30$ and $3.81$ respectively), $F(1, 80) = 23.64, p < .001$. However, there was little difference in perceptions of unpredictability between the HUNC and LUNC conditions and HDAN and LDAN conditions respectively, with the main effects for the Uncontrollability and Dangerousness manipulations not being statistically significant. Subjects in the HDAN condition perceived the spider as more dangerous than did subjects in the LDAN condition, $F(1, 80) = 37.57, p < .001$. Smaller
differences characterised the Unpredictability and Uncontrollability groups and these were not statistically significant.

Table P4.3

Means and standard deviations (in parentheses) of perceived uncontrollability, unpredictability, and dangerousness for all conditions in Phase 2.

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>Stimulus perceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncontrollability</td>
</tr>
<tr>
<td>Uncontrollability</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>5.11 (1.53)</td>
</tr>
<tr>
<td>Low</td>
<td>3.44 (1.54)</td>
</tr>
<tr>
<td>Unpredictability</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.74 (1.46)</td>
</tr>
<tr>
<td>Low</td>
<td>3.82 (1.89)</td>
</tr>
<tr>
<td>Dangerousness</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.22 (1.71)</td>
</tr>
<tr>
<td>Low</td>
<td>4.34 (1.79)</td>
</tr>
</tbody>
</table>

Hypothesis Testing

Mean TRSF scores for the different levels of the Uncontrollability, Unpredictability, and Dangerousness manipulations are shown in Figure P4.2. Like in the imaginal task, greater uncontrollability, unpredictability and dangerousness led to increased task related fear. To assess the significance of these differences, a 2 x 2 x 2 fully factorial ANCOVA was conducted with the IVs being Uncontrollability, Unpredictability and Dangerousness. The covariates in the analysis were Gender, PSF, and the inversely transformed Believability Scale (BS) scores. While ratings of PSF had a significant effect on TRSF scores, $F(1, 69) = 12.73, p = .001$, the effects of both Gender and BS scores were not significant. As predicted, subjects in the HUNC condition experienced more fear than did subjects in the LUNC condition ($M_s = 5.18$ and 4.45 respectively), $F(1, 76) = 10.15, p = .002$. Similarly, participants in both the HUNP ($M = 5.42$) and HDAN groups ($M = 5.10$) rated
themselves as more fearful than did subjects in the LUNP ($M = 4.21$) and LDAN groups ($M = 4.52$) respectively. The main effect of the Unpredictability manipulation was significant, $F(1, 76) = 19.19, p < .001$ as was the effect of the Dangerousness manipulation, $F(1, 76) = 8.83, p = .004$. None of the two-way or higher order interactions were significant. The results, therefore, support the hypothesis developed earlier that manipulating control, predictability, and dangerousness in an in vivo scenario would affect the fear experienced when confronting a spider.

![Figure P4.2. Task related fear for Low and High conditions for each of the experimental manipulations following in vivo exposure.](image)

**Additional Analyses**

Once again an additional set of analyses was conducted looking at the relationship between the vulnerability perceptions of uncontrollability, unpredictability, and dangerousness, as measured by the manipulation checks, and the TRSF scale. As with the imaginal task in Phase 1, there were significant moderate to large bivariate correlations.
between the fear scale and perceptions of uncontrollability \( (r = .66, p < .001) \), unpredictability \( (r = .65, p < .001) \), and dangerousness \( (r = .51, p < .001) \).

To compare the relative contributions of the manipulations and vulnerability perceptions to the prediction of TRSF scores, a hierarchical multiple regression analysis was conducted. The Uncontrollability, Unpredictability, and Dangerousness manipulations were entered as a block at Step 1 followed by the three vulnerability-related perceptions as a block at Step 2. In contrast to the results of Phase 1, the manipulations accounted for a significant 25.8% of the variance in TRSF scores, \( F(3, 84) = 9.73, p < .001 \). Despite this, the vulnerability perceptions still accounted for an additional 40.0% of the variance in fear scores, with this being significant, \( F(3, 81) = 31.63, p < .001 \).

**Comparisons of Predicted and Actual Fear**

An initial analysis was conducted to compare the mean fear ratings in the imaginal and in vivo scenarios. Subjects predicted greater fear in the imaginal scenario \( (M = 4.91, SD = 1.42) \) than their rated fear in the in vivo scenario \( (M = 4.82, SD = 1.51) \), however the magnitude of this difference was small and a paired-samples t-test revealed it to be non-significant. The Pearson \( r \) correlation between predicted and actual fear was high, \( r(88) = .63, p < .001 \). Nonetheless, approximately 60% of the variance in actual fear was not explained by predicted fear, indicating that the imaginal scenario yielded an imperfect prediction of fear.

The effect of the experimental manipulations on TRSF scores across the imaginal and in vivo conditions is given in Table P4.4. As can be seen, all the manipulations produced bigger effects on fear in the actual scenario than in the imaginal scenario. To test whether or not there were significant differences in the effectiveness of the manipulations across the exposure modalities, a mixed model ANOVA was conducted with the between subjects factors being the Uncontrollability (High, Low), Unpredictability (High, Low), and Dangerousness (High, Low) manipulations and the within subjects factor being Fear Rating (Predicted, Actual). A significant effect was found for the fear rating x Unpredictability manipulation, \( F(1, 80) = 7.61, p = .007 \), indicating that the effect of the Unpredictability manipulation was significantly different in the actual scenario than in the imaginal scenario. However, the difference between the effectiveness of the Uncontrollability
manipulation was not significant, nor was the effect of the fear rating x Dangerousness manipulation.

Further analyses were conducted to test whether differences between predicted and actual fear may have been a function of either pre-existing spider fear or gender. PSF was recoded based on tertiles to create Low, Medium, and High Fear groups. The means and standard deviations of predicted and actual fear for the three fear groups are given in Table P4.5. As can be seen, participants in the Low Fear group underpredicted their fear. Conversely, subjects in the High Fear group predicted more fear than what they experienced when in the actual exposure scenario. There was no difference between predicted and actual fear for participants in the Medium Fear group.

Table P4.4
Mean predicted and actual fear ratings for the Low and High conditions of each manipulation.

<table>
<thead>
<tr>
<th></th>
<th>Uncontrollability</th>
<th></th>
<th>Unpredictability</th>
<th></th>
<th>Dangerousness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>Diff.</td>
<td>High</td>
<td>Low</td>
<td>Diff.</td>
</tr>
<tr>
<td>Predicted</td>
<td>5.10</td>
<td>4.72</td>
<td>0.38</td>
<td>5.15</td>
<td>4.66</td>
<td>0.41</td>
</tr>
<tr>
<td>Actual</td>
<td>5.18</td>
<td>4.45</td>
<td>0.73</td>
<td>5.42</td>
<td>4.21</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Table P4.5
Means and standard deviations (in parentheses) of predicted and actual fear ratings for the Low, Medium and High fear groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Fear Rating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted</td>
<td>Actual</td>
</tr>
<tr>
<td>Low Fear</td>
<td>3.75 (1.25)</td>
<td>4.06 (1.35)</td>
</tr>
<tr>
<td>Medium Fear</td>
<td>4.69 (1.28)</td>
<td>4.69 (1.34)</td>
</tr>
<tr>
<td>High Fear</td>
<td>5.82 (0.96)</td>
<td>5.39 (1.51)</td>
</tr>
</tbody>
</table>
A 2 x 2 mixed between-within-subjects ANOVA was conducted to test whether the
differences between predicted and actual fear varied as a result of pre-existing spider fear.
The between subjects variable was Fear Group (Low, Medium, High) while the within
subjects factor was Fear Rating (Predicted, Actual). The analysis revealed a significant
effect for Fear Group $F(2, 85) = 16.88, p < .001$. However, the Fear Group x Fear Rating
interaction, although approaching significance, did not reach the criterion alpha, $F(2, 85) = 2.67, p = .075$.

**Discussion**

The major findings of this study were that although manipulating perceptions of
uncontrollability and dangerousness significantly affected predicted fear in the imaginal
scenario, the manipulations of uncontrollability, dangerousness, and unpredictability all
had a significant effect on the fear measure in the in vivo exposure scenario. While only
the effect of the unpredictability manipulation was significantly affected by the nature of
exposure, the three experimental manipulations accounted for only about 5% of the
variance in predicted fear in the imaginal situation compared to over 25% of the variance
in fear in the in vivo situation.

Although the manipulations were found to have significant effects on task related
spider fear in the in vivo exposure scenario, the magnitude of these effects differed
significantly from those in the imaginal scenario only for the Unpredictability
manipulation. The reason for the failure to find an interaction between exposure scenario
and the effect of the Uncontrollability and Dangerousness manipulations was undoubtedly
a result of the significant effect of these variables on task related fear in the imaginal
scenario. Nonetheless, it is worth noting that although the differential effectiveness of the
Uncontrollability and Dangerousness manipulations across exposure modalities was not
significant, the direction of the interaction was as predicted. For all manipulations, actual
exposure produced larger effects for the manipulations than did imaginal exposure,
although these were not significant.

In general, it was shown that predicted fear was moderately to highly correlated
with actual fear. However, predicted fear only explained approximately 40 percent of the
variance in actual fear. Additionally, the experimental manipulations were more effective
during the in vivo exposure scenario than during imaginal exposure. This study therefore underlines the sub-optimal effectiveness of hypothetical scenarios to accurately gauge emotions which would be elicited via in vivo exposure. It can be concluded that manipulations used to influence fear ratings may be more profitably implemented during in vivo exposure to the fear-relevant stimulus than by using imaginal exposure.

The perceptions of uncontrollability, unpredictability and dangerousness associated with the spider encounter accounted for a large percentage of the variance in fear beyond that accounted for by the experimental manipulations. Indeed, in the imaginal scenario, the experimental manipulations accounted for a non-significant percentage of the variance in TRSF scores while the vulnerability related perceptions accounted for approximately 53% of the variance in TRSF scores. However, in the in vivo scenario, the manipulations accounted for approximately 20% more variance in task related fear than was accounted for by the manipulations in Phase 1 while the vulnerability variables accounted for about 13% less variance in TRSF scores than for the imaginal task. These results are consistent with the idea that the manipulations affected fear of spiders only to the extent that they were successful in altering perceptions of the spider and the nature of the task. Indeed, had the manipulations been more effective in influencing perceptions of the spider and the situation it is highly plausible that the effect on fear would have been even greater.

The study reported here reveals a relative lack of effectiveness of the imaginal encounter in comparison to the in vivo encounter with a spider. This is compatible with findings of differing effects of real and imaginal exposure to feared stimuli in outcome studies involving the psychological treatment of anxiety disorders. Imaginal and in vivo exposure are two of the most frequently employed behavioural treatments for these disorders (Goisman et al., 1993). Numerous studies have demonstrated the effectiveness of systematic desensitisation to treat circumscribed fears in analogue and clinical populations. Although in vivo exposure is generally regarded as the exposure modality of choice in systematic desensitisation, procedures using imaginal exposure have proven effective in treating a range of fears (Crits & Singer, 1984; Denney & Sullivan, 1976; McConaghy, Armstrong, Blaszczynski, & Allcock, 1983; Rainwater et al., 1988). In outlining the application of systematic desensitisation to phobias, Wolpe (1963) originally declared that there is a one to one relationship between what the patient can imagine without anxiety and what a person can experience in reality without anxiety. However,
numerous studies have since demonstrated a ‘transfer gap’ between what a person can imagine without fear and their emotional response following in vivo exposure (Agras, 1967; Barlow, Leitenberg, Agras, & Wincze, 1969; Sherman, 1972). That is, the degree of fear amelioration is not maintained from imaginal to parallel in vivo exposure.

Results directly comparing the treatment efficacy of systematic desensitisation to imaginal and in vivo stimuli indicate that in vivo exposure is superior to imaginal exposure (Dyckman & Cowan, 1978; Egan, 1981; Litvak, 1969; Sherman, 1972; Ultee, Griffioen, & Schellekens, 1982). This is believed to be especially the case in regards to the treatment of specific phobias (Emmelkamp, 2003). However, some studies report few or no differences between imaginal and in vivo exposure (Richards, Lovell, & Marks, 1994; James, May-Hampton, & Larsen, 1983). Additionally, long-term studies have sometimes shown comparable results for these two exposure modalities (Mathews, 1977; Wieselberg, Dyckman, & Abramowitz, 1979). Hecker (1990), for instance, found that when the degree of emotional processing is held constant, there are few differences in treatment outcome between imaginal and in vivo exposure for analogue snake phobics. Drawing on bio-informational theory, Hecker and Thorpe (1987; Hecker, 1990) claim that it is the degree of emotional processing, rather than the treatment procedure per se that is associated with the treatment outcome for phobic anxiety. Invariably, greater vividness accompanies in vivo exposure in comparison to imaginal exposure and this is consistent with findings that fear reduction following exposure is more pronounced for good imagers than for poor imagers (Van den Bergh, Eelen, & Baeyens, 1989).

The results for the imaginal scenario show that, of the three manipulations, it was only perceptions of the unpredictability of a spider that failed to affect fear when subjects were asked to imagine an encounter with a spider. One possible explanation for this finding is that, in relation to the proposed task, predictability was harder to visualise than the other variables and, therefore, had less of an effect on predicted fear.

It is commonly accepted that stimulus perceptions are an important cognitive component of specific fears. The Cognitive Vulnerability Model of the etiology of specific fears, however, promotes four specific stimulus perceptions as being crucial to the etiology of specific fears (Armfield, 2006b). Perceptions of uncontrollability, unpredictability, dangerousness and disgustingness are believed to contribute to a sense of vulnerability in relation to the specific object or situation and it is this perceived vulnerability that forms the core of subsequent fear responses.
A number of studies have demonstrated large and significant relationships between fear and perceptions of stimuli as uncontrollable, unpredictable and dangerous. This study has gone further, however, in demonstrating a causal relationship between these perceptions and subsequent fear. As such, this research is consistent with the central tenets of the Cognitive Vulnerability Model and with the proposed role of stimulus perceptions in the determination of fear. The results of the study indicate that affording an individual a sense of control, predictability, and safety in relation to a stimulus, in this instance a spider, can be expected to have an ameliorating effect on fear. The longevity of this effect, however, requires examination. Long-lasting reductions in fear would need to be accompanied by similarly long-lasting changes in perceptions of the uncontrollability, unpredictability and dangerousness associated with the stimulus. In addition, the evidence from this study would suggest that imaginal exposure and imaginal skill training may be insufficient to produce a substantial result and that in vivo exposure and actual tasks should be employed.
References


CHAPTER 8 (PAPER 5) – PERSONALITY ANTECEDENTS OF FEAR: MEDIATION BY COGNITIVE VULNERABILITY PERCEPTIONS

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Statement of authorship

PERSONALITY ANTECEDENTS OF FEAR: MEDIATION BY COGNITIVE VULNERABILITY PERCEPTIONS

Behaviour Research and Therapy (Submitted)

Armfield J.M. (Candidate)

Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ...................................................................... Date: ..............................
Linkage of paper to body of research

In the Cognitive Vulnerability Model there are two antecedents of fear – learning experiences and personality traits. It is hypothesised that underlying perceptions of uncontrollability, unpredictability, dangerousness and disgustingness are more general personality traits related to each of the vulnerability-related perceptions. As an example, a person with a general proclivity towards feeling disgusted is more likely to feel disgust towards some animals or in relation to blood-injection-injury situations. Someone with a strong desire for control might have considerably more problems and develop fear and avoidance of situations or stimuli involving lack of control. Similarly, someone with a preference for predictability or cognitive closure might be more likely to feel anxious when confronting something with uncertain predictability.

Given that personality traits relating to control, predictability, danger and disgust are intimately associated with their respective vulnerability-related perceptions it is important that these linkages are at least confirmed. If no associations were found there would need to be a reassessment or an abandonment of the role of personality variables in the model. The current study is therefore crucial to the body of research testing the Cognitive Vulnerability Model.
This study has had the most difficult time getting published of any of the studies comprising this thesis. One of the major problems with publication is that the paper deals somewhat with personality theory, somewhat with anxiety disorders, but not enough with either to demarcate it well for publication. Partly as a result of the the process of being submitted to different journals, and partly because of efforts to deal with the criticisms or suggestions of reviewers, the manuscript has had numerous incarnations. The early draft of the manuscript, for example, looked at both perceptions of control and desirability of control, because it was thought that both these variables might interact such that low perceived control would relate more to fearfulness when a person has a high desire for control. However, the manuscript was criticised by a reviewer because there “seems to be more than one research question” and, as a result, a potentially important aspect of the study was dropped from the manuscript.

The study used both the Mastery Scale (MS) and the Desire for Control Scale (DCS) because it has been widely theorised that these interact to determine fear. To test for the hypothesised interaction both the MS and DCS were categorised based on a median split. The relation between these variables and both general fearfulness and spider fear, which were excluded from the submitted paper, are shown in Table 4. In terms of general fearfulness, the highest fear score was for people classified into the low desire for control and low perceived control groups. The lowest mean general fearfulness score was for people in the high perceived control and high desire for control groups. A univariate analysis of variance identified a significant main effect for both perceived control \( (F = 6.12, p = .015) \) and desire for control \( (F = 4.74, p = .032) \), however the interaction effect was not significant \( (F = .58, p = .445) \). In contrast, spider fear was highest for those people with low perceived control but high desire for control. People with low perceived control and low desire for control had the next highest mean spider fear, followed by people with high perceived control but low desire for control, while people with high perceived control and high desire for control had the least spider fear. Again, this was tested using univariate analysis of variance. While perceived control had a significant main effect \( (F = 6.68, p = .011) \), desire for control did not have a statistically significant
main effect \( (F = .15, p = .704) \). The interaction effect approached, but did not obtain, statistical significance \( (F = 3.37, p = .070) \).

It was interesting that the hypothesised interaction between desire for control and perceived control was not found. It has long been postulated, and research has confirmed, that discordance between perceived control and desire for control may lead to negative psychological consequences such as anxiety and depression (Burger, 1984, 1992; Evans, Shapiro & Lewis, 1993). In relation to dental fear, for example, studies have found that low perceived control was associated with distress primarily for those dental patients who reported a high desire for control during treatment (Logan, Baron, Keeley, Law, Moreland, & Stein, 1991). People reporting low perceived control and low desire for control could not be distinguished from patients who reported high levels of control. It should be noted, however, that although there was no interaction found in this study for general fearfulness, the interaction effect approached significance in relation to spider fear with the effect going in the expected direction. Consistent with previous research, those people indicating the greatest spider fear had a relatively high desire for control over life events but perceived themselves to have relatively low control.

Table 4

Means (and standard deviations) of general fearfulness and spider fear for low and high perceived control and desire for control groups

<table>
<thead>
<tr>
<th>Perceived control (MS)</th>
<th>Desire for control (DC)</th>
<th>General fearfulness (FSS-III)</th>
<th>Spider (FS-S)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low DC (≤ 4.7)</td>
<td>High DC (&gt; 4.7)</td>
<td>Low DC (≤ 4.7)</td>
</tr>
<tr>
<td>Low (≤ 4.4)</td>
<td>1.99 (0.59)</td>
<td>1.83 (0.52)</td>
<td>3.95 (1.51)</td>
</tr>
<tr>
<td>High (&gt; 4.4)</td>
<td>1.80 (0.36)</td>
<td>1.46 (0.31)</td>
<td>3.68 (1.78)</td>
</tr>
</tbody>
</table>
Abstract

The Cognitive Vulnerability Model of the etiology of fear proposes that vulnerability perceptions of feared stimuli are shaped to some extent by personality traits related to control, predictability, danger and disgust. This study sought to examine whether the relationship between spider fear and the personality traits of perceived control, desire for control, desire for predictability, disgust sensitivity and harm sensitivity are mediated by perceptions of spiders as being uncontrollable, unpredictable, disgusting and dangerous, respectively. Statistical testing of the mediation effect provided strong support for the mediation model. In addition, vulnerability perceptions were found to be highly correlated to spider fear and the measured personality traits were found to be significantly correlated with general fearfulness. No significant interaction effect between perceived control and desire for control was observed. This study suggests a role for personality variables in the development of specific fear responses, with personality traits affecting fear of any given object or situation by impacting upon the perceptions of those objects or situations as uncontrollable, unpredictable, dangerous and disgusting.
Introduction

Explanations of specific fears and their clinical manifestations often rely on relatively simple explanations such as having previously experienced a distressing or harmful encounter with the feared object or situation. However, it is now widely acknowledged that cognitive factors are important in fear determination and expression (Beck, Emery & Greenberg, 1985; Yiend, 2004). The Cognitive Vulnerability Model, for example, holds that fear of a given stimulus stems directly from perceptions of that stimulus as dangerous, uncontrollable, unpredictable, and disgusting (Armfield, In press). These perceptions are seen as abstractions of reality, or cognitive representations, and are believed to contribute to a sense of vulnerability associated with the stimulus. This begs the question, however, as to where the origins of such perceptions lie. Quite likely one source of the vulnerability perceptions is learning events with the particular stimuli that take place across a person’s life. However, a second source, personality traits, are also argued to underlie the particular vulnerability perceptions. For example, perceptions of a particular stimulus as disgusting may be related to a more general personality trait such as disgust sensitivity. Similarly, perceptions of a stimulus along the dimensions of uncontrollability, unpredictability, and dangerousness may also be related to personality traits specific to these variables.

That at least some of these personality variables are relevant to fear research is given some credence by studies investigating infant behaviour. These behaviours reflect either predetermined biological response sets or are an indication of a child’s individual temperament, an early personality precursor. Studies have found that twelve- to thirteen-month-old infants able to control a potentially frightening mechanical toy exhibit less fear and smile more than those subjects not having control over the toy’s actions (Gunnar-vonGnechten, 1978). Also, infants have also been found to respond idiosyncratically to an uncertainty-provoking stimulus (a toy spider) with differential fear expression (Gunnar & Stone, 1984). Finally, research on infant pain has long shown variability in fear responses to surgical and other pain in very young children as part of natural inter-individual variation (e.g., Johnston, Stevens, Yang & Horton, 1995). Although research into these phenomena is limited, they are suggestive of early preferences for both controllable and predictable stimuli.
Another reason to believe that the personality variables proposed here might relate to specific fears is that such variables as locus of control have previously been found to be associated with other psychopathological states including anxiety disorders. Traub (1982), for example, found that externality as determined by the Internal-External Locus of Control Scale (Rotter, 1966) was related to fear of a large number of objects and situations. Similarly, Abdel-Khalek (1988) found scores on a fear survey to be correlated with subscales of several personality inventories. Locus of control has also been found to correlate with fear in agoraphobic (Emmelkamp & Cohen-Kettenis, 1975), panic disorder, and social phobic populations (Cloitre, Heimberg, Liebowitz, & Gitow, 1992). Studies examining harm avoidance have found it to be related to depression (Joffe, Bagby, Levitt, & Regan, 1993, Cheung & Todd-Oldehaver, 2006), social phobia (Hofmann & Loh, 2006), panic disorder (Starcevic, Uhlenhuth, Fallon, & Pathak, 1996), agoraphobia (Saviotti et al., 1991) and generalised anxiety disorder (Starcevic, Uhlenhuth, & Fallon, 1995; Starcevic et al., 1996). Finally, disgust sensitivity has been implicated in blood-injection-injury fears (de Jong & Merckelbach, 1988; Kock, O’Neil, Sawchuk & Connolly, 2002) and fear of some animals (Davey, 1992; Matchett & Davey, 1991; Ware, Jain, Burgess & Davey, 1994).

This study aimed to relate the personality variables of perceived control and desire for control, need for predictability, disgust sensitivity, and harm sensitivity to both fear in general and the perceptions of uncontrollability, unpredictability, disgustingness, and dangerousness of a specific stimulus (a spider). Several hypotheses were advanced. First, perceptions of spiders as uncontrollable, unpredictable, dangerous and disgusting would be positively correlated with fear of spiders. Second, lack of control over life events, disgust sensitivity, desire for predictability, and harm sensitivity would be significantly associated with general fearfulness. Third, some researchers have argued that perceived control is only related to psychopathology when there is a desire for control (Burger, 1984, 1992). It was therefore hypothesised that lack of control over life events and desire for control would exhibit an interaction effect with general fear. Finally, it was hypothesised that lack of control over life events, disgust sensitivity, desire for predictability, and harm sensitivity would be significantly associated with fear of spiders, however, these associations would be mediated by perceptions of spiders as being uncontrollable, disgusting, unpredictable, and dangerous respectively.
Method

Participants

The study participants were 88 students enrolled in an undergraduate psychology course in Adelaide, South Australia. Participation in the study was voluntary. There were 68 females (77.3%) and 19 males (21.6%) while one person did not indicate their gender. The mean age of participants was 23.3 years (SD = 8.54; range 18–53 years).

Measures

The Mastery Scale (MS; Pearlin, Lieberman, Menaghan, & Mullan, 1981): a modified version of the original 7-item scale which measures “the extent to which one regards one’s life-chances as being under one’s own control in contrast to being fatalistically ruled”. An additional 3 items have been added from the Internality subscale of the Internality, Powerful Others, and Chance Scales (Levenson, 1981).

The Desirability of Control Scale (DCS; Burger & Cooper, 1979): a 20-item scale included because studies have found that anxiety comes not just from a lack of control but from a lack of control where control is desired. Desirability of control has been argued to represent a stable personality characteristic (Burger & Cooper, 1979).

Disgust Scale (Haidt, McCauley, & Rozin, 1994): a modified 28-item scale measuring 6 domains of disgust elicitors (food, animals, body products, body envelope violations, death, & hygiene) and presented in two formats: the first 14 statements requiring a ‘True/False’ response and the second set of 14 statements using a 4-point Likert scale with response ranging from ‘Not disgusting’ (1) to ‘Very disgusting’ (4). One of the original disgust domains (sex; four items) was excluded because of its offensive nature.

Desire for predictability was measured using a modified version of the Need for Closure Scale (NCS; Webster & Kruglanski, 1994). This is a 28-item scale comprising three of the five original subscales (preference for order, preference for predictability, and discomfort with ambiguity). All items relate to uncertainty and unpredictability. Cognitive closure is said to “afford predictability and guidance for action” (Webster & Kruglanski, 1994).
The *Harm Sensitivity Index* (HSI) was created by combining relevant items from the Pain Sensitivity Index (Gross, 1992) and the Pain Anxiety Symptoms Scale (McCracken, Zayfert, & Gross, 1992), in addition to some newly developed items. The scale comprised 16 items.

The *Fear Survey Schedule - III* (Wolpe & Lang, 1964) comprises 56 items from the original scale (excluding items related to social and interpersonal fears and some stimuli related to miscellaneous fears) in addition to several items from subsequent revisions of the scale. For the final set of 68 items, subjects were asked to indicate “how much actual fear (not dislike or disgust) they had of them nowadays”.

The *Cognitive Vulnerability Scale - Spiders* (CVS-S) contains four subscales and measures perceptions of the unpredictability, dangerousness, disgustingness (4 items each), and uncontrollability (3 items) of spiders. Items were derived from a scale developed by Armfield & Mattiske (1996). The mean of all 15 items was calculated in order to obtain a total scale score.

The *Fear Scale - Spiders* (FS-S) is an 8-item scale with items tapping subjective fear (1 item), approach and avoidance behaviour (3 items), physiological reactivity (1 item), vigilance/preoccupation (2 items), and functional impairment (1 item). A total spider fear score was obtained by calculating the mean of all items.

### Statistical analysis of mediation effects

Mediation occurs to the extent that one variable (M) accounts for the relationship between a predictor or independent variable (IV) and a criterion or dependent variable (DV). The mediation model proposed in this study is shown in Figure P5.1. According to this model, the spurious relationships between personality traits and spider fear (Path C) are actually mediated by vulnerability perceptions of the spider.
The most common method for testing for mediation effects in psychological research follows from the work of Kenny and colleagues (e.g., Baron & Kenny, 1986; Judd & Kenny, 1981). Although there are a number of issues to consider when designing studies to test for mediator effects (Frazier, Tix & Barron, 2004), the formal heuristic analysis for establishing the presence of a mediating effect is relatively straight-forward (Preacher & Hayes, 2004). Variable M is considered a mediator if (1) the IV is significantly associated with the DV, (2) the IV is significantly associated with M, and (3) M is significantly associated with the DV after controlling for IV. Perfect mediation is said to occur when there is no association between the IV and the DV after controlling for the effects of M (James & Brett, 1984). To test for the significance of a mediating effect, a test was developed by Sobel (1982) which divides the difference between the effect of the IV and the DV before and after controlling for the mediator (M) by the standard error of the indirect effect. However, there are limitations to the Sobel test in terms of assumptions of distribution and sample size and, for this reason, bootstrapping approaches to testing for the significance of mediating effects have been designed (Preacher & Hayes, 2004). Bootstrapping is a non-parametric approach to effect size estimation involving the generation of large numbers of effect sizes, based on the original sample size and using random resampling, in order to derive a sample distribution of test statistics and associated
confidence intervals. For the analyses presented here, the SPSS macro made available by Preacher and Hayes (2004) was used with both the Sobel Test and bootstrapping analyses based on 5000 resamples being reported.

Results

Descriptive statistics, internal consistency, and gender differences

Scale descriptives and differences between males and females on all the scales are presented in Table P5.1. The internal reliability of all scales, as measured by Cronbach’s alpha, was good and ranged from .73 for the Cognitive Vulnerability Scale (Spiders) Disgustingness subscale to .96 for the Fear Survey Schedule - III. Mean spider fear was 3.73 and almost 30% of subjects indicated that their fear of spiders was at least definitely disturbing or at least moderately disabling. A series of one-way ANOVAs revealed that females perceived spiders as being more dangerous, disgusting, uncontrollable and unpredictable than did males. Compared to males, females had greater spider fear \( (p = .009) \), and higher general fearfulness \( (p = .004) \). Finally females had significantly higher mean scores on the measure of disgust sensitivity \( (p < .001) \) and on the Harm Sensitivity Index \( (p = .020) \). No significant gender differences were found on the Mastery Scale, Desire for Control Scale or the Need for Closure Scale \( (p’s > .05) \).
Table P5.1

Means, standard deviations and ranges for all scales as well as means, standard deviations and significance of differences for males and females on each scale

<table>
<thead>
<tr>
<th>Scale</th>
<th>Scale Descriptives</th>
<th>Males (M)</th>
<th>Females (F)</th>
<th>M-F Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
<td>α</td>
</tr>
<tr>
<td>MS</td>
<td>4.37</td>
<td>.65</td>
<td>2.70-5.70</td>
<td>.80</td>
</tr>
<tr>
<td>DCS</td>
<td>4.74</td>
<td>.58</td>
<td>3.35-6.45</td>
<td>.75</td>
</tr>
<tr>
<td>DS</td>
<td>12.76</td>
<td>5.51</td>
<td>1.98-23.95</td>
<td>.88</td>
</tr>
<tr>
<td>NCS</td>
<td>4.46</td>
<td>.68</td>
<td>2.50-6.50</td>
<td>.86</td>
</tr>
<tr>
<td>HSI</td>
<td>3.74</td>
<td>1.08</td>
<td>1.31-5.88</td>
<td>.91</td>
</tr>
<tr>
<td>FSS-III</td>
<td>1.79</td>
<td>.52</td>
<td>1.00-3.67</td>
<td>.96</td>
</tr>
<tr>
<td>FS-S</td>
<td>3.73</td>
<td>1.61</td>
<td>1.00-6.63</td>
<td>.95</td>
</tr>
<tr>
<td>CVS Dan.</td>
<td>3.40</td>
<td>1.23</td>
<td>1.00-6.25</td>
<td>.77</td>
</tr>
<tr>
<td>CVS Dis.</td>
<td>4.16</td>
<td>1.43</td>
<td>1.00-7.00</td>
<td>.73</td>
</tr>
<tr>
<td>CVS Unc.</td>
<td>3.59</td>
<td>1.85</td>
<td>1.00-7.00</td>
<td>.85</td>
</tr>
<tr>
<td>CVS Unp.</td>
<td>4.49</td>
<td>1.55</td>
<td>1.00-7.00</td>
<td>.88</td>
</tr>
<tr>
<td>CVS Total</td>
<td>15.64</td>
<td>5.06</td>
<td>5.25-25.67</td>
<td>.91</td>
</tr>
</tbody>
</table>

Notes: α = Cronbach’s alpha, Mastery Scale (MS), Desirability of Control Scale (DCS), Disgust Scale (DS), Need for Closure Scale (NCS), Harm Sensitivity Index (HSI), Fear Survey Schedule III (FSS-III), Fear Scale -Spiders (FS-S), Cognitive Vulnerability Scale (Spiders) Dangerousness Subscale (CVS Dan.), Cognitive Vulnerability Scale (Spiders) Disgustingness Subscale (CVS Dis.), Cognitive Vulnerability Scale (Spiders) Uncontrollability Subscale (CVS Unc.), Cognitive Vulnerability Scale (Spiders) Unpredictability Subscale (CVS Unp.)

The relation between the vulnerability variables and spider fear

Given the association between gender and the fear scales, a series of partial correlations were computed between all the scales, controlling for gender. The partial correlation coefficients between spider fear and perceptions of spiders as uncontrollable, unpredictable, dangerous and disgusting were all statistically significant (ps < .001) after controlling for gender. Perceived dangerousness exhibited the lowest correlation (r = .57), perceived uncontrollability had the highest correlation (r = .83), while the partial correlations between spider fear and perceived disgustingness (r = .70) and perceived unpredictability (r = .74) were in between these two extremes. These results mirror those obtained by Armfield and Mattiske (1996) who found correlations between the vulnerability variables and spider fear to range between .49 and .80 with perceived
dangerousness having the lowest correlation and perceived uncontrollability the highest. In this study the Cognitive Vulnerability Scale (Spiders) that combines the four domains to cognitive vulnerability was highly correlated with fear of spiders ($r = .89, p < .001$)

**The relation between general fearfulness and personality traits**

It was hypothesised that general fearfulness would be significantly associated with personality traits related to disgust sensitivity, harm sensitivity and the desire for control and predictability. After once again partialling out the effects of gender there were statistically significant positive correlations between general fearfulness and disgust sensitivity ($r = .60, p < .001$), need for closure ($r = .24, p < .05$) and harm sensitivity ($r = .58, p < .001$). Significant negative correlations were found between general fearfulness and both perceived mastery and desire for control ($rs = -.25, ps < .05$). This means that those people with more general fear had a decreased sense of mastery over life events and had a decreased desire for control.

**The relation of perceived control and desire for control with fearfulness**

Two aspects of control were measured in this study – perceived control and desire for control. It was thought that both these variables might interact such that low perceived control would relate more to fearfulness when a person has a high desire for control. To test this interaction hypothesis both the MS and DCS were categorised based on a median split. The relation between these variables and general fearfulness are shown in Table P5.2. Also examined was the relationship between the control variables and fear of spiders. In terms of general fearfulness, the highest fear score was for people classified into the low desire for control and low perceived control groups. The lowest mean general fearfulness score was for people in the high perceived control and high desire for control groups. A univariate analysis of variance identified a significant main effect for both perceived control ($F = 6.12, p = .015$) and desire for control ($F = 4.74, p = .032$), however the interaction effect was not significant ($F = .58, p = .445$). Contrary to expectations, the control variables had an additive but not a multiplicative effect on general fearfulness. In contrast, however, spider fear was highest for those people with low perceived control but high desire for control. People with low perceived control and low desire for control had the next highest mean spider fear, followed by people with high
perceived control but low desire for control, while people with high perceived control
and high desire for control had the least spider fear. Again, this was tested using univariate
analysis of variance. While perceived control had a significant main effect \( F = 6.68, p =
.011 \), desire for control did not have a statistically significant main effect \( F = .15, p =
.704 \). The interaction effect approached, but did not obtain, statistical significance \( F =
3.37, p = .070 \).

Table P5.2

Means (and standard deviations) of general fearfulness and spider fear for low and high
perceived control and desire for control groups

<table>
<thead>
<tr>
<th>Perceived control (MS)</th>
<th>General fearfulness (FSS-III)</th>
<th>Spider fear (FS-S)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low DC (≤ 4.7)</td>
<td>High DC (&gt; 4.7)</td>
</tr>
<tr>
<td>Low (≤ 4.4)</td>
<td>1.99 (0.59)</td>
<td>1.83 (0.52)</td>
</tr>
<tr>
<td>High (&gt; 4.4)</td>
<td>1.80 (0.36)</td>
<td>1.46 (0.31)</td>
</tr>
</tbody>
</table>

The relation of perceptions of spiders to personality traits

Table P5.3 shows the partial correlations between the cognitive vulnerability
variables and the personality traits. Because no significant interaction effect was found
between perceived control and desire for control, these two personality traits were
combined for subsequent analyses by multiplying them together, to create a variable
incorporating both of these dimensions. The combined variable was significantly
correlated with perceptions of spiders as being uncontrollable \( r = -.27, p < .05 \).
Likewise, disgust sensitivity was associated with perceptions of spiders as being disgusting
\( r = .47, p < .001 \), need for closure was significantly associated with perceptions of
spiders as being unpredictable \( r = .27, p < .05 \), and harm sensitivity had a significant
positive correlation with perceptions of spiders as dangerous \( r = .27, p < .05 \).
Table P5.3

Partial correlation coefficients between scales controlling for gender

<table>
<thead>
<tr>
<th></th>
<th>MSxDCS</th>
<th>DS</th>
<th>NCS</th>
<th>HSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVS Dan.</td>
<td>-.19</td>
<td>.27*</td>
<td>.17</td>
<td>.27*</td>
</tr>
<tr>
<td>CVS Dis.</td>
<td>-.24*</td>
<td>.47***</td>
<td>.31**</td>
<td>.31*</td>
</tr>
<tr>
<td>CVS Unc.</td>
<td>-.27*</td>
<td>.36**</td>
<td>.26*</td>
<td>.21</td>
</tr>
<tr>
<td>CVS Unp</td>
<td>-.28**</td>
<td>.18</td>
<td>.27*</td>
<td>.16</td>
</tr>
<tr>
<td>CVS Tot.</td>
<td>-.31**</td>
<td>.40***</td>
<td>.32**</td>
<td>.29**</td>
</tr>
</tbody>
</table>

Notes: Mastery Scale (MS), Desirability of Control Scale (DCS), Disgust Scale (DS), Need for Closure Scale (NCS), Harm Sensitivity Index (HSI), Cognitive Vulnerability Scale (Spiders) Dangerousness Subscale (CVS Dan.), Cognitive Vulnerability Scale (Spiders) Disgustingness Subscale (CVS Dis.), Cognitive Vulnerability Scale (Spiders) Uncontrollability Subscale (CVS Unc.), Cognitive Vulnerability Scale (Spiders) Unpredictability Subscale (CVS Unp.)

* p < .05, ** p < .01, *** p < .001

Mediation of the relationship between personality traits and spider fear by specific vulnerability perceptions

Mediation of the relationships between personality traits and spider fear were tested using both the Sobel and Bootstrap tests (Table P5.4). Models were constructed to test the mediation of harm sensitivity by perceived spider dangerousness (Model 1), the mediation of disgust sensitivity by perceived spider disgustingness (Model 2), the mediation of lack of control and desire for control by perceived spider uncontrollability (Model 3), and the mediation of need for closure by perceived spider unpredictability (Model 4). For all models, spider fear, as measured by the FS-S, was the dependent variable. Path C represents the direct effect between the personality trait and spider fear for each model, while Path C’ represents the effect after controlling for the respective cognitive vulnerability perception. Each personality trait demonstrated a significant association with spider fear (Path C), with all Beta coefficients being statistically significant. However, after controlling for the possible mediating effects of the cognitive vulnerability variables (Path C’) the association between the personality traits and spider fear was not significant. Both the Sobel and Bootstrap tests provide similar results and indicate that the mediating effect of the spider vulnerability perceptions are statistically significant, providing evidence for a mediated effect of the personality traits on spider fear.
Table P5.4.
Tests of mediating effects of cognitive vulnerability perceptions of spiders between personality variables and fear of spiders

<table>
<thead>
<tr>
<th>Model</th>
<th>Path C</th>
<th>Path C'</th>
<th>Sobel Test</th>
<th>Bootstrap Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effect</td>
<td>SE</td>
</tr>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dangerousness</td>
<td>.509</td>
<td>.152</td>
<td>.001</td>
<td>.215</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disgustingness</td>
<td>.04</td>
<td>.01</td>
<td>.000</td>
<td>.01</td>
</tr>
<tr>
<td>Model 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncontrollability</td>
<td>-.103</td>
<td>.036</td>
<td>.005</td>
<td>-.01</td>
</tr>
<tr>
<td>Model 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unpredictability</td>
<td>.648</td>
<td>.247</td>
<td>.010</td>
<td>.226</td>
</tr>
</tbody>
</table>

Notes: Path C = Effect of IV on DV (spider fear); Path C' = Effect of IV on DV (spider fear) after controlling for mediator; Model 1 = HSI → perceived dangerousness of spiders → spider fear; Model 2 = DSI → perceived disgustingness of spiders → spider fear; Model 3 = MSxDCS → perceived uncontrollability of spiders → spider fear; Model 4 = NCS → perceived unpredictability of spiders → spider fear
Discussion

This study found a relationship between personality traits, to do with control, disgust, harm and predictability, and spider fear and that these relationships were mediated by perceptions of spiders. These findings are consistent with the hypothesis by Armfield (In press) that personality traits affect specific fears by influencing how an object or situation is perceived. Fear of a given stimulus is believed to result directly from the perceptions of the stimulus as being uncontrollable, unpredictable, dangerous and disgusting. In turn, each of these perceptions is the sum result of a lifetime of learning experiences undergirded by a constellation of personality traits that interact with the learning experiences and serve to either exacerbate or ameliorate vulnerability perceptions. Together, personality traits and learning experiences shape the perceptions of every situation a person experiences and every object a person encounters. And it is these specific perceptions which determine the degree of fear and anxiety a person feels towards any given object or situation.

Ideally, the personality traits examined in this study should fit within established higher-order taxonomies, such as that proposed by Eysenck and Eysenck (1975). However, while harm sensitivity has been shown to be associated with the Neuroticism subscale from the Eysenck Personality Questionnaire (Caseras, Avila & Torrubia, 2003), disgust sensitivity, desire for control and desire for predictability have received less theoretical attention. Darvill and Johnson (1991) found perceived control over negative life events to be significantly negatively correlated with Neuroticism, yet no significant associations were found between perceived control over positive events and personality traits. Meyers and Wong (1988), however, found Neuroticism to be greater for people with an internal locus of control orientation than for those with an external orientation. Interestingly, Vogeltanz and Hecker (1999) found no interaction in emotional responding between Neuroticism and experimental manipulation of the controllability and predictability of aversive slides. Yet, desire for control and desire for predictability appear very early in the human lifespan. In addition, it has been argued that disgust is one of four basic emotions, developing early in a child’s life as an offshoot of the biologically derived reaction of distaste (Rozin, Haidt & McCauley, 2000). Exactly how the lower-order personality traits examined in this study fit within established higher-order taxonomies remains to be more thoroughly investigated.
It is interesting that the hypothesised interaction between desire for control and perceived control was not found in this study. It has long been postulated, and research has confirmed, that discordance between perceived control and desire for control may lead to negative psychological consequences such as anxiety and depression (Baron, Cusumano, Evans, Hodne & Logan, 2004; Burger, 1984, 1992; Evans, Shapiro & Lewis, 1993). In relation to dental fear, for example, studies have found that low perceived control was associated with distress primarily for those dental patients who reported a high desire for control during treatment (Logan, Baron, Keeley, Law, Moreland & Stein, 1991). Subjects reporting low perceived control and low desire for control could not be distinguished from patients who reported high levels of control. It should be noted, however, that although there was no interaction found in this study for general fearfulness, the interaction effect approached significance in relation to spider fear with the effect going in the expected direction. Consistent with previous research, those people indicating the greatest spider fear had a relatively high desire for control over life events but perceived themselves to have relatively low control. It is quite likely that these results would have been statistically significant given a slightly larger sample.

The results of this study provide an important replication of earlier work by Armfield and Mattiske (1996), who found high correlations between spider fear and vulnerability perceptions of spiders. The comparability of the results across these two studies is impressive given that their study used a differing measure of spider fear and the current study used short versions of the scales measuring perceived dangerousness, uncontrollability, unpredictability and disgustingness. Armfield and Mattiske found that the four cognitive vulnerability variables accounted for 55% of the variation in spider fear beyond gender and learning experiences, which only accounted for 15% of the variation in spider fear. The study explained gender differences in spider fear as a result of both differences in perceptions of spiders and the stronger relationship for females than for males of the vulnerability perceptions with spider fear.

The results of this study should be interpreted with an awareness of its limitations. First, the number of subjects participating in the study was small. The results would usefully be replicated using a larger study sample. Second, the subjects represent a non-clinical population and diagnoses of Specific Phobia were not made. It is possible that the results might have been stronger if a phobic population had been compared to a non-fearful population, rather than using a population exhibiting a range of fear experiences.
Finally, while the results for this study using spiders as the fear-relevant stimulus might be generalisable to some other objects or situations, it is possible that the relationships between personality traits and other fears may differ in some ways to that shown for spiders. Fear of maggots, for example, may be much more strongly related to the personality trait of disgust sensitivity than to desire for control. Fear of going to the dentist may be more strongly related to desire for control and harm sensitivity than to disgust sensitivity.

In summary, it was found that the personality traits of desire for control, desire for predictability, harm sensitivity, and disgust sensitivity were related to both general fear and to spider fear, and that for spider fear these relationships were almost entirely mediated by perceptions of spiders as uncontrollable, unpredictable, dangerous and disgusting. This finding confirms one of the underlying premises of the Cognitive Vulnerability Model of the etiology of fear, that personality traits are related to specific fears as a result of their effect on perceptions of objects and situations as being uncontrollable, unpredictable, dangerous and disgusting. It is hoped that this work may encourage further study of personality traits in relation to specific fears and phobias.
References


CHAPTER 9 (PAPER 6) – MEMORY BIAS FOR GENERAL SPIDER WORDS AND VULNERABILITY SCHEMA RELATED SPIDER WORDS

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Statement of authorship

EXPLICIT MEMORY BIAS FOR VULNERABILITY SCHEMA RELATED SPIDER WORDS
BUT NOT GENERAL SPIDER WORDS

Anxiety, Stress, & Coping (Submitted)

Armfield J.M. (Candidate)
Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: ..............................
The core construct of the Cognitive Vulnerability Model is that of a cognitive schema. But, a schema cannot be seen or measured – it is a cognitive psychological construct used as a heuristic to describe the organisation or clumping of information and emotions in memory. It is a mistake to reify the concept. However, it has been argued that schema affect the processing and retrieval of information thereby giving rise to various cognitive biases and distortions. If these cognitive biases could be found they would, ipso facto, be an indication of the presence of a schema.

The present study, therefore, aimed to examine memory biases in the recall and recognition of spider-related words specifically addressing the themes of uncontrollability, unpredictability, danger and disgust. The identification of memory biases consistent with effects one might expect from a cognitive schema related to vulnerability perceptions would provide support for the central construct of the Cognitive Vulnerability Model.
Introduction to paper and additional information

While questionnaire and self-report studies capture vital information regarding the critical factors involved in anxiety syndromes, such studies are, ultimately, limited by the inherent subjectivity of participant responses. Additionally, these studies do not provide an understanding of the underlying cognitive mechanics of the fear response. Increasingly, therefore, the concepts and methods of experimental cognitive psychology have been employed to elucidate the information processing biases that may be involved in the maintenance, and perhaps etiology, of these disorders. It is believed that these methodologies provide a direct measure of the cognitive processing involved in emotional disorders (MacLeod, 1986).

There have been several lines of investigation of cognitive biases in anxiety disorders. The information-processing approaches can be classified as those concerning disturbances in interpretation, attention, and memory (McNally, 1996). These studies throw light on the existence of cognitive biases in anxiety disorders and provide a justification for using similar methods to delve deeper into the nature of cognitive biases in the area of specific fears. These are briefly described below.

Interpretive Bias

The interpretation of ambiguous stimuli has long been used as a means to indicate underlying thought processes. Individuals vulnerable to anxiety or fear may be expected to demonstrate a bias for interpreting ambiguous stimuli as anxiety-relevant (McNally, 1996). In an early study of interpretive bias, Butler and Mathews (1983) found that subjects with Generalised Anxiety Disorder (GAD), relative to control subjects, exhibit a bias towards the interpretation of ambiguous scenarios as potentially threatening. Other studies using high and low-anxious participants have obtained similar results. In comparison to non-anxious subjects, high trait anxious and clinically anxious subjects presented with a series of homophones (words that sound the same but have different meanings, e.g., pain and pane) are more likely to select the threat-relevant meaning (Eysenck, MacLeod, & Mathews, 1987; Mathews, Richards, & Eysenck, 1989). Similarly, when anxious individuals are presented with ambiguous sentences they are more likely, in contrast to
non-anxious controls, to interpret the sentences in a threatening manner than in a non-threatening fashion (Eysenck, Mogg, May, Richards, & Mathews, 1991; MacLeod & Cohen, 1993). People are also likely to interpret ambiguous images in line with their phobic beliefs (Kolassa et al., 2007)

Attentional Bias

The search for attentional biases in anxiety disorders has been a consistent locus of research. A number of cognitive theories propose, and research suggests, that anxiety and fear have an automatic, preconscious effect on attention, with attentional resources directed towards the anxiety eliciting stimulus. Studies have mostly used variations of three main procedures: dichotic listening tasks, Stroop colour-naming tasks, and visual attention tasks.

Dichotic Listening Tasks

In an early study, Burgess and his colleagues utilised a dichotic listening paradigm to examine attentional bias for threat-related information in agoraphobics, social phobics, and controls (Burgess, Jones, Robertson, Radcliffe, & Emerson, 1981). Participants were presented with a different prose passage to each ear and were required to shadow one passage (repeating it aloud) while ignoring the other. A button was required to be pushed whenever they detected either threat (e.g., shopping alone) or neutral words (e.g., pick) occurring out of context in either passage. Burgess et al. found that social phobic and agoraphobic participants, but not controls, detected more threat targets than neutral targets in the unattended prose passage. This finding implies the presence of an attentional bias for potentially threatening information.

A similar study by Foa and McNally (1986) investigated attentional bias in people with OCD both before and after exposure therapy. Again, participants were asked to indicate the detection of out-of-context threat or neutral targets in either attended or unattended prose passages. As well as detecting more threat than neutral targets, participants exhibited SCRs to a greater magnitude to the threat than neutral targets and this only occurred prior to behaviour therapy, not after.
In another dichotic listening study, Mathews and MacLeod (1986) found that clinically anxious individuals, in comparison to controls, responded more slowly to a visual probe presented at the same time as a threat word in the non-attended ear. In this study, as in others using dichotic listening procedures, it appears that attention was directed towards threat words even though participants may not have been consciously aware of the non-shadowed words (Mathews & MacLeod, 1986).

**Stroop Colour-Naming Tasks**

Although doubt has been cast on the validity of the Stroop paradigm as a test of attentional bias, numerous studies have adopted this approach to assessing the relationship between emotion and cognition. It is proposed that delays in colour naming anxiety-relevant compared to anxiety-irrelevant information reflects the automatic capturing of attention by the anxiety-relevant stimuli. Studies have consistently demonstrated Stroop interference for people with anxiety disorders including Social Phobia (Hope, Rapee, Heimberg, & Dombeck, 1990; Maidenberg, Chen, Craske, Bohn, & Bystritsky, 1996), PTSD (McNally, Kaspi, Riemann, & Zeitlin, 1990), OCD (Foa, Ilai, McCarthy, Shoyer, & Murdock, 1993), and Panic Disorder (de Ruiter & Brosschot, 1994; Ehlers, Margraf, Davies, & Roth, 1988; Maidenberg et al., 1996).

Numerous studies have used adaptations of the Stroop paradigm to investigate cognitive bias in Specific Phobia. Both pictorial Stroop tasks (Lavy & van den Hout, 1993; Martin & Jones, 1995) and linguistic Stroop tasks (Lavy, van den Hout, & Arntz, 1993; Martin, Horder, & Jones, 1992; Thorpe & Salkovskis, 1997) demonstrate that spider phobics are hindered in the naming of spider information relative to control information. Additionally, as shown by studies employing backwards-masking, conscious awareness of spider-related words is not required for the manifestation of processing bias (van den Hout, Tenney, Huygens, & De Jong, 1997).

Despite its widespread use, the Stroop paradigm has limitations in relation to the information it provides on attentional bias. Impairment in the speed of colour naming may be the result of threat cues capturing attention, emotional distress at the sight of the threat cue, or capacity consumption stemming from participants’ attempting to avoid processing of meaning (Mathews, 1990). Beyond these problems, other researchers contest that the modified Stroop task provides a poor test of attentional bias (Kahneman & Chajczyk,
1983; MacLeod & Mathews, 1991). Nonetheless, the results from the numerous studies employing the Stroop paradigm clearly indicate the presence of a processing bias, even if the source of this bias is unknown.

Visual Attention Tasks

Interference tasks indicate the presence of attentional bias when threat cues disrupt performance on a primary task. If threat cues do, in fact, capture attentional resources away from a given task, they should, conversely, aid performance on tasks involving attention shifts towards threat cues. One such task is the dot-probe attention deployment paradigm, which has been used with GAD patients (MacLeod, Mathews, & Tata, 1986), people with Social Phobia (Asmundson & Stein, 1994), and people with Panic Disorder (Asmundson, Sandler, Wilson, & Walker, 1992). Asmundson and Stein, for example, found that social phobics responded more rapidly to dot probes following social threat words than following neutral or physical threat words.

Summary

The preceding discussion provides examples of some of the numerous differences found in information processing between individuals with and without fears and phobias. They certainly provide a solid basis for the belief that cognitive biases exist in the anxiety disorders. However, there is another area of bias that has not been covered in the brief literature review above. This relates to memory biases in recall and recognition of words and is dealt with in the study that follows.

Interestingly, although this study actually found better recall and recognition for high-fear schema-relevant words among people with greater spider fear, there is an alternative argument that high-fear schema relevant words would be more memorable for low-fear participants whereas low-fear schema relevant words would be more memorable for high-fear participants. This phenomenon, termed the von Restorff or distinctiveness effect, is based on the theory that distinctive, incongruent or unexpected items lead to superior memory (Geraci & Rajaram, 2004; Hunt, 1995). Research suggests that the effect of distinctiveness is not straight-forward but is heavily influenced by encoding context (Hunt, 1995; Hunt & Smith, 1996; Smith & Hunt, 2000). A different viewpoint, however, holds that the advantage in recall attributed to distinctiveness is actually a consequence of
retrieval processes (McDaniel, Dornburg, & Guynn, 2005). In any event, whether encoding or retrieval processes underlie the distinctiveness effect, there is an apparent conflict with schema theory, which holds that schema congruent information is more likely to be recalled. From the literature it is known that the more ‘isolated’ an unusual word is, the more likely it is to be remembered (McDaniel, Einstein, DeLosh, May, & Brady, 1995; Waddill & McDaniel, 1998). In contrast, an unusual word presented in a list of other unusual words gains no significant recall advantage relative to usual items. In the current study, participants were presented with a mix of schema congruent and schema incongruent words. The extent of the distinctiveness effect is therefore difficult to glean from the study, although any effect would most likely work towards the null. Future research might therefore require an untangling of the various effects and a reconciliation of the distinctiveness effect with schema theory.
Abstract

Studies of explicit memory biases in relation to specific fears have provided inconsistent results. However, it is possible that words tapping perceived important stimulus characteristics may reveal memory biases where general stimulus or response related words have previously proven equivocal. This study involved both recall and recognition tests of three lists of words. Word lists related to: (1) babies; (2) spiders; and (3) spider characteristics related to uncontrollability, unpredictability, dangerousness and disgustingness. Self-rated spider fear was not significantly associated with recall or recognition of baby or spider related words. However, greater spider fear was significantly associated with better recall and recognition of high-fear schema relevant words even after controlling for a number of possible confounding variables. Results provide partial support for the hypothesis that spider fear is associated with a bias towards recall and recognition of spider related information salient to a person’s fear experience.
Introduction

Clinicians have long realised that people with anxiety disorders exhibit distorted cognitions. These observations have formed the basis of cognitive or information-processing accounts of anxiety disorders, with abnormal anxiety levels seen as a consequence of, or at least maintained by, dysfunctional thought patterns (e.g. Beck, 1976; Eysenck, 1997; Williams, Watts, MacLeod, & Mathews, 1997). Because the human information-processing system is generally assumed to be of circumscribed capacity, any predisposition for selectively allocating attention is proposed as being biased towards the ready detection of salient information (Beck & Emery, 1985).

Recent empirical work suggests that anxiety captures attention away from any given index task and towards the processing of threat-relevant information. The use of backward-masking (when a briefly presented visual target is followed shortly afterwards by a ‘mask’ that interrupts processing of the target) demonstrates a preconscious, automatic influence of threat-relevant material on attention (Bradley, Mogg, Millar, & White, 1995; Mogg, Bradley, Williams, & Mathews, 1993) although some studies have failed to find this preconscious processing effect (Thorpe & Salkovskis, 1997).

While memory biases have received considerable attention in relation to a number of anxiety disorders (Coles & Heimberg, 2002) relatively few studies have looked at memory recall or recognition for words relating to specific fears. These studies tend to use spiders as the fear-relevant stimulus and stem from an early study showing poor recognition memory for spider features (Watts, Trezise, & Sharrock, 1986). Watts and Dalgleish (1991) report results for two studies investigating recall and recognition biases. The first experiment used two word lists, one relating to spiders and one to babies. Subjects with spider fear (reported as “spider phobics”) were allocated to either an anxiety-provoking (exposure to a live spider) or relaxation group prior to list exposure. A delayed recall test (approximately 20 minutes after presentation) produced greater recall of baby than spider words. Semantic intrusions were almost 2.5 times more likely for spider than for baby words. For recognition, a significant effect was found, with more hits for spider words than for baby words. There are two points worth making in regards to this study. First, differences in recall were greatest for subjects who were exposed to a live spider either during word presentation or during recall. There was little difference between the
recall of spider and baby words for subjects not exposed to the live spider. Second, without the inclusion of a control group of subjects, and despite “roughly” equating word lists for frequency, differences in the intrinsic recallability of the word lists can not be ruled out as the reason for the differential recall of spider- and baby-related words.

The problems with the first experiment were rectified to some extent in a second study reported by the same authors by the inclusion of a control group (Watts & Dalgleish, 1991). Participants were allocated to an avoidance test, prior to list presentation, with either a live or a dead spider, and recall tests took place two minutes and two days post-presentation. Again, however, a main effect for word list was obtained, with baby words better recalled by all subjects than spider words. This finding indicates that enhanced recall of baby words was due to the greater recallability of these words. The only result which indicated diminished recall in the spider-fear group came from analyses confined to the live spider group \((n=16)\). Indeed, the opposite trend was found in analyses restricted to the dead spider condition and overall there was no difference in the differential recall of spider words and baby words across high and low fear groups. This is despite Watts and Dalgleish claiming that the critical finding of the study was the “significantly poorer recall of spider words in phobics than in controls”. Additionally, the obvious confound of state anxiety is not discussed in the context of interpreting the results of the experiments. Kulas, Conger and Smolin (2003), for example, have found that the emotional arousal resulting from recall of the word “spider” led to a detriment in recall for following words. Therefore, despite the conclusions reached by Watts and Dalgleish, these studies fail to show any convincing support for the proposition that spider fearful individuals show poor recall of spider related words.

The recall of elements, or critical idea units, from pieces of prose has been examined by Rusted & Dighton (1991). The idea units presented in this study related to both burglars and the presence of spiders, although neither burglars nor spiders were specifically mentioned in the text passage. Subjects with high spider fear had significantly greater recall of spider-related units and significantly poorer recall of burglar-related units, than did low spider-fear subjects. This finding supports the idea of enhanced recall of spider-related material for high spider-fear individuals.

Two other studies have shown conflicting results for memory biases in high spider-fearful people (Watts and Coyle, 1992, 1993). Both these studies used stimulus and response words in relation to spiders and again exposed subjects to a live spider prior to
list presentation. In the first study, high spider-fear subjects recalled significantly more spider words than baby words, and this difference was significantly greater than for control subjects (Watts & Coyle, 1992). The difference in recognition of spider and baby words across high and low fear groups was not significant. In the second study, Watts and Coyle (1993) omitted the control category of words (babies) and looked at differences in the recall of stimulus and response words across spider ‘phobic’ and control subjects. Spider fearful subjects showed poorer recall of both categories of words than controls, and this differential recall increased with increasing recall trials. Again, however, prior to encoding and recall tests, subjects were exposed for 1 minute to a live spider. The varying emotional sequelae of this exposure across fear groups again confounds the results, and offers an interpretation of differential recall based on the interference of state anxiety with memory recall.

The results of the studies reviewed above suggest that there may be a recall bias for spider-related words for spider fearful compared to non-fearful people. This bias is only evident when spider-fearful individuals are not experiencing significant anxiety. In addition, high spider-fear individuals appear to have greater semantic intrusion of non-presented spider-related words than do low spider-fear individuals. However, there is evidence which suggests that neither recall nor memory effects are found for phobic individuals when video stimuli are used (Thorpe & Salkovskis, 2000). Williams, Watts, MacLeod, and Mathews (1997) have put forward an influential process-specificity hypothesis which proposes that while people with depression have enhanced recall of negative stimuli, the main adaptive function of anxiety is to facilitate detection rather than memory of threatening stimuli. Their review of the literature leads them to propose that information processing biases in anxiety disorders relate to the processes involved in attention and interpretation, rather than memory, and that any bias in memory would be for implicit rather than explicit recall. It appears that both theory and scientific research into memory biases in people with specific fears are conflicting and more research is required to clarify these issues.

Other than the use of stimulus and response words by Watts and Coyle (1993), studies of recall and recognition biases in spider fear have tended to use general spider related words. It is possible, however, that memory tasks directed at the main elements of a person’s fear may be more likely to show cognitive biases. For instance, it can be argued that it is not spiders per se which are considered frightening but particular stimulus
characteristics of spiders. Armfield (2006) has proposed that perceptions of a given stimulus as uncontrollable, unpredictable, dangerous and disgusting form a vulnerability schema which is automatically elicited by exposure to that stimulus, and these stimulus perceptions are central to the determination of anxiety and fear. Although the conceptualisation of schemata is not uniformly presented, there is general agreement that a schema is an active knowledge structure in that it guides both attention and the encoding and retrieval of information (Rojahn & Pettigrew, 1992). If an automatic processing bias exists towards potentially threatening stimuli it may be that the extra anxiety exhibited by sufferers of anxiety disorders is related to an abnormal processing bias favouring the object, or characteristics of the object, which they fear. In addition, the range of fear demonstrated towards any one stimulus would be expected to be a consequence of a bias in the processing of vulnerability relevant information.

The current study aims to address some of the issues left unresolved by previous studies. In an effort to clarify the relationship between fear, recall, and recognition the current study will replicate previous research by investigating the differential recall and recognition of spider and baby-related words. Consistent with schema-theory and a number of studies investigating memory biases for anxiety-relevant information, it is predicted that greater fear of spiders will be associated with increased recall and recognition of spider-related words compared to baby-related words. Both spider stimulus and spider response words will be used. Watts and Coyle (1992) have differentiated between the possibly discrepant memorability of these two groups of words based on Lang’s (1984, 1985) discussion of the “emotion prototype”. Watts and Coyle (1993) have previously found that subjects with high-spider fear have relatively poor recall of words relating to the anxiety response in comparison to words pertaining to stimulus features of spiders.

A central tenet of the Cognitive Vulnerability Model (Armfield, 2006) is that the core determinants of fear are certain perceptions of a stimulus and these perceptions comprise an automatically elicited fear-relevant schema. Therefore, the primary aim of the current study is to examine recall and recognition biases in words related to perceptions of control, predictability, danger, and disgust. It is predicted that subjects with higher spider fear will exhibit a memory bias for schema-relevant spider perceptions and, within subjects, for schema-congruent compared to schema incongruent perceptions.
There are a number of specific hypotheses driving this study: (1) subjects with greater fear of spiders will have significantly better recall and recognition of spider-related words than will subjects with low spider fear; (2) there will be a significant interaction between fear of spiders and word list (spider-related/baby-related) for both recall and recognition memory with the difference in recall and recognition of spider-related versus baby words being significantly greater for high fear than for low fear subjects; (3) high spider-fear people compared to low spider-fear individuals, will recall and recognise significantly more schema-relevant words than baby words; (4) people with high spider fear compared to people with low spider fear will recall and recognise schema-congruent words significantly better than schema incongruent words.

Method

Participants

Subjects were obtained via an online psychological research portal (http://www.hanover.edu/about.htm) maintained by the Hanover College, Indiana USA. Recruitment occurred between 2000 and 2002. Although there are issues with experimental control and sampling of participants when using the Internet to sample subjects, research that compares Internet-based and laboratory-based results have shown a good convergence between the two methods (Krantz & Dalal, 2000) and some comparisons show that Internet-based data are of higher quality than laboratory-based data (Birnbaum, 1999). No attempt was made to select for differing fear levels as previous research has indicated a broad spread of spider fear in the general population. Additionally, there was a desire to examine the extent of memory bias in individuals with moderate levels of fear, these people often being excluded in previous research.
Materials

Recall Lists

Three primary word lists of 20 words each were created for the recall tests, and were thematically grouped by vulnerability schema relevance, baby perception, and spider perception (for all word lists, see Appendix). The spider related words were adapted from previous studies (Watts & Coyle, 1992; Watts & Dalgleish, 1991) and pertained to spider stimulus characteristics and negative-affect reactions to spiders. Examples of the spider stimulus words are bulbous, web, and patterned while example response words are shout, terrified, and panic. Spider-related words were selected so as to not overlap with words in the other lists.

The baby perception words were chose to be a suitable semantically grouped control word list. Baby words were used as there was no reason to expect a relationship between perceptions of spiders and those of babies, and other studies have also used baby words (Watts & Coyle, 1992; Watts & Dalgleish, 1991). The specific words were generated for the purpose of this study and examples are horrible, charming, disruptive, and huggable. In order to match the baby and spider related lists, half the words in the baby list had a positive valence and half a negative valence. It was expected that perceived congruity and incongruity would be comparable across baby and spider perception lists.

The vulnerability schema relevant word list contained four words each relating to control, predictability, danger, and disgust. An additional four filler words were included in this list. For each schema dimension, two words from each pole of the dimension were included (eg. handsome⎯grotesque and fascinating⎯repulsive). For high and low spider-fear participants this resulted in eight schema-congruent and eight schema-incongruent words occurring in the spider perception list. The direct polar opposites (eg. controllable⎯uncontrollable) were not included in the word list as this would have created methodological problems with subsequent recall and recognition testing. To control for order effects, the list was presented in three different sequences. To control for primacy and recency effects known to affect recall tasks, the three list sequences were constructed so that each word (to the extent possible) appeared in the first six words, the list six words, and the middle group of words. Eighteen of the 20 words appeared once in
either the first or last three words in one of the three list orders (the other two words each
appeared once in the forth position in one of the list orders).

The sequence of the words in the spider list, the baby list, and order 1 of both
spider schema-relevant lists was randomised. Additionally, the three lists were matched on
word usage frequency using the British National Corpus (BNC). The BNC is a 100 million
word collection of samples of written and spoken language from 4124 sources
representing a wide cross-section of current British English. The mean frequencies of the
word lists ranged from 571.60 to 575.60 and these were not significantly different, \( F(3,76) = 0.000, p = 1 \). An effort was also made to as nearly as possible match the
distribution of word frequencies within lists. The standard deviations for the word lists
ranged from 575.55 to 632.94.

**Recognition Lists**

For each word list a pool of words was develop
ed to serve as fillers for the
recognition tests. For all lists three matched fillers were used for each word. The fillers for
each of the spider-related words were all synonyms (e.g. terrified, scared, afraid, and
petrified) whereas for the baby and spider perception words the fillers comprised two
antonyms and one synonym such that each recognition question consisted of two words
representing both poles of a dimension (e.g., charming, delightful—obnoxious,
repugnant). The order of recognition questions for all lists was randomised as was the
position of each of the four words within each recognition question.

**Self-Report Measures**

All subjects completed a number of self-report measures. These included a
shortened version of the S-Anxiety scale of the State-Trait Anxiety Inventory (Form Y;
Spielberger, 1983), the Spider Fear Index (SFI), and the Beck Depression Inventory - II
(BDI-II; Beck, Steer, & Brown, 1996).

The shortened version of the State-Trait Anxiety Inventory (STAI) comprises the 10
odd-numbered items from the State scale and has been used previously in research on
memory bias (McNally, Foa, & Donnell, 1989; Smith, Ingram, & Brehm, 1983). The 10
items related to current feelings and were included as previous studies indicate an effect
for state anxiety on memory. Possible responses to descriptors of current mood (e.g., “I am tense”) were ‘Not at all’, ‘Somewhat’, ‘Moderately so’, and ‘Very much so’.

The Spider Fear Index (SFI) consisted of nine items, each measured on a 7-point Likert scale, relating to several dimensions of spider fear. Fear dimensions measured were global subjective fear, avoidance, vigilance and preoccupation, physiological reactivity, and the phobic characteristics of functional interference and psychological distress. An example item is “To what extent are you on the lookout for spiders?” with possible responses ranging from ‘Never’ to ‘Always’. The SFI was developed from a questionnaire by Armfield & Mattiske (1996) and uses a weighted combination of items so that each dimension contributes equally to the final SFI score. Subscales corresponding to each dimension are also calculated. Responses on the SFI were categorised as either ‘low fear’, ‘medium fear’ or ‘high fear’ so that 3 groups of approximately equal size were obtained.

The BDI-II is a 21 item measure of depression. The BDI-II is highly correlated with the earlier version of this inventory (Beck Depression Inventory -IA), although it is not directly comparable. In developing the BDI-II, four items were dropped from the scale and four new items added. Other changes are documented by Beck, Steer, and Brown (1996). Responses are made on a 4-point scale ranging from an indication of a complete lack of each depressive symptom to an indication of a significant experience of each symptom.

Procedure

All participants were informed of their rights before commencing the experiment. The subjects were initially given an introduction to the experiment and were led through some of the procedures required for them to successfully navigate through the computer program. This interactive introduction was also used to obtain information on gender, age, and any possible anxiety about participating in the experiment (“How concerned are you about participating in this experiment?” with responses ranging from ‘Not at all concerned’ to ‘Very concerned’ on a 7-point Likert scale). As with a number of other sections of the experiment, the participants were required to mouse click on a button to submit this information before moving on to the next section of the experiment. Submission occurred via e-mail to the experimenter.

The experiment proper consisted of three recall sequences and three recognition tests, separated by the completion of several self-report measures. Prior to the first recall
sequence, participants completed the shortened version of the STAI-S and a short practice recall test of six colour names. For each subsequent recall task an initial introduction explaining the task was given. A picture of a spider (Sydney funnel-web) was presented beside the text for both spider lists and a picture of a baby beside the introductory text for the baby list. Pictures were presented in order to increase the schema priming for each word list. The participants were required to press a button when they were ready for word presentation to commence.

Each recall sequence involved word presentation, a short distracter task, and the recall test itself. Words for all lists were presented at a rate of one every 3.0 seconds. Immediately following presentation of the last word of each list, the participants performed a 40 second distraction task which involved the completion of a series of progressively harder mathematical questions. The distracter task was included to prevent possible active rehearsal of the word list. Participants were then required to proceed to the recall test where they were asked to recall as many words as possible from the list just presented. Participants had a maximum of 5 minutes for the recall task and were provided with a countdown (in seconds) of time remaining. A time limit was set on the recall test to prevent subjects from taking excessively long to complete the task and so that time-to-recognition-tests could be controlled. It was anticipated that most subjects would finish the test within the maximum limit. If the limit was reached a message was displayed instructing participants to move on to the next task.

After completing the three recall sequences as described above, participants completed the SFI and the BDI-II. Upon responding to each question a check was performed of the previous question and if it had been missed, participants were informed of the number of the question and urged to complete it before proceeding. The self-report measures were included at this juncture to produce a suitable delay to the recognition tests.

After finishing the BDI-II, the participants proceeded to the first unforshadowed recognition test. The order of recognition tests corresponded to the order of presentation of word lists. For each test, participants were told to try and remember as many of the words as they could from the lists previously presented. Again, a maximum of 5 minutes was provided to complete the task. If subjects reached the time limit they were instructed to proceed to the next section of the experiment. The three recognition tests were presented in parallel fashion, one after the other.
Following the final recognition test, participants were given the opportunity to comment on the experiment. All participants were provided with a feedback sheet (if desired) containing a summary of the aims and method of the study.

**Results**

Data were obtained on 234 people. Almost 70% of participants were female, with 25.2% male and 5.6% not providing information on their gender. In regards to age, 34.2% were aged 20 years or younger, 36.7% were aged between 21 and 30, 12.0% were aged between 31 and 40 and 11.1% were older than 40 years of age. Information on nationality of participants was not collected. On average, the experiment took 20 minutes 12 seconds to complete.

The Spider Fear Index was recoded into three categories based on an approximate tertile split. Categories were ‘low fear’ (<2.30), ‘medium fear’ (2.31–4.00) and ‘high fear’ (>4.00). There were 78, 79, and 77 participants in each group, respectively. Scores on the SFI ranged from 1–6.7, with a mean of 3.30 (SD = 1.45). Although the age distribution of participants did not differ by spider fear, there was a significant effect for gender with increasing percentages of female respondents in higher spider fear groups (Table P6.1).

There was a moderate level of concern over performing the task (mean = 2.46, SD = 1.69), and this was higher among more spider fearful people (Table P6.2). The STAI-S and BDI were also significantly associated with spider fear. The mean spider fear across SFI categories was 1.69, 3.20 and 5.02. All SFI subscales were significantly associated with spider fear, with avoidance of spiders being the most commonly endorsed and phobic components of spider fear (significant interference with an aspect of social functioning or causing significant distress) being the least commonly endorsed. The SFI was significantly positively correlated with task-related concern, r(219) = .24, p < .001, the STAI-S, r(233) = .18, p = .006, and the BDI, r(233) = .24, p < .001. There was no significant correlation between spider fear and the number of practice words recalled.
Table P6.1
Age and sex characteristics by spider fear.

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<td>31-40</td>
<td>12</td>
<td>16.0</td>
<td>8</td>
<td>11.1</td>
<td>8</td>
<td>11.0</td>
<td>28</td>
<td>12.7</td>
</tr>
<tr>
<td>41-50</td>
<td>12</td>
<td>16.0</td>
<td>8</td>
<td>11.1</td>
<td>1</td>
<td>1.4</td>
<td>21</td>
<td>9.5</td>
</tr>
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<td>51+</td>
<td>2</td>
<td>2.7</td>
<td>2</td>
<td>2.8</td>
<td>1</td>
<td>1.4</td>
<td>5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Chi-square: * p < .001

Table P6.2
Task-related concern, state anxiety, depression and spider fear across spider fear groups.

<table>
<thead>
<tr>
<th></th>
<th>Low fear</th>
<th></th>
<th>Medium fear</th>
<th></th>
<th>High fear</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Concern*</td>
<td>1.89</td>
<td>1.39</td>
<td>2.61</td>
<td>1.64</td>
<td>2.89</td>
<td>1.88</td>
<td>2.46</td>
<td>1.69</td>
</tr>
<tr>
<td>STAI-S*</td>
<td>1.72</td>
<td>0.57</td>
<td>1.78</td>
<td>0.54</td>
<td>2.01</td>
<td>0.61</td>
<td>1.84</td>
<td>0.59</td>
</tr>
<tr>
<td>BDI**</td>
<td>1.47</td>
<td>0.46</td>
<td>1.47</td>
<td>0.41</td>
<td>1.73</td>
<td>0.48</td>
<td>1.56</td>
<td>0.47</td>
</tr>
<tr>
<td>SFI**</td>
<td>1.69</td>
<td>0.36</td>
<td>3.20</td>
<td>0.45</td>
<td>5.02</td>
<td>0.67</td>
<td>3.30</td>
<td>1.45</td>
</tr>
<tr>
<td>SFI – Subj. **</td>
<td>2.23</td>
<td>0.88</td>
<td>4.10</td>
<td>1.03</td>
<td>5.95</td>
<td>0.86</td>
<td>4.09</td>
<td>1.78</td>
</tr>
<tr>
<td>SFI – Avoid. **</td>
<td>2.28</td>
<td>0.96</td>
<td>4.76</td>
<td>1.05</td>
<td>6.45</td>
<td>0.63</td>
<td>4.49</td>
<td>1.93</td>
</tr>
<tr>
<td>SFI – Phys. **</td>
<td>1.50</td>
<td>0.70</td>
<td>3.46</td>
<td>1.37</td>
<td>6.05</td>
<td>1.96</td>
<td>3.66</td>
<td>2.35</td>
</tr>
<tr>
<td>SFI – Pre/Vig**</td>
<td>1.41</td>
<td>0.53</td>
<td>2.33</td>
<td>0.82</td>
<td>4.02</td>
<td>1.24</td>
<td>2.58</td>
<td>1.41</td>
</tr>
<tr>
<td>SFI – Phobia**</td>
<td>1.01</td>
<td>0.06</td>
<td>1.37</td>
<td>0.58</td>
<td>2.65</td>
<td>1.35</td>
<td>1.67</td>
<td>1.10</td>
</tr>
</tbody>
</table>

ANOVA: * p < .01, ** p < .001
Recall memory

The mean number of words recalled correctly was calculated for each word list and for each spider fear group (Figure P6.1). Overall, 46.4% of spider words, 36.4% of baby words, and 32.1% of schema-related words were correctly recalled. Associations between number of words correctly recalled and spider fear were tested using General Linear Modelling. There was a significant association between spider fear and recall of schema-relevant words, $F(2,231) = 6.42, p = .002$. Post-hoc analyses using Scheffe’s pairwise comparisons revealed significant differences in mean word recall between the low fear and medium fear groups ($p = 0.038$) and between the low fear and high fear groups ($p = .003$). However, there was no statistically significant association between spider fear and either recall of spider-related words, $F(2, 231) = 2.75, p = .066$, or recall of baby-related words, $F(2, 231) = 1.11, p = .330$.

![Figure P6.1. Mean (and standard error) of schema-relevant, spider and baby words recalled by spider fear](image-url)
To test for an interaction between spider fear and recall of spider compared to baby words and schema compared to baby words, the number of relevant words correctly recalled for each list was converted into the percentage of words correctly recalled. This was done because there were only 16 schema-relevant words compared to 20 baby-relevant and spider-relevant words. A one-way analysis of variance (ANOVA) was used to compare the difference in recall of word lists across each level of spider fear. There was no statistically significant difference in recall of either spider compared to baby words, or schema compared to baby words, within each fear group.

Each word list was comprised of two types of words. Based on the Cognitive Vulnerability Model, the vulnerability schema relevant list contained high-fear schema relevant words and low-fear schema relevant words, while the general spider related list contained response and stimulus words and the baby related list contained words of either positive or negative valence. Differences in recall of these word types are shown in Table P6.3. The only significant difference in word recall across all word types was for high-fear schema-relevant words, $F(2,231) = 7.45, p = .001$, with mean recall being 2.10 for low fear individuals, 2.70 for medium fear individuals and 2.94 for people with high spider fear.

Scheffe’s post-hoc comparisons indicated a significant difference between the low and medium fear groups ($p = .029$) and between the low and high fear groups ($p = .001$). Low-fear schema relevant words were better recalled by people with low spider fear, while high-fear schema relevant words were better recalled by people with high spider fear. However, a one-way ANOVA revealed no statistically significant interaction effect between word recall and spider fear, $F(2,231) = .80, p = .453$. While high-fear schema relevant words were not recalled better overall than low-fear schema relevant words, spider relevant stimulus words were better recalled than response words, $t(233) = 23.73, p < .001$ and negative baby relevant words were better recalled than positive baby relevant words, $t(233) = -7.92, p < .001$. 


Table P6.3

Mean (and standard error) of recalled words by spider fear

<table>
<thead>
<tr>
<th></th>
<th>Low fear</th>
<th>Medium fear</th>
<th>High fear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>%</td>
</tr>
<tr>
<td>Schema-relevant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-fear schema</td>
<td>2.10</td>
<td>0.14</td>
<td>26.3</td>
</tr>
<tr>
<td>Low-fear schema</td>
<td>2.40</td>
<td>0.16</td>
<td>30.0</td>
</tr>
<tr>
<td>Spider-relevant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response words</td>
<td>2.85</td>
<td>0.18</td>
<td>28.5</td>
</tr>
<tr>
<td>Stimulus words</td>
<td>6.27</td>
<td>0.22</td>
<td>62.7</td>
</tr>
<tr>
<td>Baby-relevant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive valence</td>
<td>3.01</td>
<td>0.19</td>
<td>30.1</td>
</tr>
<tr>
<td>Negative valence</td>
<td>3.97</td>
<td>0.18</td>
<td>39.7</td>
</tr>
</tbody>
</table>

Note: Superscripts indicate significant pairwise differences using Scheffe’s comparisons.

Multivariate linear regression was used to test for the linear association between spider fear and schema relevant word recall after controlling for the possible confounders of age, gender, word list order, state anxiety, depression and the number of baby-related words recalled. Word list order was used because significant associations were evident between the number of words recalled and the temporal sequence of word list presentation. The number of positive valence baby words recalled was used as a proxy for differences between individuals in general recall ability, and was used because it had the poorest association with spider fear. Table P6.4 presents hierarchical linear regression models with schema-relevant words, high-fear schema-relevant words and low-fear schema-relevant words as the DV. Possible confounders are entered at Step 1 and the continuous SFI measure at Step 2. After controlling for age, sex, word list order, STAI, BDI and the number of positive valence baby-related words recalled, spider fear had a statistically significant effect on schema-relevant word recall. Similarly, the association between spider fear and recall of high-fear schema-relevant words was significant after controlling for the various other variables. However, no significant association was found between spider fear and low-fear schema relevant word recall.
### Table P6.4

Linear regression models for schema relevant recall, high-fear schema-relevant recall, and low-fear schema-relevant recall

<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficients</th>
<th>Model change statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
</tr>
<tr>
<td>Model 1 – Schema-relevant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>Age</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Word list order</td>
<td>-0.28</td>
</tr>
<tr>
<td></td>
<td>STAI</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>BDI</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>Baby words (pos.) recalled</td>
<td>0.31</td>
</tr>
<tr>
<td>Step 2</td>
<td>SFI</td>
<td>0.23</td>
</tr>
<tr>
<td>Model 2 – High-fear schema-relevant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>Age</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Word list order</td>
<td>-0.27</td>
</tr>
<tr>
<td></td>
<td>STAI</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>BDI</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Baby words (pos.) recalled</td>
<td>0.14</td>
</tr>
<tr>
<td>Step 2</td>
<td>SFI</td>
<td>0.18</td>
</tr>
<tr>
<td>Model 3 – Low-fear schema-relevant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>Age</td>
<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Word list order</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>STAI</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>BDI</td>
<td>-0.19</td>
</tr>
<tr>
<td></td>
<td>Baby words (pos.) recalled</td>
<td>0.17</td>
</tr>
<tr>
<td>Step 2</td>
<td>SFI</td>
<td>0.05</td>
</tr>
</tbody>
</table>

292
Recognition memory

Results for the recognition tasks by spider fear are presented in Figure P6.2. As with word recall, spider related words were recognised best, while the least number of words correctly recognised being for schema-relevant words. After controlling for the number of relevant words present in each list (16 for schema-related words and 20 each for spider and baby lists), 77.8% of spider words, 77.5% of schema related words, and 70.8% of baby words were correctly recognised. For all word lists high fear people recognised more words correctly than low fear or medium fear people. The statistical significance of these differences was tested using general linear modelling. However, none of the associations were statistically significant and Scheffe’s post-hoc multiple comparisons revealed no significant pairwise effects.

Figure P6.2. Mean (and standard error) of schema-relevant, spider and baby words recognised by spider fear
To test for the hypothesised interaction between spider fear and recognition of spider compared to baby words and schema compared to baby words, the number of relevant words correctly recognised for each list was converted into the percentage of words correctly recognised. A one-way analysis of variance (ANOVA) was again used to compare the difference in percentage recognition of words from the different lists across each level of spider fear. There was no statistically significant difference in recognition of either spider compared to baby words, or schema compared to baby words, across fear groups although all differences were in the anticipated direction.

A further series of analyses were conducted to test for differences in recognition memory for high-fear schema relevant versus low-fear schema relevant words as well as for differences in recognition of response versus stimulus spider related words and positive compared to negative valence baby related words (Table P6.5). As with the recall task, recognition memory for high-fear schema relevant words was significantly associated with spider fear, \( F(2,224) = 4.03, \ p = .019 \). None of the other word types, however, exhibited statistically significant associations with spider fear. Using paired sample t-tests, high-fear schema relevant words were recognised better overall than low-fear schema relevant words, \( t(226) = 9.33, \ p < .001 \), spider relevant stimulus words were better recognised than response words, \( t(217) = 27.60, \ p < .001 \), and negative baby relevant words were recognised better than positive baby relevant words, \( t(226) = -12.20, \ p < .001 \). There was no statistically significant interaction between recognition of high and low-fear schema relevant words and spider fear.
Table P6.5

Mean (and standard error) of recognition words by spider fear

<table>
<thead>
<tr>
<th></th>
<th>Low fear</th>
<th></th>
<th>Medium fear</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>%</td>
<td>Mean</td>
<td>SE</td>
<td>%</td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>Schema-relevant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-fear schema</td>
<td>5.01</td>
<td>0.22</td>
<td>62.6</td>
<td>5.21</td>
<td>0.24</td>
<td>65.1</td>
<td>5.86</td>
<td>0.20</td>
</tr>
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<td>Low-fear schema</td>
<td>4.04</td>
<td>0.22</td>
<td>50.5</td>
<td>3.84</td>
<td>0.21</td>
<td>48.0</td>
<td>4.25</td>
<td>0.21</td>
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<tr>
<td>Spider-relevant</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response words</td>
<td>6.01</td>
<td>0.22</td>
<td>60.1</td>
<td>6.03</td>
<td>0.23</td>
<td>60.3</td>
<td>6.45</td>
<td>0.19</td>
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<tr>
<td>Stimulus words</td>
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<td>92.0</td>
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<td>0.21</td>
<td>93.8</td>
<td>9.59</td>
<td>0.18</td>
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<tr>
<td>Baby-relevant</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Positive valence</td>
<td>6.07</td>
<td>0.22</td>
<td>60.7</td>
<td>6.33</td>
<td>0.23</td>
<td>63.3</td>
<td>6.21</td>
<td>0.21</td>
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<td>Negative valence</td>
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<td>7.89</td>
<td>0.26</td>
<td>78.9</td>
<td>8.07</td>
<td>0.25</td>
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</table>

To control for possible confounding, a series of hierarchical multiple linear regression models were again calculated to test the association between spider fear and vulnerability schema relevant recognition, high-fear schema-relevant recognition and low-fear schema-relevant recognition controlling for age, sex, word list order, STAI, BDI and the number of positive baby words correctly recognised. Results are presented in Table P6.6. After controlling for the other variables the positive association between spider fear and number of high-fear schema-relevant words correctly recognised remained statistically significant, \( F (1,198) = 4.25, p = .041 \). However, spider fear was not significantly associated either with low-fear schema-relevant words or with recognition of all schema-relevant words.
Table P6.6

Linear regression models for schema relevant recognition, high-fear schema-relevant recognition, and low-fear schema-relevant recognition

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Model change statistics</th>
</tr>
</thead>
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<td>$\beta$</td>
<td>$t$</td>
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<td><strong>Model 1 – Schema-relevant</strong></td>
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</tr>
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<td><strong>Step 1</strong></td>
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<tr>
<td>BDI</td>
<td>0.70</td>
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<td>Baby words (pos.) recognised</td>
<td>0.64</td>
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<td><strong>Step 2</strong></td>
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<td><strong>Model 2 – High-fear schema-relevant</strong></td>
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<tr>
<td>Word list order</td>
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<td>-0.36</td>
</tr>
<tr>
<td>BDI</td>
<td>0.66</td>
</tr>
<tr>
<td>Baby words (pos.) recognised</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>0.136</td>
</tr>
<tr>
<td>SFI</td>
<td>0.18</td>
</tr>
<tr>
<td><strong>Model 3 – Low-fear schema-relevant</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td>0.069</td>
</tr>
<tr>
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<tr>
<td>Sex</td>
<td>-0.24</td>
</tr>
<tr>
<td>Word list order</td>
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<tr>
<td>STAI</td>
<td>0.03</td>
</tr>
<tr>
<td>BDI</td>
<td>0.01</td>
</tr>
<tr>
<td>Baby words (pos.) recognised</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>0.070</td>
</tr>
<tr>
<td>SFI</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Discussion

The results of the experiment reported here provide mixed evidence that people display spider fear related to spiders being uncontrollable, unpredictable, dangerous and disgusting. Enhanced memory was found for high-fear schema relevant words and this was significant after controlling for age, sex, state anxiety, depression and other possible confounders. No biases in recall or recognition memory were found in relation to low-fear schema relevant words; that is, words related to spiders being controllable, predictable, harmless and non-disgusting.

The study also found differences in recall and recognition across word lists, with better memory for spider related words relative to the other word lists. Baby related words were recalled more often than spider schema related words but schema related words were recognised better than baby related words. Although these differences may reflect memory biases relating to the word list subject matter, they may also be accounted for by differences between the lists. One of the most obvious differences between the word lists is that they are comprised of differing percentages of adjectives, nouns, and verbs. In particular, the schema relevant word list was comprised primarily of adjectives whereas the spider list was comprised of nouns and verbs. Research into the ‘concreteness effect’ suggests that concrete nouns may be more readily recalled than adjectives. Certainly, concrete nouns are better recalled than abstract nouns (Hamilton & Rajaram, 2001) and this fits in with Paivio’s (1971, 1991) dual-code hypothesis which essential posits greater depth of processing for concrete (activating both verbal and imaginal codes) than for abstract nouns (activating only the verbal code). We might therefore expect differing memorability of nouns and adjectives which might explain some of the difference in recall and recognition of the word lists.

Another difference between the lists was the average word length, which was 9.25 letters for schema-relevant words, 8.25 letters for baby words, and 6.25 letters for spider words. Serial recall of lists of long words is poorer than the recall of lists of short words (Baddeley, Thomson, & Buchanan, 1975). It should be pointed out, however, that the primary aim of the current study was not to look at differences in recall between lists but to examine differences in recall of each list by spider fear. In this respect, and given
inherent differences between the word lists, the differential memorability of word lists is tangential to the main aim of this study.

The study found significantly better recall and recognition for high-fear schema relevant words among people with higher spider fear than among people with less fear, even after controlling for a number of potentially confounding variables. Surprisingly, however, no effect was found for recall of low-fear schema relevant words. It might have been expected that individuals with low spider fear would have had better recall for low-fear schema relevant words. In fact, this study found the opposite effect, although this was not statistically significant. It is an interesting question as to why low-fear individuals did not demonstrate better recall and recognition of low-fear schema relevant words in the same way high-fear individuals showed improved recall and recognition of high-fear schema relevant words. Indeed, the results would indicate that there was no pervasive schema relevant recall effect but, rather, a bias in memory processes skewed towards increasingly more spider fearful individuals.

A relevant consideration when interpreting the study’s outcomes are differences in recall by fear within word lists. Of particular note is the relationship between anxiety and cognitive performance in recall and recognition tasks. A great deal of research on emotion and memory has focused on the question of whether emotion enhances memory. It was clear in this study that people with high spider fear both recalled and recognised more words correctly from each of the word lists than did individuals with low spider fear, although these differences were not always statistically significant. However, the relevant literature on this issue is often conflicting. Investigators have variously claimed that emotional memories are indelible; that emotion has no special effects on memory at all; and that emotion leads to enhanced memory for either congruent or central information (Levine & Pizarro, 2004). The effect of emotional arousal on memory depends on such factors as the level of anxiety aroused, the task difficulty, cognitive effort expended, and other background variables (Watts & Coyle, 1992). It should be noted, however, that although both self-rated task anxiety and state anxiety were both significantly associated with spider fear, these variables were statistically controlled for in the multivariate analyses, with the associations between spider fear and both recall and recognition of high-fear schema relevant words remaining statistically significant.

One potential issue with the current study concerns the possible counter-argument that high-fear schema relevant words might actually be more memorable for low-fear
participants whereas low-fear schema relevant words may be more memorable for high-fear participants. This phenomenon, termed the von Restorff or distinctiveness effect, is based on the theory that distinctive, incongruent or unexpected items lead to superior memory (Geraci & Rajaram, 2004; Hunt, 1995). Research suggests that the effect of distinctiveness is not straightforward but is heavily influenced by encoding context (Hunt, 1995; Hunt & Smith, 1996; Smith & Hunt, 2000). A different viewpoint, however, holds that the advantage in recall attributed to distinctiveness is actually a consequence of retrieval processes (McDaniel, Dornburg, & Guynn, 2005). In any event, whether encoding or retrieval processes underlie the distinctiveness effect, there is an apparent conflict with schema theory, which holds that schema congruent information is more likely to be recalled. From the literature it is known that the more ‘isolated’ an unusual word is, the more likely it is to be remembered (McDaniel, Einstein, DeLosh, May, & Brady, 1995; Waddill & McDaniel, 1998). In contrast, an unusual word presented in a list of other unusual words gains no significant recall advantage relative to usual items. In the current study, participants were presented with a mix of schema congruent and schema incongruent words. The extent of the distinctiveness effect is therefore difficult to glean from the study, although any effect would most likely work towards the null. Future research might therefore require an untangling of the various effects and a reconciliation of the distinctiveness effect with schema theory.

A limitation of this study is that it was difficult to determine the representativeness of the study population. Although Internet-based research has been found to be effective in the past (Krantz & Dalal, 2000), the inability to maintain control over the recruitment of participants potentially compromises both study reliability and validity. For example, it is not possible to isolate participants from distractions. Although checks of the time taken for each subject to complete the various phases of the study revealed none which were excessive or indicative of any subjects having taken breaks, there is no way of guaranteeing that subjects were entirely focused on the task during their participation. In terms of validity, given that subjects were a self-selected population it may be that spider fearful subjects were more motivated and more interested in the study than low fear subjects. This might even explain the difference in recall and recognition across spider fear groups and if so would threaten the validity of these results.

Despite the various limitations of the study, the results provide some support for the Cognitive Vulnerability Model of the etiology of fear, which proposes that a cognitive
schema pertaining to perceptions of uncontrollability, unpredictability, dangerousness and disgustingness underlies specific fears such as spider fear. The enhanced recall and recognition of high-fear schema congruent words found in this study is consistent with schema theory. Beck and Emery argue that schemata are experience-based rules which orient the individual to select relevant details from the environment and recall relevant data (Beck & Emery, 1985). It is noteworthy, that while no statistically significant difference was found across fear groups in recall or recognition of general spider related words, an effect was found for high spider fear schema relevant words. The results support the contention that spider fearful individuals may not be biased towards spider information per se but to stimulus characteristics most salient to their fear experience.
References


### Appendix

<table>
<thead>
<tr>
<th>Spider list words</th>
<th>Baby list words</th>
<th>Schema list words</th>
</tr>
</thead>
<tbody>
<tr>
<td>insect</td>
<td>enjoyable</td>
<td>lazy</td>
</tr>
<tr>
<td>jump</td>
<td>horrible</td>
<td>controllable</td>
</tr>
<tr>
<td>alarm</td>
<td>worthless</td>
<td>unsafe</td>
</tr>
<tr>
<td>patterned</td>
<td>soothing</td>
<td>repulsive</td>
</tr>
<tr>
<td>unwanted</td>
<td>calm</td>
<td>usable</td>
</tr>
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<td>terrified</td>
<td>charming</td>
<td>unmanageable</td>
</tr>
<tr>
<td>bulbous</td>
<td>frustrating</td>
<td>expected</td>
</tr>
<tr>
<td>web</td>
<td>fulfilling</td>
<td>harmless</td>
</tr>
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<td>reliable</td>
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<td>crying</td>
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<td>horror</td>
<td>disruptive</td>
<td>handsome</td>
</tr>
<tr>
<td>squashy</td>
<td>enchanting</td>
<td>drab</td>
</tr>
<tr>
<td>panic</td>
<td>boring</td>
<td>sluggish</td>
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<tr>
<td>thorax</td>
<td>refreshing</td>
<td>non-hazardous</td>
</tr>
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<td>scream</td>
<td>infuriating</td>
<td>diseased</td>
</tr>
<tr>
<td>discouraging</td>
<td>satisfying</td>
<td>unpredictable</td>
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<td>spin</td>
<td>needy</td>
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</tr>
<tr>
<td>shake</td>
<td>stupid</td>
<td>poisonous</td>
</tr>
<tr>
<td>fangs</td>
<td>defiant</td>
<td>appealing</td>
</tr>
<tr>
<td>sinister</td>
<td>huggable</td>
<td>smart</td>
</tr>
</tbody>
</table>
PART THREE
While fear of spiders serves as a prototypical animal fear it lacks complexities which characterise some other fears which fit under the rubric of specific fears. A good example of a more socially complex fear is in relation to visiting a dentist. Concomitant with dental fears are immediate consequences in terms of a person’s oral health and more distal consequences in terms of social functioning. While fear of spiders or dogs or lightning is unlikely to bring about actual harm to a person, fear of going to the dentist might result in significant pain and suffering due to untreated dental disease. Figure 10 presents a model showing how dental fear may act as a barrier to both the intention to obtain dental treatment and then also to the receipt of dental treatment.

And yet, there are still large gaps when it comes to understanding dental fear. Limited or conflicting information exists on such issues as prevalence and demographic correlates, let alone the etiological factors responsible for dental fear. It is still common in dentistry, where negative personal experiences with dentists are rife or at least considered
common, to attribute dental fear to an understandable reaction to a previous negative experience. Smyth (1999) reports on patients with dental fear who had previously undergone traumatic dental extractions, suffered through painful and protracted surgery or who were highly fearful of being hurt by needle penetration. Understanding the aversive experiences is generally believed to be akin to uncovering the causal factors of the fear.

The Cognitive Vulnerability Model is as applicable to dental fear as it is to other specific fears. Fear is a determinant of how dental visits are perceived, and the more they are perceived as uncontrollable, unpredictable, dangerous and disgusting the greater the anxious anticipation and subsequent fear response is likely to be. However, and before proceeding to a more explicit look at the relationship between dental fear and vulnerability perceptions of dental visits, there is a need to better understand the effect of dental fear in the community. Dental fear is not just an isolated individual response, but a social phenomenon with implications for dental health services and quality of life. Poor dental health has important flow on effects in terms of self-esteem, the ability to eat foods, sleep disturbance etc. The following two papers (Paper 7 and Paper 8) report on the nature of dental fear. The first, published in the *Australian Dental Journal*, describes an epidemiological investigation into the prevalence of dental fear and attempts to profile the type of person with a fear of going to the dentist. It is well known that females are likely to be more fearful of a wide range of specific fear-relevant stimuli than are males, but beyond this our knowledge of the characteristics of fearful individuals can only be gleaned tangentially and opportunistically from existing research. The second study, published in *BMC Oral Health*, looks at what can be called the ‘vicious cycle’ of dental fear. One of the proposed characteristics of dental fear is that it feeds back into itself as a result of the avoidance of treatment, deteriorating dental health, and eventually an increased likelihood of necessary painful invasive surgery. This is a similar process to the problem of phobic avoidance whereby people miss opportunities to extinguish what are called ‘unrealistic’ fears because they always avoid the fearful stimulus and therefore fail to acquire positive associations with the feared stimulus. In the case of dental fear, however, this avoidance may actually make the fear worse because it directly increases the potential for aversive surgical procedures in the future. Dental fear therefore presents a special challenge and is especially important in regards to the application of the Cognitive Vulnerability Model. Indeed, dental fear is such an important specific fear that the remainder of this thesis shall be devoted to better understanding it.
CHAPTER 10 (PAPER 7) – DENTAL FEAR IN AUSTRALIA: WHO’S AFRAID OF THE DENTIST?

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Statement of authorship

DENTAL FEAR IN AUSTRALIA: WHO’S AFRAID OF THE DENTIST?
Australian Dental Journal 2006;51:78–85.

Armfield J.M. (Candidate)
Conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ……………………………………………………………….   Date: ………………………….

Spencer A.J.
Designed study and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ……………………………………………………………….   Date: ………………………….

Stewart, J.F.
Managed data collection and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ……………………………………………………………….   Date: ………………………….
Linkage of paper to body of research

The paper comprising this chapter marks not just a qualitative shift to another specific fear, but a quantitative change of focus. Although this paper does not deal with the Cognitive Vulnerability Model specifically, it serves as an introduction to the further investigation of dental fear. Because dental fear is more complex than some other fears, with important social, behavioural, and health aspects and consequences, it was believed that a greater understanding of dental fear was an important prerequisite for further investigation into this area. While there has been and continues to be much research into dental fear, there is surprisingly little information regarding the population prevalence of dental fear and the characteristics of those people most likely to experience this fear.
Abstract

Background: This study aimed to describe both the prevalence of dental fear in Australia and to explore the relationship between dental fear and a number of demographic, socio-economic, oral health, insurance and service usage variables. Methods: A telephone interview survey of a random sample of 7,312 Australian residents, aged five years and over, from all states and territories. Results: The prevalence of high dental fear in the entire sample was 16.1%. A higher percentage of females than males reported high fear (HF). Adults aged 40–64 years old had the highest prevalence of high dental fear with those adults aged 80+ years old having the least. There were also differences between low fear (LF) and HF groups in relation to socio-economic status (SES), with people from higher SES groups generally having less fear. People with HF were more likely to be dentate, have more missing teeth, be covered by dental insurance and have a longer time since their last visit to a dentist. Conclusions: This study found a high prevalence of dental fear within a contemporary Australian population with numerous differences between individuals with HF and LF in terms of socio-economic, socio-demographic and self-reported oral health status characteristics.
Introduction

Despite advances in both pain control and patient management, dental fear remains a serious issue for patients and dental clinicians. Associations have been found between dental fear and less frequent dental visiting, poorer oral health, and greater functional impairment.\(^1\)\(^-\)\(^7\) It has been suggested that dental anxiety and fear may be a central aspect of a cycle of dental disadvantage.\(^2\)

Dental fear may be distinguished from dental anxiety by the situational boundaries within which it occurs. Fear is generally regarded as a physiological, behavioural and emotional response to a feared stimulus whereas anxiety is a feeling of dread or worry focused on, yet temporally prior to, exposure to a feared stimulus. Fear and anxiety are highly related and are often used interchangeably in the fear literature.

The prevalence of fears has been found to vary in content, pattern and level of fear across different cultures and across different populations.\(^8\) Estimates of childhood dental fear, for instance, have been found to vary from 3% to 43% in different populations.\(^9\) Although there are no reported prevalence figures for childhood dental fear in Australia, Thomson and colleagues have published data from 1995 which found that 14.9% of adults could be classified as having high dental anxiety.\(^2\) Other estimates of the prevalence of dental fear in the Australian community, based on information from a diverse range of sources, has yielded a prevalence of dental fear within the range 10–15 per cent.\(^10\)

Although a considerable body of research has focused on the origin, consequences and treatment implications of dental fear, only recently have efforts began to examine the profile of people with high levels of dental fear.\(^11\) Nonetheless, there have been incidental reports of differences in the characteristics of dentally anxious and non-anxious people from a number of studies.

A consistent finding in relation to the characteristics of fearful people is that females have a greater prevalence of fear and more extreme fear than do males.\(^12\)\(^-\)\(^14\) These findings have also been born out in relation to dental fear\(^15\)\(^-\)\(^18\) with some studies showing fear prevalence approximately twice as high for females as for males.\(^1\)\(^,\)\(^2\)

Another commonly reported variable with a relationship to fear is age. Although results from the published literature on the association between age and dental fear are
inconsistent, younger people have generally been found to be more anxious than older people. \(^{19}\) However, conflicting results can be found and there is some evidence that younger adults have the least fear of any adult age group. \(^{3, 20, 21}\) In Australia, for example, the highest prevalence of fear has been found for adults aged 35–44 years (19.7\%) with younger adults (18–34 years) having a lower prevalence (15.1\%). \(^{2}\)

While socio-economic gradients are rife in relation to health outcomes, there is less evidence of differences in dental fear by socio-economic status. In general, it appears that people from lower socio-economic backgrounds have higher fear, \(^{18, 22, 23}\) although some studies have failed to find a relationship between education and dental fear. \(^{6, 20}\) There is also evidence that socio-economic status may be related only to moderate levels of dental anxiety. Moore et al. found both low education and low income to be risk factors for moderate dental anxiety however these variables were not significantly related to extreme dental anxiety. \(^{24}\)

Other studies have identified a plethora of further variables related to the prevalence of high dental fear. However, while this body of research provides insight into some of the correlates of dental fear, there remains a paucity of data on dental fear within an Australian context. The general aim of this study, therefore, was to explore, within a contemporary Australian population, the characteristics of those people who are afraid of going to the dentist. In addition, we sought to update and reconfirm population prevalence estimates for dental fear, for children as well as adults.

**Methods**

This paper reports cross-sectional findings from the 2002 National Dental Telephone Interview Survey \(^{25}\) which used computer assisted telephone interviews of a random sample of Australian residents aged five years and over. Telephone numbers for the survey were sampled by random selection from the then most recent edition of an electronic ‘white pages’ listing. Separate samples were selected from five mainland state capitals – Sydney, Melbourne, Brisbane, Perth and Adelaide – as well as the rest-of-state corresponding to each of those capitals. Finally, samples were drawn for Tasmania and the two mainland territories of the Northern Territory and the Australian Capital Territory. This resulted in 13 separate samples or strata.
In order to reach unlisted telephone numbers, a single random digit was added to the end of each sampled telephone number. These new numbers were back matched to the electronic white pages to obtain addresses where possible. Numbers for which there was a matching phone number in the white pages directory were regarded as ‘listed’ numbers, while those without a matching phone number and corresponding address listing were regarded as ‘unlisted’ numbers. The target number of participants was 400 for each mainland territory, 450 for Tasmania, and 600 for each of the ten remaining strata.

Survey methods were based on methods advocated by Dillman. Approximately 10 days prior to dialling the sampled telephone numbers, a primary approach letter (PAL) was mailed to the address that accompanied each listed sampled telephone number. The PAL explained the purpose of the study and encouraged participation. Each sampled telephone number was initially called up to six times. Where no answer was obtained after six calls, the number was abandoned. When telephone interviewers contacted a household a standard procedure was followed to establish that the household was within scope and to randomly select the target person:

1) telephone numbers that did not serve a residential dwelling were excluded;

2) if only one person resided at the dwelling they were selected as the target person;

3) if more than one person resided at the dwelling, information was obtained on both the resident who had the most recent birthday as well as the resident with the next birthday coming, and the target person was selected based on a random selection of either person by a computer. When a sampled person was identified for any dwelling, up to six additional calls were made in an attempt to contact that person.

Participants in the study were asked a structured list of questions that followed one of three schedules. Schedule 1 interviews were administered to persons aged 16 years or more who agreed to participate and were able to answer the questions. Schedule 2 interviews were conducted for selected persons aged at least 5 years but less than 16 years, and were answered by a person who lived in the household and aged 16 years or more (proxy interview). Schedule 3 interviews were conducted for selected persons aged 16 years or more, but were answered by an adult other than the selected person in instances where the selected person was unable to communicate (for example, due to illness, language barriers, or if the selected person was away from the household for more
than six weeks). A small number of interviews were also conducted in Italian, Greek, Cantonese, Mandarin, Arabic, Vietnamese, and Polish where appropriate. The series of questions were based on previous rounds of the National Dental Telephone Interview Survey. The questions and interview procedures were pilot tested on a random selection of Adelaide households with any modifications made prior to formal data collection. All interviewers were trained and interviews were conducted in the presence of a supervisor.

To assess dental fear, participants were asked the question “Are you afraid of going to the dentist?”, with the four response categories being ‘Not at all’, ‘A little’, ‘Yes, quite’, and ‘Yes, very’. The single item Dental Anxiety Question has previously been found to be reliable and possess good validity. The expression ‘quite’ is elsewhere defined as referring to “a considerable extent or degree” and is here taken as contrasting to the response ‘A little’. It is therefore considered to be a more extreme positive endorsement than a theoretical mid-point response. For the purposes of the current study, participants who rated themselves as ‘Quite’ or ‘Very’ afraid were classified as ‘High Fear’ while participants who responded ‘Not at all’ or ‘A little’ were classified as ‘Low Fear’.

Weights were calculated for all data. This was done for two purposes: first, to account for differing sampling probabilities due to the sampling design and second, to ensure that the sample for each stratum more accurately represented the population of the corresponding stratum, using post-stratification by age and sex. All results presented subsequently used weighted data. The intention of weighting the data was to yield estimates of prevalence that could be generalised to the Australian population.

Ethical consent for the study was obtained from The University of Adelaide Ethics Committee. Participants were informed of their rights to refuse to answer any question and were assured that they would not be identifiable in regards to the results of the study.

Results

A total of 24,938 unique telephone numbers were called resulting in 7,312 participants providing completed interviews. Large proportions of the unlisted numbers were either out of service ($n = 6,596$), out of scope ($n = 3,923$) or resulted in a non-contact ($n = 3,414$). Of those people contacted, there were 3,966 refusals yielding an
overall participation rate of 64.8%. As a result of the random digit substitution, a total of 21.3% of participants were from an unlisted household. For all strata the participation rate was higher among listed numbers than among unlisted numbers. Participation rates ranged from 56.2% in the Sydney stratum to 74.4% in the Tasmania stratum.

A total of 913 proxy interviews were conducted for children and 348 for adults. For children, almost 20% of proxy interviews were by fathers or male guardians and approximately 80% by mothers or female guardians. For adults interviewed by proxy, 48 were edentulous and 300 dentate. No adult proxies received the question relating to dental fear due to previously noted inconsistencies in reporting fear for other adults.

A comparison of the sample characteristics with those of the Australian population as derived from the 2001 national census reveal that the sample respondents are representative of the Australian population (Table P7.1).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>NDTIS 2002 (%)</th>
<th>Australia 2001 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5–11 years</td>
<td>10.9</td>
<td>10.7</td>
</tr>
<tr>
<td>12–17 years</td>
<td>8.7</td>
<td>9.1</td>
</tr>
<tr>
<td>18–24 years</td>
<td>10.0</td>
<td>10.1</td>
</tr>
<tr>
<td>25–44 years</td>
<td>32.2</td>
<td>31.9</td>
</tr>
<tr>
<td>45–64 years</td>
<td>24.8</td>
<td>24.7</td>
</tr>
<tr>
<td>65+ years</td>
<td>13.4</td>
<td>13.6</td>
</tr>
<tr>
<td>Male</td>
<td>49.5</td>
<td>49.2</td>
</tr>
<tr>
<td>Household income &lt; $20,000 per year*</td>
<td>21.1</td>
<td>21.2</td>
</tr>
<tr>
<td>Employed</td>
<td>61.5</td>
<td>56.6</td>
</tr>
<tr>
<td>Speaks English at home</td>
<td>91.2</td>
<td>84.0</td>
</tr>
<tr>
<td>Born in Australian</td>
<td>78.8</td>
<td>76.8</td>
</tr>
</tbody>
</table>

* Australia 2001 figure refers to household income < $400 per week which translates to < $20,800 per year
In response to the question “Are you afraid of the dentist?”, 68.8% of participants responded ‘Not at all’, 15.2% responded ‘A little’, 4.8% said ‘Yes, quite’, and 11.3% stated ‘Yes, very’. Classifying people responding to the two highest fear categories as indicating high fear, 16.1% of the Australian population had high dental fear.

Across Australia there were few differences in self-reported dental fear by state and territory (Figure P7.1). Although New South Wales had the lowest percentage of people with high dental fear, and the Northern Territory had the highest percentage, these differences were not statistically significant ($\chi^2 = 5.58, p > 0.05$). There were 489 edentulous individuals in the sample representing 6.7% of all cases. A significantly higher prevalence of dental fear was indicated by the dentate than by people who were edentulous. Overall, while 18.0% of dentate people had high dental fear, only 7.8% of edentulous people reported high fear ($\chi^2 = 29.64, p < 0.001$). This finding is evident across all age groups (Figure P7.2). An analysis of just the edentulous showed a relationship between the length of time edentulous and fear. Those who reported low fear

![Figure P7.1. Response by state and territory to the question “How afraid are you of going to the dentist?”](image-url)
had been edentulous, on average, 10 years longer than people reporting high fear (33.81 compared to 23.73 years respectively) and this difference was statistically significant, \( t = 3.30, p = 0.001 \). Because edentulousness may be a significant confounder between fear and a number of other variables the remaining analyses were conducted using only dentate people.

Dental fear prevalence by socio-demographic characteristics for dentate people is presented in Table P7.2. Consistent with most research looking at sex differences in fear, this study found a higher percentage of females than males reporting high dental fear. Almost 12% of males reported high fear, compared with approximately 20% of females. Indeed, of those people with high dental fear, almost two-thirds were female. Differences by residential location, as measure by the Accessibility/Remoteness Index of Australia (ARIA),\(^{30}\) Indigenous status, and language spoken at home and were not statistically significant, however there were significant differences by generation. Second generation Australians (that is, people who were born in Australia but who’s parents were born overseas) had a lower prevalence of high dental fear than either first generation Australians or third or higher generation Australians.
Table P7.2
Prevalence of high dental fear by socio-demographic characteristics

<table>
<thead>
<tr>
<th>Socio-demographic characteristic</th>
<th>Weighted n</th>
<th>High fear (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3,156</td>
<td>12.2</td>
<td>11.0,13.4</td>
</tr>
<tr>
<td>Female</td>
<td>3,287</td>
<td>20.9</td>
<td>19.5,22.3</td>
</tr>
<tr>
<td><strong>Residential location</strong></td>
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<td></td>
</tr>
<tr>
<td>Major cities</td>
<td>4,324</td>
<td>16.5</td>
<td>15.2,17.8</td>
</tr>
<tr>
<td>Inner regional</td>
<td>1,322</td>
<td>17.5</td>
<td>15.6,19.4</td>
</tr>
<tr>
<td>Outer regional</td>
<td>663</td>
<td>14.6</td>
<td>12.5,16.7</td>
</tr>
<tr>
<td>Remote</td>
<td>83</td>
<td>18.1</td>
<td>13.1,23.1</td>
</tr>
<tr>
<td>Very remote</td>
<td>23</td>
<td>21.7</td>
<td>11.3,32.1</td>
</tr>
<tr>
<td><strong>Indigenous status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aboriginal or Torres Strait Islander</td>
<td>134</td>
<td>20.1</td>
<td>13.5,26.7</td>
</tr>
<tr>
<td>Non-Indigenous</td>
<td>6,300</td>
<td>16.5</td>
<td>15.6,17.4</td>
</tr>
<tr>
<td><strong>Language spoken at home</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speaks language other than English</td>
<td>770</td>
<td>16.0</td>
<td>12.8,19.2</td>
</tr>
<tr>
<td>Speaks English</td>
<td>5,674</td>
<td>16.7</td>
<td>15.7,17.7</td>
</tr>
<tr>
<td><strong>Generation of Australian</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st generation (born overseas)</td>
<td>1,437</td>
<td>17.3</td>
<td>15.2,19.4</td>
</tr>
<tr>
<td>2nd generation (parents born overseas)</td>
<td>1,346</td>
<td>13.8</td>
<td>11.8,15.8</td>
</tr>
<tr>
<td>3rd+ generation</td>
<td>4,093</td>
<td>16.4</td>
<td>15.2,17.6</td>
</tr>
<tr>
<td><strong>Age</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Childhood (&lt;13 years)</td>
<td>873</td>
<td>10.5</td>
<td>8.2,12.8</td>
</tr>
<tr>
<td>Adolescence (13–17 years)</td>
<td>516</td>
<td>9.5</td>
<td>6.7,12.3</td>
</tr>
<tr>
<td>Emerging adulthood (18–24 years)</td>
<td>681</td>
<td>12.9</td>
<td>10.2,15.6</td>
</tr>
<tr>
<td>Early adulthood (25–39 years)</td>
<td>1,662</td>
<td>16.9</td>
<td>14.9,18.9</td>
</tr>
<tr>
<td>Middle adulthood (40–64 years)</td>
<td>2,104</td>
<td>22.4</td>
<td>20.7,24.1</td>
</tr>
<tr>
<td>Older adulthood (65–79 years)</td>
<td>517</td>
<td>15.9</td>
<td>13.2,18.6</td>
</tr>
<tr>
<td>Old old adulthood (80+ years)</td>
<td>89</td>
<td>7.9</td>
<td>3.1,12.7</td>
</tr>
</tbody>
</table>

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
In this study, age was divided up into 7 categories based on developmental psychology research. The results show an increase in reported dental fear up to ‘middle adulthood’, that is for those aged 40–64 years (Table P7.2). The percentage of people with high dental fear declines sharply in older adulthood and is lowest for those adults classed as old old, that is 80 years and over.

Some researchers have found age differences between males and females in relation to dental fear. However, other than a widening of the gap between males and females during early adulthood, the trend in prevalence of high dental fear across the lifespan was found to vary little between males and females in this study, with the interaction between age and sex not being significant, $F = 1.37, p > 0.05$ (Figure P7.3)

![Figure P7.3. Prevalence of dental fear by age and sex](image)

**Figure P7.3. Prevalence of dental fear by age and sex**

Age: $F = 15.82, p < 0.001$
Sex: $F = 29.69, p < 0.001$
Age x Sex: $F = 1.37, p = 0.223$
As shown in Table P7.3, there was a clear gradient in the prevalence of dental fear across income categories. Apart from the lowest income group (< $20,000), which was comprised of a disproportionately high percentage of older, lower-fear adults, there was a consistent relationship between higher household income and lower prevalence of high fear. People from households with a combined income of up to $40,000 had 43.4% higher prevalence than people from households with an income in excess of $80,000 per annum.

Table P7.3

Prevalence of high dental fear by socio-economic characteristics

<table>
<thead>
<tr>
<th>Socio-economic characteristics</th>
<th>Weighted n</th>
<th>High fear (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$20,000</td>
<td>1,014</td>
<td>19.3</td>
<td>17.2,21.4</td>
</tr>
<tr>
<td>$20,000–&lt;$40,000</td>
<td>1,304</td>
<td>19.4</td>
<td>17.3,21.5</td>
</tr>
<tr>
<td>$40,000–&lt;$60,000</td>
<td>1,352</td>
<td>15.9</td>
<td>13.9,17.9</td>
</tr>
<tr>
<td>$60,000–&lt;$80,000</td>
<td>877</td>
<td>14.3</td>
<td>11.8,16.8</td>
</tr>
<tr>
<td>&gt;$80,000</td>
<td>1,182</td>
<td>13.5</td>
<td>11.2,15.8</td>
</tr>
<tr>
<td>Employment status***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>857</td>
<td>24.2</td>
<td>21.4,27.0</td>
</tr>
<tr>
<td>Part-time</td>
<td>1,002</td>
<td>20.6</td>
<td>18.0,23.2</td>
</tr>
<tr>
<td>Full-time</td>
<td>2,299</td>
<td>17.1</td>
<td>15.5,18.7</td>
</tr>
<tr>
<td>Student/retired</td>
<td>2,231</td>
<td>11.4</td>
<td>10.1,12.7</td>
</tr>
<tr>
<td>Home ownership*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rents accommodation</td>
<td>1,277</td>
<td>19.0</td>
<td>16.9,21.1</td>
</tr>
<tr>
<td>Currently purchasing</td>
<td>2,059</td>
<td>15.9</td>
<td>14.2,17.6</td>
</tr>
<tr>
<td>Owns accommodation outright</td>
<td>2,970</td>
<td>16.0</td>
<td>14.7,17.3</td>
</tr>
<tr>
<td>Tertiary education***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No tertiary education</td>
<td>3,353</td>
<td>15.2</td>
<td>14.0,16.4</td>
</tr>
<tr>
<td>CAE/Certificate/Nursing etc.</td>
<td>1,785</td>
<td>21.3</td>
<td>19.4,23.2</td>
</tr>
<tr>
<td>University – Degree/Diploma</td>
<td>1,172</td>
<td>14.3</td>
<td>12.2,16.4</td>
</tr>
<tr>
<td>University – Masters/PhD</td>
<td>133</td>
<td>9.0</td>
<td>3.6,14.4</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.01, *** p < 0.001
In terms of unemployment status, the highest prevalence of dental fear was found among those categorised as unemployed while the lowest prevalence was for people in full-time employment (Table P7.3). Unemployed here refers to people who were either unemployed but looking for work, not employed and not looking for work, or performing unpaid household work. People who were neither employed or unemployed (that is students or people who were retired) had a low prevalence of dental fear.

In regards to home ownership, prevalence of high dental fear was highest for people who rented and least for those who were currently purchasing or owned their home outright, with these differences being statistically significant (Table P7.3). For tertiary education, again a relationship with SES was found, with the highest prevalence of fear for people who had received non-University tertiary education (21.3%) and the lowest prevalence among that group of people who had received post-graduate university qualifications (9.0%). Non-University tertiary qualifications included trade certificates, College of Advanced Education or TAFE degrees, or Teacher’s College or nursing degrees.

Oral health status was derived from a self-reported count of missing and remaining teeth for each arch. This method has been previously shown to have good reliability. In both arches, people with high fear had more teeth missing than people with low fear and conversely, therefore, fewer teeth remaining than people with low fear (Figure P7.4). These results were statistically significant for both the maxillary (\( F = 26.3, p < 0.001 \)) and mandibular arches (\( F = 10.2, p = 0.001 \)).

The relationships between dental fear and insurance and service usage characteristics are shown in Table P7.3. Excluding edentulous individuals, there was a significant relationship between whether people had private dental insurance and the prevalence of high dental fear (\( \chi^2 = 6.54, p = 0.011 \)). However, although there appears to be a relationship between dental fear and length of time since insurance was taken up, with higher prevalence of dental fear among those who took up insurance within the last year and those who took up insurance more than 10 years ago, these differences were not statistically significant. Finally, there was no significant difference between dental fear groups in whether the insurance cover was single or family cover.
Figure P7.4. Mean numbers of missing and remaining teeth by dental fear for the mandibular and maxillary arches.

There were significant differences in service usage between dentate people with high and low fear (Table P7.4). A clear linear relationship was found between time since last visit and the prevalence of dental fear ($\chi^2 = 66.39, p < 0.001$), with fear prevalence increasing from 14.2% for those people who visited in the previous 12 months to 31.0% for those who last visited more than 10 years previously. In terms of the location of the last visit, dentate people who had made their last dental visit with a technician, at a clinic operated by a health insurance fund, or at the School Dental Service had the lowest prevalence of high dental fear. In contrast, people who visited either a private or a public clinic demonstrated the highest prevalence of dental fear. Because 86% of dental visits were last made at either a private or public clinic a separate analysis of attendance by dental fear by these visit sites was conducted. There was no statistically significant difference in the prevalence of high dental fear between those people who had last visited at a private clinic (17.1%) in comparison to those who last visited a public dental service (19.7%), $\chi^2 = 2.68, p > 0.05$.)
Table P7.4

Prevalence of high dental fear by insurance and service usage characteristics

<table>
<thead>
<tr>
<th>Insurance and service usage characteristic</th>
<th>Weighted n</th>
<th>High fear (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insurance coverage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has private dental insurance</td>
<td>2,974</td>
<td>15.6</td>
<td>14.3,16.9</td>
</tr>
<tr>
<td>Does not have private dental insurance</td>
<td>3,354</td>
<td>18.0</td>
<td>16.7,19.3</td>
</tr>
<tr>
<td><strong>Length of time since taking up insurance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year ago</td>
<td>208</td>
<td>17.8</td>
<td>11.4,24.2</td>
</tr>
<tr>
<td>1–5 years ago</td>
<td>685</td>
<td>12.8</td>
<td>9.8,15.8</td>
</tr>
<tr>
<td>5–10 years ago</td>
<td>416</td>
<td>16.1</td>
<td>11.9,20.2</td>
</tr>
<tr>
<td>10+ years ago</td>
<td>1,592</td>
<td>16.5</td>
<td>14.6,18.4</td>
</tr>
<tr>
<td><strong>Type of insurance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>552</td>
<td>16.5</td>
<td>13.5,19.5</td>
</tr>
<tr>
<td>Family</td>
<td>2,411</td>
<td>15.4</td>
<td>13.7,17.1</td>
</tr>
<tr>
<td><strong>Time since last visit</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 12 months</td>
<td>4,019</td>
<td>14.2</td>
<td>13.1,15.3</td>
</tr>
<tr>
<td>1 year - &lt; 2 years</td>
<td>1,140</td>
<td>18.9</td>
<td>16.6,21.2</td>
</tr>
<tr>
<td>2 years - &lt; 5 years</td>
<td>722</td>
<td>20.6</td>
<td>17.7,23.5</td>
</tr>
<tr>
<td>5 years - &lt; 10 years</td>
<td>294</td>
<td>21.1</td>
<td>16.4,25.8</td>
</tr>
<tr>
<td>10+ years</td>
<td>213</td>
<td>31.0</td>
<td>25.2,36.8</td>
</tr>
<tr>
<td><strong>Site of last dental visit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>4,858</td>
<td>17.1</td>
<td>16.0,18.2</td>
</tr>
<tr>
<td>Public</td>
<td>639</td>
<td>19.7</td>
<td>16.8,22.6</td>
</tr>
<tr>
<td>School</td>
<td>673</td>
<td>11.7</td>
<td>9.2,14.2</td>
</tr>
<tr>
<td>Technician</td>
<td>21</td>
<td>19.0</td>
<td>3.6,34.4</td>
</tr>
<tr>
<td>Health fund</td>
<td>84</td>
<td>10.7</td>
<td>2.7,18.7</td>
</tr>
<tr>
<td>Defence force</td>
<td>31</td>
<td>12.9</td>
<td>3.1,22.7</td>
</tr>
<tr>
<td>Other</td>
<td>42</td>
<td>16.7</td>
<td>2.9,30.5</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.01, *** p < 0.001


**Discussion**

This study found a population prevalence of dental fear of 16.4% for adults and 10.3% for children, yielding an overall prevalence of 16.1%. This is comparable to the 14.9% reported by Thomson and colleagues from 1995 and the estimate of 10–15 percent provided by Francis and Stanley. The second aim of this study, however, was to sketch a profile of those people in Australia with high dental fear. We attempted to answer the question: “Who is afraid of the dentist?” Although it is important to keep in mind the generalisations that such a question must inevitably seed, the results presented here enable us to explore an answer nonetheless.

First, females, more so than males, are afraid of the dentist. This result effectively replicates the findings of Thomson et al. who found the prevalence of high dental anxiety to be 10% and 19% for males and females respectively. Research has found that women report higher fear in relation to specific stimuli (such as fear of the needle and fear of the drill) than do males, and this coupled with reported lower pain thresholds and less tolerance for pain may explain such a finding. Such research underlines the importance of not only good pain control measures in the dental surgery but the need to mitigate a client’s negative perceptions. An alternative explanation of sex differences in fear comes from psychological literature that has found that women may be more open to expressing fears than are men. Although exception has been taken to the claim by some researchers that men are more likely to lie in fear surveys than females, it may still be that males are more likely to express fear though alternate emotional manifestations such as anger or impatience.

Differences in fear prevalence were also seen between different age groups. This is not surprising given the often considerable changes that take place across the human lifespan. Not only do biological changes occur with age but people of different ages are exposed to different social and cultural events and these transpire at different cognitive and emotional stages. Within this context, this study found that the middle adulthood age group, that is those aged between 40 and 64 years, had almost twice the prevalence of high fear as the other age groups combined. Middle adulthood is often considered to represent a period of change and may be associated with physical decline, increased illness, and a growing awareness of one’s own mortality. Life stress may also result from
mid-career reassessment, job stress, job loss, and job burnout. Interestingly, however, the findings here differ from other reports. Holtzman and colleagues, for example, found fear and anxiety in a US metropolitan region to decrease with increasing age while Thomson and colleagues found the highest prevalence of fear, in a national Australian study, in the 35–44-year-old age group. One way to reconcile these Australian findings is to take a cohort perspective. Adults aged 35–44 years old in the Thomson et al. study would have been aged 42–51 years in the current study. Effectively, those individuals with high fear in the 35–44-year-old age group in 1995 may have ‘moved up’ into the next age group. Future studies will be needed to determine whether this is, in fact, the case.

Considerable evidence was found that people from low socio-economic backgrounds have a higher prevalence of dental fear. Socio-economic status is effectively a marker for a raft of behavioural, social, economic and psychological covariates. People from lower socio-economic backgrounds experience poorer physical health, more psychological problems and have reduced access to resources. Although health differentials are frequently found by socio-economic status, there was no reason to assume that there would be a relationship between socio-economic status and dental fear. However, the current findings are consistent with evidence that people from lower SES backgrounds have poorer dental health. Whether this contributes to differences in dental treatment and subsequently to increased fear remains to be investigated.

This study found oral health status to be related to dental fear. Dentate people were found to have significantly higher prevalence of dental fear than the edentulous. It should be noted, however, that dentate status is closely related to age, with older adults with less fear more likely to be edentulous. The percentage of edentulous people in this study increased from 6 percent among 40–64 year olds, to 30 percent among 65–80 year olds to 50 percent for 80+ year olds. Whether the relationship with dental fear is therefore a matter of cognitive and emotional changes occurring with age or the consequences of possible full clearances earlier in life remains to be investigated. It is certainly possible that people who are edentulous might experience dental visits in a qualitatively different manner to dentate people, which helps to explain the dramatic difference in fear prevalence between dentate and edentulous people. Edentulous people are more likely to visit for replacement of dentures and clinical procedures that do not include some key fear stimuli such as needles and drills.
For those people who have retained some teeth, there is a clear difference between people with high and low fear in disease experience with people with high fear having fewer teeth remaining than people with low fear. With research showing the aetiology of dental fear for many people to be via a direct conditioning pathway, it seems likely that those people who have had more teeth extracted are more likely to have had unpleasant or painful experiences which would translate into higher fear prevalence.

Given the association between high dental fear and time since last dental visit, it was expected that people with high fear would be less likely to have dental insurance. Yet, few differences were found here between insurance coverage and dental fear prevalence, with only a small difference evident after controlling for dentate status. An explanation for this might lie in the related finding that insurance coverage is poorly related to service use. Another possibility is that the level of insurance coverage of people with high fear is balanced by the higher treatment needs of these people.

Given both the reasonably high prevalence of dental fear in the population and the associated impact of dental fear, there are clear clinical implications for oral health professionals in terms of both fear identification and treatment. It is important that dentists and allied staff anticipate and are trained to identify anxious patients. Fearful patients should either be identified by verbal cues or body language, or more formally via a question as part of a screening or initial patient questionnaire. An open-ended question might then be used as a follow-up to ascertain which aspects of dental visits they find particularly fear-evoking. Surprisingly, however, in the UK only 20 per cent of dentists identified as having a special interest in treating patients with dental anxiety used dental anxiety assessment questionnaires for adults and only 17 per cent were found to use child dental anxiety assessment questionnaires. Given the current apparent limited use of fear assessment questionnaires, it might perhaps be more judicious to assume each new patient to be fearful and treat them accordingly until evidence to the contrary was established. Patients exhibiting behaviours such as cancelling appointments or delaying scheduled recalls may be displaying fear-related symptoms.

Following identification, a fearful patient may require extra or special measures to ensure successful completion of a course of care. Such measures may involve providing extra control in relation to the dental procedures, providing more information, taking breaks during the procedure, use of distraction techniques, and more efficient anesthesia. Patients with dental fears who refuse or consistently delay needed treatment might be
referred to a cognitive or behavioural specialist such as a psychologist to help them overcome their fear.

In summary, this study found that the greatest prevalence of high dental fear occurred for people who were female, in middle adulthood, from low socio-economic circumstances, who were dentate, visited the dentist less often and who had fewer remaining teeth. Indeed, 40–64-year-old dentate females with a family income of less than $40,000 per year and with fewer than 12 teeth remaining in either arch had a prevalence of high dental fear of 37%. This is of particular relevance given that this represents a very common demographic cluster encountered in the public sector dental service while in private sector clinics middle-aged dentate females make up the most common patient demographic cluster. There therefore needs to be continued vigilance and awareness by treating dentists of the high levels of dental fear likely in their patient population and the possible ramifications of that fear on their patient’s future disease and future dental attendance patterns.
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49. AIHW Dental Statistics and Research Unit. *Dental insurance and access to dental care*. Adelaide: The University of Adelaide; 2002.

CHAPTER 11 (PAPER 8) – THE VICIOUS CYCLE OF DENTAL FEAR: EXPLORING THE INTERPLAY BETWEEN ORAL HEALTH, ORAL HEALTH CARE UTILIZATION AND DENTAL FEAR.

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BMC Oral Health

Statement of authorship

THE VICIOUS CYCLE OF DENTAL FEAR: EXPLORING THE INTERPLAY BETWEEN ORAL HEALTH, ORAL HEALTH CARE UTILIZATION AND DENTAL FEAR


Armfield J.M. (Candidate)
Conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: .................................

Stewart, J.F.
Designed study and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ................................................................. Date: .................................

Spencer A.J.
Managed data collection and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ................................................................. Date: .................................
Linkage of paper to body of research

The paper featured in this chapter sought to extend the understanding of dental fear which was commenced in Paper 7 (Chapter 10). It is well documented that dental fear is associated with poor dental attendance and one possible consequence of not attending a dentist for treatment is a worsening of the diseased state of the teeth. It is further possible that this worsening oral health leads to the need for dental treatment which may be distressing, painful or uncomfortable, leading to reinforcement or enhancement of the fear. This ‘vicious cycle’ of dental fear is an example of the complexity of this psychological state, and shows its interaction with health and health systems.

Despite several researchers having hypothesised the existence of a vicious cycle of dental fear and avoidance, no empirical investigation of this phenomena has ever been carried out. The current study aimed to provide some preliminary evidence that the set of associations inherent in a vicious cycle do, in fact, occur. Such findings are important in relation to further studies of the Cognitive Vulnerability Model in relation to dental fear. When investigating the applicability of the Cognitive Vulnerability Model to dental fear it is important that these complex inter-relationships are kept in mind as they affect the expression of dental fear and have significant implications for treatment.
Introduction to paper and additional information

This paper was accepted for publication by *BMC Oral Health*, where it was judged by the reviewers as “an article of importance in its field”. The article appeared as a featured paper by the Journal for some months and was accessed thousands of times in the first 6 months after it became available.

Figure 12. The paper was featured by *BMC Oral Health* as a research highlight
Abstract

Background: Based on the hypothesis that a vicious cycle of dental fear exists, whereby the consequences of fear tend to maintain that fear, the relationship between dental fear, self-reported oral health status and the use of dental services was explored.

Methods: The study used a telephone interview survey with interviews predominantly conducted in 2002. A random sample of 6,112 Australian residents aged 16 years and over was selected from 13 strata across all States and Territories. Data were weighted across strata and by age and sex to obtain unbiased population estimates.

Results: People with higher dental fear visited the dentist less often and indicated a longer expected time before visiting a dentist in the future. Higher dental fear was associated with greater perceived need for dental treatment, increased social impact of oral ill-health and worse self-rated oral health. Visiting patterns associated with higher dental fear were more likely to be symptom driven with dental visits more likely to be for a problem or for the relief of pain. All the relationships assumed by a vicious cycle of dental fear were significant. In all, 29.2% of people who were very afraid of going to the dentist had delayed dental visiting, poor oral health and symptom-driven treatment seeking compared to 11.6% of people with no dental fear.

Conclusions: Results are consistent with a hypothesised vicious cycle of dental fear whereby people with high dental fear are more likely to delay treatment, leading to more extensive dental problems and symptomatic visiting patterns which feed back into the maintenance or exacerbation of existing dental fear.
Background

Despite reductions in pain associated with dental visits and an increased awareness by dentists of the importance of building trusting relationships, dental fear remains a major issue for dental clinicians and their patients [1]. Dental fear has long-term implications because it is both reasonably stable and difficult to assuage [2]. The significance of dental fear as an issue in dentistry is magnified by the high prevalence of dental fear reported in many countries. Child dental fear has been reported to be as high as 43 per cent [3] in some countries while estimates of the prevalence of high dental fear among Australian adults are about 16 per cent [4, 5]. Both the high prevalence of dental fear and the ramifications in terms of disease experience and treatment make it important that we better understand the mechanisms by which dental fear is maintained and possibly exacerbated.

A number of studies have found an association between dental fear and both visiting patterns and disease experience. For example, Schuller et al. [6] found that individuals with high fear visited the dentist less often and had more decayed and more missing teeth. Similarly, Thomson et al. [5] found associations between dental fear and less frequent dental visiting, increased visiting for a problem and increased social and functional impairment. Similar findings have been reported in other research [7, 8].

The idea of a vicious cycle of dental fear has been promulgated by several studies [5, 9-16]. Some researchers posit a role for psychological variables such as embarrassment, with dental fear and anxiety leading to avoidance, a deterioration in dental health, and feelings of shame and embarrassment culminating in reinforced avoidance [17, 18]. In contrast, Bouma et al. [14] propose that anxiety plays a crucial role in avoidance behaviour by causing a deterioration in oral health and an increase in the perceived likelihood of pain and restorative treatments resulting in further negative dental visiting experiences. Similarly, Thomson et al. [5] have argued that dental fear may be a component in a cycle of dental disadvantage, with dentally anxious individuals avoiding dental care and thereby worsening their problems and increasing the likelihood that subsequent dental visits will be for emergency reasons. These conceptualisations share the common feature that the dental fear is believed to feed back into itself as a result of a
number of repercussions of the fear (Figure P8.1). While it may be argued that being forced to seek help as a result of an acute dental problem, most likely due to toothache, provides an opportunity for an individual to confront their feared situation and therefore reduce their fear, given the likelihood of painful and invasive treatment associated with the visit it is likely that any positive benefit from exposure would be mitigated by the aversive treatment experiences.

Figure P8.1. Model of the vicious cycle of dental fear
References to the concept of a vicious cycle of fear are replete within the psychological literature, however no systematic effort has yet been made to apply this idea in an analytical fashion to dental fear. For the most part, the idea of a ‘vicious cycle’ has been used post hoc to explain the relationship between dental fear and dental visiting behaviours without any substantive effort to explore the chain of relationships presupposed by the concept. The aim of this study was, therefore, not only to explore, within a contemporary Australian population, the relationship between dental fear and dental visiting patterns, prevalence of dental problems and symptom-driven treatment but to examine the hypothesised sequence of the ‘vicious cycle’ of fear, whereby dental fear, delayed dental visiting, increased dental problems and symptom-driven treatment form a linked chain feeding back into the fear experience.

**Methods**

The data for the study are derived from the 2002 National Dental Telephone Interview Survey (NDTIS) [19] that used computer assisted telephone interviews of a random sample of people across Australia aged five years and over. Telephone numbers were randomly sampled from an electronic ‘white pages’ listing and grouped into 13 separate samples or strata. The mainland state capitals of Sydney, Melbourne, Brisbane, Perth and Adelaide as well as rest-of-state for each of the capital cities respectively comprised 10 separate strata. The remaining strata consisted of the state of Tasmania and the two largest mainland territories, the Northern Territory and the Australian Capital Territory.

In an effort to reach unlisted telephone numbers, a random digit substitution was applied to the final digit of each telephone number sampled, as described by Frankel and Frankel [20]. Where possible, these numbers were back matched to the electronic white pages to obtain addresses. Telephone numbers were designated as ‘unlisted’ if they lacked electronic white pages phone listings and corresponding addresses while telephone numbers were deemed to be ‘listed’ if there was a matching phone number in the white pages directory. In the state capital and rest-of-state strata the target number of participants was 600, while the target numbers in the smaller jurisdictions of Tasmania, and each of the mainland territories were 450 and 400 respectively.
Survey methods were based on those recommended by Dillman [21]. A primary approach letter (PAL) was sent to the address accompanying each sampled telephone numbers about 10 days before initial telephone contact. The PAL contained information regarding the study and the anticipated time of telephone contact. Each sampled number was initially called up to a maximum of six times, after which the number was abandoned if there was no answer. To ensure that the household was in scope and to select a target person, a standard procedure was followed upon successfully contacting a household. First, telephone numbers belonging to anything other than a residential dwelling were excluded. Second, if only a single person resided at the residence they were selected for participation. Third, if more than one person resided at the dwelling, respondents were randomly selected based on them being either the person in the household having the next birthday or the person with the most recent birthday. When a target person was identified up to six more calls were made, if necessary, in an effort to contact that person.

Participants were asked a structured series of questions which were based on previous rounds of the NDTIS. Pilot testing of the questions and interview procedures was carried out on a random selection of households from the city of Adelaide in South Australia and any modifications based on this testing incorporated into the telephone interviewing procedure prior to formal data collection. Interviewers were trained and all interviews were conducted in the presence of a supervisor.

Participants aged 16 years or over were asked a sequence of questions that accorded to one of two schedules. Schedule 1 interviews were presented to people who agreed to participate in the study while Schedule 2 interviews were undertaken when a selected person was unable to answer for themselves (for example due to illness, temporary absence from the house or language barriers) and were answered by an adult proxy. Where no proxy existed for a Schedule 2 interview, and so as not to exclude people who had poor English language skills, a small number of interviews with selected participants were conducted in other languages.

The interview schedules contained a number of items relating primarily to use of dental services, treatment outcomes, insurance characteristics, and socio-demographic characteristics. The Australian Government Department of Health and Aged Care funded the NDTIS with the majority of the study questions addressing research on ‘adult access to dental care’. Only a selection of the results from the full interview schedule is presented here.
To assess dental fear, participants were asked the single-item Dental Anxiety Question (DAQ) “Are you afraid of going to the dentist?”. This relatively simple single-item measure of dental fear has previously been found to have good reliability and validity [22, 23]. Single-item fear measures have been used in other epidemiological research and demonstrate good agreement with more commonly used multi-item dental fear scales [24]. The four response categories of the DAQ are ‘Not at all’, ‘A little’, ‘Yes, quite’ and ‘Yes, very’.

Dental visiting characteristics were assessed via several items. Delays in visiting were measured by questions pertaining to previous service use: “How long ago did you see a dental professional about your teeth, dentures or gums?” and “How often on average would you seek care from a dental professional?”. Intentions regarding future service use were measured using two additional questions: “When do you expect to make your next dental visit?” and “Do you have an appointment set for a check-up within the next 18 months?”.

Dental problems were assessed using a number of approaches. First, subjects were asked to count either the number of missing or remaining teeth in their mouth. Second, people were asked if they felt they currently needed to have any fillings, any extractions, a scale and clean, a denture made or repaired, a check-up, gum treatment, or a dental crown or bridge. The studies participants were also asked a series of questions regarding the social impact of their dental condition. They were asked how often in the past 12 months they had had a toothache, felt uncomfortable about the appearance of their teeth, mouth or dentures, had to avoid eating some foods because of dental problems, felt that life in general was less satisfying because of dental problems or had had trouble sleeping because of dental problems. Responses were recorded on a 5-point scale ranging from ‘Very often’ to ‘Never during the last 12 months’ with an additional option of ‘don’t know’. Items were based on social impacts assessed by the Oral Health Impact Profile [25, 26]. Finally, people were asked a global question regarding their oral health: “How would you rate your own dental health?”.

Symptom-driven treatment seeking was assessed by questions relating to the reason for a person’s most recent dental visit and the reason for their usual dental visiting. For those people who responded that their usual reason for visiting a dental professional was when they had a dental problem, they were asked the additional question “Would your dental visits usually be (necessary) for the relief of pain?”.
The data obtained were weighted for two purposes: first, to account for differing sampling probabilities due to variations in both household size and state/territory population and second, to ensure that the sample for each stratum more accurately represented the population of the corresponding stratum, by also weighting by age and sex. The weights result in reported frequencies corrected for differences in probability of selection while maintaining the same sample size [19].

Data analysis comprised three steps. First, associations between dental fear and sociodemographic and dental characteristics, dental health and dental visiting patterns were examined. Second, the associations assumed by a vicious cycle of dental fear were analysed. Finally, a multivariate model was constructed to test the independent association of dental fear and other possible confounders with the vicious cycle profile.

The NDTIS was approved by the Australian Institute of Health and Welfare Ethics Committee. All participants were informed that they had the right to refuse to answer any question and that they would not be individually identifiable in regards to the results of the study.

**Results**

A total of 24,938 unique telephone numbers were called in the NDTIS. A large proportion of the unlisted numbers were either out of service (n = 6,596), or out of scope predominantly due to being a business number (n = 3,923). Of the remaining 14,419 households deemed as in scope 3,141 resulted in non-contact after the six call attempts while participation was refused in a further 3,966 households. As a result of the random digit substitution, a total of 21.3% of participants were from an unlisted household. Overall, 7,312 participants providing completed interviews with a final participation rate of 64.8%. After excluding children aged 15 years old and younger, a final NDTIS study population of 6,112 people aged 16 years and over was obtained. The average age of this sample was 44.2 years (SD = 18.1, range = 16–98 years of age).

Table P8.1 presents a comparison of the sample characteristics with those of the Australian population as derived from the Australian census in 2001. There was good similarity between population characteristics and those of the sample.
Table P8.1

Comparison of NDTIS 2002 sample characteristics with population statistics derived for Australia from the 2001 national census

<table>
<thead>
<tr>
<th></th>
<th>NDTIS 2002 (%)</th>
<th>Australia 2001 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–24 years</td>
<td>13.1</td>
<td>13.0</td>
</tr>
<tr>
<td>25–44 years</td>
<td>32.2</td>
<td>31.9</td>
</tr>
<tr>
<td>45–64 years</td>
<td>24.8</td>
<td>24.7</td>
</tr>
<tr>
<td>65+ years</td>
<td>13.4</td>
<td>13.6</td>
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<tr>
<td>Male</td>
<td>49.1</td>
<td>49.2</td>
</tr>
<tr>
<td>Household income &lt; $20,000 per year**</td>
<td>20.3</td>
<td>21.2</td>
</tr>
<tr>
<td>Employed***</td>
<td>58.8</td>
<td>56.6</td>
</tr>
<tr>
<td>Speaks English at home</td>
<td>87.6</td>
<td>84.0</td>
</tr>
<tr>
<td>Born in Australian</td>
<td>76.0</td>
<td>76.8</td>
</tr>
</tbody>
</table>

* Percentages based on total population aged 5 years +
** Australia 2001 figure refers to household income < $400 per week which translates to < $20,800 per year
*** Australia 2001 figure refers to persons aged 15 years and over

In response to the single-item DAQ, 67.7% of participants responded ‘Not at all’, 15.1% responded ‘A little’, 5.2% said ‘Yes, quite’, and 11.9% stated ‘Yes, very’. A number of socio-demographic differences were observed between dental fear groups (Table P8.2). Higher dental fear was associated with being dentate, female, having part-time employment or being unemployed, and having an annual household income of between $20,000 and $50,000 per year. Dental fear was also associated with age, increasing across age groups up to 46–64-year-olds but then decreasing among those aged 65+ years old. The association between fear and country of birth and speaking a language other than English at home was not statistically significant. Similarly, residential remoteness as measured by the Accessibility/Remoteness Index of Australia (ARIA) [27] and based on road distance to service centers was not significantly related to dental fear.
### Table P8.2

Socio-demographic and dental characteristics by dental fear

<table>
<thead>
<tr>
<th></th>
<th>Not afraid</th>
<th></th>
<th>A little afraid</th>
<th></th>
<th>Quite afraid</th>
<th></th>
<th>Very afraid</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
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<tr>
<td><strong>Dentate status</strong>*</td>
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<td></td>
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<tr>
<td>Dentate</td>
<td>3,482</td>
<td>90.3</td>
<td>826</td>
<td>96.2</td>
<td>295</td>
<td>99.0</td>
<td>648</td>
<td>95.3</td>
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<tr>
<td>Edentulous</td>
<td>375</td>
<td>9.7</td>
<td>33</td>
<td>3.8</td>
<td>3</td>
<td>1.0</td>
<td>32</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Sex</strong>*</td>
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<tr>
<td>Male</td>
<td>2,024</td>
<td>52.4</td>
<td>332</td>
<td>38.6</td>
<td>124</td>
<td>41.6</td>
<td>218</td>
<td>32.1</td>
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<td>Female</td>
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<td>47.6</td>
<td>529</td>
<td>61.4</td>
<td>174</td>
<td>58.4</td>
<td>462</td>
<td>67.9</td>
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<td><strong>Age</strong>*</td>
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<td></td>
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<td></td>
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<tr>
<td>16–24 years</td>
<td>633</td>
<td>16.4</td>
<td>160</td>
<td>18.6</td>
<td>45</td>
<td>15.2</td>
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<td>25–39 years</td>
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<td>269</td>
<td>31.2</td>
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<td>191</td>
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<td>40–64 years</td>
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<td>341</td>
<td>39.6</td>
<td>135</td>
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<td>65+ years</td>
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<td>9.1</td>
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<td><strong>Country of birth</strong></td>
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<td>Australia</td>
<td>2,958</td>
<td>76.6</td>
<td>647</td>
<td>75.1</td>
<td>231</td>
<td>77.5</td>
<td>514</td>
<td>75.6</td>
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<td>Other</td>
<td>903</td>
<td>23.4</td>
<td>214</td>
<td>24.9</td>
<td>67</td>
<td>22.5</td>
<td>165</td>
<td>24.3</td>
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<td><strong>Language spoken at home</strong></td>
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<td>LOTE</td>
<td>461</td>
<td>11.9</td>
<td>121</td>
<td>14.1</td>
<td>33</td>
<td>11.1</td>
<td>75</td>
<td>11.0</td>
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<tr>
<td>English</td>
<td>3,401</td>
<td>88.1</td>
<td>740</td>
<td>85.9</td>
<td>265</td>
<td>88.9</td>
<td>604</td>
<td>89.0</td>
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<tr>
<td><strong>Employment</strong>*</td>
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<tr>
<td>Full-time</td>
<td>1,577</td>
<td>42.9</td>
<td>365</td>
<td>44.4</td>
<td>135</td>
<td>47.4</td>
<td>261</td>
<td>39.0</td>
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<tr>
<td>Part-time</td>
<td>673</td>
<td>18.3</td>
<td>148</td>
<td>18.0</td>
<td>64</td>
<td>22.5</td>
<td>145</td>
<td>21.6</td>
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<td>Not employed</td>
<td>1,422</td>
<td>38.7</td>
<td>309</td>
<td>37.6</td>
<td>86</td>
<td>30.2</td>
<td>264</td>
<td>39.3</td>
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<tr>
<td><strong>Annual household income</strong></td>
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<tr>
<td>Less than $20,000</td>
<td>824</td>
<td>24.3</td>
<td>151</td>
<td>19.8</td>
<td>52</td>
<td>20.2</td>
<td>141</td>
<td>23.5</td>
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<tr>
<td>$20,001 – $50,000</td>
<td>1,111</td>
<td>32.8</td>
<td>236</td>
<td>30.9</td>
<td>97</td>
<td>37.7</td>
<td>239</td>
<td>39.8</td>
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<tr>
<td>$50,001 – $80,000</td>
<td>783</td>
<td>23.1</td>
<td>210</td>
<td>27.5</td>
<td>62</td>
<td>24.1</td>
<td>123</td>
<td>20.5</td>
</tr>
<tr>
<td>Greater than $80,000</td>
<td>672</td>
<td>19.8</td>
<td>166</td>
<td>21.8</td>
<td>46</td>
<td>17.9</td>
<td>97</td>
<td>16.2</td>
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<td><strong>Residential remoteness</strong></td>
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<td></td>
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<tr>
<td>Highly accessible</td>
<td>2,586</td>
<td>67.2</td>
<td>590</td>
<td>68.7</td>
<td>204</td>
<td>69.2</td>
<td>455</td>
<td>67.5</td>
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<tr>
<td>Accessible</td>
<td>799</td>
<td>20.8</td>
<td>179</td>
<td>20.8</td>
<td>66</td>
<td>22.4</td>
<td>151</td>
<td>22.4</td>
</tr>
<tr>
<td>Moderately accessible</td>
<td>401</td>
<td>10.4</td>
<td>83</td>
<td>9.7</td>
<td>22</td>
<td>7.5</td>
<td>55</td>
<td>8.2</td>
</tr>
<tr>
<td>Remote</td>
<td>50</td>
<td>1.3</td>
<td>5</td>
<td>0.6</td>
<td>3</td>
<td>1.0</td>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>Very remote</td>
<td>10</td>
<td>0.3</td>
<td>2</td>
<td>0.2</td>
<td>0</td>
<td>0.0</td>
<td>5</td>
<td>0.7</td>
</tr>
</tbody>
</table>

* $\chi^2 < 0.05$, ** $\chi^2 < 0.01$, *** $\chi^2 < 0.001$

Note: Dentate refers to at least one natural tooth present in the mouth
Dental fear was associated with having had a longer time since the last dental visit and a greater average time between visits (Table P8.3). While 56.5% of people with no dental fear last visited the dentist in the previous 12 months, 46.2% of people who were very afraid of visiting the dentist reported last visiting within the previous year. Looking at average visiting frequency, 44.1% of people who rated themselves as very afraid visited the dentist less than once every two years on average compared to approximately 30% of individuals with no dental fear. In terms of future visiting patterns a similar trend was observed, with 76.9% of people who were very afraid expecting to make a dental visit in the next year, compared to 66.7% of people with no dental fear. In relation to when people expected to make their next dental visit, perhaps the most striking difference was that 27.6% of people who were very afraid of the dentist expected to make their next visit only when they experienced pain or a problem, compared to less than 17% of people with less dental fear. Almost 17% of the no dental fear group had an existing appointment to see a dentist compared to only 11.4% of the very afraid group.

People who were very afraid of visiting the dentist had significantly more teeth missing than did people with less extreme dental fear (Table P8.4). Confining analyses to the maxillary arch, people with the most dental fear had significantly more missing teeth than people with either no dental fear or a little dental fear. Similarly, those people who were very afraid of going to the dentist had significantly more missing teeth in the mandibular arch than those people who were not afraid, were a little afraid or were quite afraid of going to the dentist.

Higher self-rated dental fear was associated with significantly greater perceived need for fillings, tooth extraction, a scale and clean, a check-up, gum treatment, a dental crown or bridge and other treatment (Figure P8.2). There was a linear relationship between dental fear and perceived need for a filling, an extraction and gum treatment.
### Table P8.3

Dental visiting characteristics by dental fear

<table>
<thead>
<tr>
<th></th>
<th>Not afraid</th>
<th></th>
<th>A little afraid</th>
<th></th>
<th>Quite afraid</th>
<th></th>
<th>Very afraid</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
</tr>
<tr>
<td>Time since last dental visit**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 12 months</td>
<td>2,169</td>
<td>56.5</td>
<td>456</td>
<td>53.3</td>
<td>176</td>
<td>59.1</td>
<td>311</td>
<td>46.2</td>
</tr>
<tr>
<td>1 year to &lt; 2 years</td>
<td>682</td>
<td>17.8</td>
<td>186</td>
<td>21.7</td>
<td>54</td>
<td>18.1</td>
<td>134</td>
<td>19.9</td>
</tr>
<tr>
<td>2 years to &lt; 5 years</td>
<td>505</td>
<td>13.2</td>
<td>113</td>
<td>13.2</td>
<td>46</td>
<td>15.4</td>
<td>112</td>
<td>16.6</td>
</tr>
<tr>
<td>5 years to &lt; 10 years</td>
<td>237</td>
<td>6.2</td>
<td>52</td>
<td>6.1</td>
<td>12</td>
<td>4.0</td>
<td>53</td>
<td>7.9</td>
</tr>
<tr>
<td>&gt; 10 years ago</td>
<td>246</td>
<td>6.4</td>
<td>49</td>
<td>5.7</td>
<td>10</td>
<td>3.4</td>
<td>63</td>
<td>9.4</td>
</tr>
<tr>
<td>Average visiting frequency**</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>More than twice a year</td>
<td>976</td>
<td>26.6</td>
<td>189</td>
<td>22.7</td>
<td>82</td>
<td>29.4</td>
<td>107</td>
<td>17.2</td>
</tr>
<tr>
<td>Once per year</td>
<td>1,051</td>
<td>28.6</td>
<td>252</td>
<td>30.3</td>
<td>66</td>
<td>23.7</td>
<td>132</td>
<td>21.2</td>
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<tr>
<td>Once every 2 years</td>
<td>559</td>
<td>15.2</td>
<td>168</td>
<td>20.2</td>
<td>52</td>
<td>18.6</td>
<td>109</td>
<td>17.5</td>
</tr>
<tr>
<td>&gt; Once every 2 years</td>
<td>1,083</td>
<td>29.5</td>
<td>224</td>
<td>26.9</td>
<td>79</td>
<td>28.3</td>
<td>274</td>
<td>44.1</td>
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<tr>
<td>When expected to make next visit**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 6 months</td>
<td>2,182</td>
<td>58.7</td>
<td>511</td>
<td>61.2</td>
<td>181</td>
<td>61.6</td>
<td>348</td>
<td>54.0</td>
</tr>
<tr>
<td>6 months to &lt; 12 months</td>
<td>678</td>
<td>18.2</td>
<td>171</td>
<td>20.5</td>
<td>57</td>
<td>19.4</td>
<td>82</td>
<td>12.7</td>
</tr>
<tr>
<td>1 year to &lt; 2 years</td>
<td>129</td>
<td>3.5</td>
<td>24</td>
<td>2.9</td>
<td>6</td>
<td>2.0</td>
<td>24</td>
<td>3.7</td>
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<tr>
<td>2 years to &lt; 5 years</td>
<td>69</td>
<td>1.9</td>
<td>8</td>
<td>1.0</td>
<td>5</td>
<td>1.7</td>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>Greater than 5 years</td>
<td>35</td>
<td>1.0</td>
<td>3</td>
<td>0.3</td>
<td>4</td>
<td>1.3</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>Only for pain or a problem</td>
<td>626</td>
<td>16.8</td>
<td>118</td>
<td>14.1</td>
<td>41</td>
<td>13.9</td>
<td>178</td>
<td>27.6</td>
</tr>
<tr>
<td>Has an appointment for a future dental visit*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>664</td>
<td>17.2</td>
<td>129</td>
<td>15.0</td>
<td>55</td>
<td>18.5</td>
<td>77</td>
<td>11.4</td>
</tr>
<tr>
<td>No</td>
<td>3,191</td>
<td>82.8</td>
<td>731</td>
<td>85.0</td>
<td>243</td>
<td>81.5</td>
<td>598</td>
<td>88.6</td>
</tr>
</tbody>
</table>

* $\chi^2 < 0.05$, ** $\chi^2 < 0.01$, *** $\chi^2 < 0.001$

Note: Dentate refers to at least one natural tooth present in the mouth
Table P8.4

Mean number of teeth missing due to dental caries by dental fear

<table>
<thead>
<tr>
<th>Afraid of the dentist</th>
<th>Maxillary arch</th>
<th>Mandibular arch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Not at all</td>
<td>2.73\textsuperscript{a}</td>
<td>4.02</td>
</tr>
<tr>
<td>A little</td>
<td>2.60\textsuperscript{b}</td>
<td>3.68</td>
</tr>
<tr>
<td>Yes, quite</td>
<td>3.01</td>
<td>4.15</td>
</tr>
<tr>
<td>Yes, very</td>
<td>3.61\textsuperscript{a,b}</td>
<td>4.66</td>
</tr>
</tbody>
</table>

F = 9.76, p < 0.001
F = 9.01, p < 0.001

Note: Superscripts indicates significant Scheffe post-hoc differences, p < 0.05.

Figure P8.2. Perceived treatment needs by dental fear.
The distribution of responses to questions assessing the social impact of problems with the teeth, mouth or dentures of people with different levels of dental fear are shown in Figure P8.3. Dental fear was associated with a higher prevalence of toothache ($\chi^2 = 64.35, p = 0.001$), more discomfort with the appearance of teeth, mouth or dentures ($\chi^2 = 184.16, p < 0.001$), more frequent food avoidance due to dental problems ($\chi^2 = 108.11, p < 0.001$), finding life less satisfying because of dental problems ($\chi^2 = 127.12, p < 0.001$) and more trouble sleeping as a result of dental problems ($\chi^2 = 78.15, p < 0.001$). Not only did people with very high dental fear report these impacts more often than did people with lower fear, but the ratings were more extreme with more people with very high fear stating that these social impacts occurred ‘very often’ than did people with less or no dental fear.

Participants made a global assessment of their oral health in response to the question “How would you rate your own dental health?” Just over 45% of people with no dental fear rated their dental health as being excellent or very good compared to 30.9% of people who were very afraid of going to the dentist (Figure P8.4). Conversely, people with the most dental fear were more likely to rate their dental health as average, poor or very poor (36.4%) in contrast to people who were not afraid, a little afraid or quite afraid (17.7%, 22.2% and 28.3% respectively). The association between dental fear and self-rated oral health was statistically significant, $\chi^2 = 178.95, p < 0.001$

Some 61.3% of people who were very afraid of going to the dentist reported that the reason for their most recent visit in the last 12 months was for a problem, compared to 47.2% of people with no dental fear, 53.5% of people with a little fear and 59.4% of people who were quite afraid of going to the dentist ($\chi^2 = 31.09, p < 0.001$). In addition, 67.3% of people with very high dental fear reported that their usual reason for a dental visit was for a problem compared with only 44.9% of people with no dental fear, 47.1% with a little fear and 45.8% who were quite afraid ($\chi^2 = 121.03, p < 0.001$). Of those people who usually visited the dentist for a problem 72.3% of people who were very afraid of going to the dentist stated that the problem was usually for the relief of pain, compared to 54.7% of people with no dental fear, 67.2% with a little fear and 61.7% who were quite afraid ($\chi^2 = 57.72, p < 0.001$).
Figure P8.3. Psychosocial impacts of problems with teeth, mouth, or dentures during the previous 12 months by dental fear.
Given that dental fear showed a relationship with delayed visiting patterns, poorer dental health and symptom-driven treatment, justification was provided for examining the cyclical process that is proposed as characterising the maintenance of dental fear. Specifically, we examined the relationship between fear and delayed visiting, the relationship between delayed visiting and dental problems, the relationship between dental problems and symptom-driven treatment, and finally the relationship between symptom-driven treatment and fear. Complete information on delayed visiting, dental problems, and usual reason for visiting was available for the 3,615 non afraid, 826 a little afraid, 271 quite afraid and 612 very afraid individuals.

People with high dental fear were significantly more likely to have a delayed visiting pattern, with a significantly higher percentage last visiting a dentist at intervals of greater than 2 years (43.9%) in comparison to people who were not, a little or quite afraid.
(29.1%, 26.5% and 27.7% respectively), \(\chi^2 = 62.65, p < 0.001\). In turn, those people with a longer time since their last dental visit had significantly more dental problems. People who last visited the dentist more than two years previously were significantly (Chi-square tests, \(p < 0.001\)) more likely to perceive themselves as needing a filling (39.4%), an extraction (18.6%) or gum treatment (12.6%) in contrast to people who had last visited within 2 years (23.7%, 7.3%, and 7.9% respectively). Of those people who perceived themselves as in need of dental treatment, determined here by anybody who responded that they needed either a filling, an extraction or gum treatment, 61.1% usually visited the dentist for an emergency treatment in comparison to 36.8% of people without a perceived need for a filling, extraction or gum treatment, \(\chi^2 = 330.58, p < 0.001\). Finally, a significantly greater percentage of people who usually visit the dentist for an emergency were very afraid of going to the dentist (16.3%), compared to people who normally visit for a check-up (7.3%), \(\chi^2 = 106.02, p < 0.001\).

A graphical presentation of the concept of a vicious cycle for the four fear groups is shown in Figure P8.5. The figure shows the number and percentage of people in each fear group, after each component of the vicious cycle, who still fit the profile at that given point in the cycle. Overall, 179 people or 29.2% of those who were very afraid of going to the dentist fitted the profile of having delayed dental visiting, dental problems, and symptom-driven treatment seeking. This can be contrasted to the 11.6% of the group with no dental fear who exhibited the same characteristics.

Because dental fear was shown to vary by individual characteristics (see Table P8.2), a multivariate logistic regression was carried out to see if the difference between dental fear groups in fitting a vicious cycle profile was accounted for merely by differences in socio-demographic and dentate status variables between groups with differing levels of dental fear. The odds ratio of very fearful individuals having delayed dental visiting, dental problems, and symptom-driven treatment seeking was 3.33 (95% confidence interval 2.67–4.15) that for people without dental fear (Table P8.5). This effect for dental fear was statistically significant even though sex, dentate status, employment status and annual household income exhibited significant associations with fitting a profile consistent with being part of a vicious cycle. The odds ratios for people who were a little afraid or quite afraid of going to the dentist (ORs = 1.24 and 1.40 respectively) were in the expected direction but not statistically significant.
Figure P8.5. Following the path of the vicious cycle by categories of dental fear
Table P8.5

Logistic regression model of characteristics associated with a vicious cycle profile (having delayed dental visiting, dental problems and symptom-driven treatment)

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>Confidence interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fear of going to the dentist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not afraid (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A little afraid</td>
<td>1.24</td>
<td>0.97-1.59</td>
<td>0.087</td>
</tr>
<tr>
<td>Quite afraid</td>
<td>1.40</td>
<td>0.96-2.04</td>
<td>0.079</td>
</tr>
<tr>
<td>Very afraid</td>
<td>3.33</td>
<td>2.67-4.15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.96</td>
<td>1.63-2.36</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–24 (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–39</td>
<td>1.28</td>
<td>0.95-1.73</td>
<td>0.100</td>
</tr>
<tr>
<td>40–64</td>
<td>0.99</td>
<td>0.74-1.32</td>
<td>0.918</td>
</tr>
<tr>
<td>65+</td>
<td>1.10</td>
<td>0.75-1.61</td>
<td>0.642</td>
</tr>
<tr>
<td>Dentate status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edentulous (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dentate</td>
<td>1.71</td>
<td>1.25-2.35</td>
<td>0.001</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student/retired (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>1.49</td>
<td>1.09-2.03</td>
<td>0.013</td>
</tr>
<tr>
<td>Part-time</td>
<td>1.48</td>
<td>1.05-2.07</td>
<td>0.023</td>
</tr>
<tr>
<td>Full-time</td>
<td>1.62</td>
<td>1.18-2.22</td>
<td>0.003</td>
</tr>
<tr>
<td>Annual household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $20,000 (Ref.)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20,001 – $50,000</td>
<td>0.64</td>
<td>0.50-0.82</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>$50,001 – $80,000</td>
<td>0.48</td>
<td>0.36-0.64</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Greater than $80,000</td>
<td>0.32</td>
<td>0.23-0.45</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Discussion

It was proposed that a vicious cycle exists in relation to dental fear whereby the behavioural and symptomatic consequences of dental fear ultimately lead to its maintenance and possible exacerbation. While causality can obviously not be established in a study such as this, the results of the current study are consistent with the notion of a vicious cycle of dental fear whereby the delaying of dental visits is related to increased dental problems which is related to increased invasive emergency treatment which, in turn, is related to greater dental fear and anxiety. A significant association was shown for each link in the proposed vicious cycle.

Dental fear was found to be related to less frequent dental visiting, whether measured by past behaviour or future intentions, more prevalent dental problems, whether assessed by the number of teeth missing, perceived need, social impact or self-rated oral health, and symptom-driven treatment as measured by a person’s usual reason for visiting. These findings support those of a number of other studies both within Australia and elsewhere. In Australia, for example, Thomson et al. found higher dental fear for people who last visited the dentist more than 2 years ago, who usually visited for a problem, and who experienced social impacts resulting from their oral health state [5].

People who were very afraid of going to the dentist had more missing teeth than did people with less or no fear. The number of missing teeth has previously been found to be a more sensitive marker of dental fear than the traditional measure of the number of decayed, missing or filled teeth (DMFT). For instance, Schuller et al. found that while there was no statistically significant difference between the DMFT scores of individuals with high or low dental fear, the number of missing teeth was almost 50% higher among high dental fear than among low dental fear people [6]. This was interpreted as a preference for high fear people to have their teeth extracted instead of restored. However, it is also possible that the increased number of teeth extracted might be as a result of differences in the progression of carious lesions between people with high and low fear when they finally seek treatment. This fits well with the belief of Bouma et al. that if the vicious cycle of fear, treatment need and negative treatment experience is not broken the eventual consequence is full mouth extraction [14].
In many countries, use of dental services may be strongly related to access to oral health care. In Australia, at least theoretically, dental services are universally available. Publicly funded dental care, however, is rationed and available to those earning less than a specified income, who are on an invalid or old-age pension or who are war veterans. About one-quarter of Australians are eligible to receive public-funded dental care [19]. Income strongly affects access to services in relation to both private dental services and public dental care which may be characterised by lengthy waiting lists. It is therefore not surprising that this study found household income to be significantly associated with the vicious cycle phenomenon. People on lower income invariably have both increased oral disease experience and more barriers to accessing dental care. Nonetheless, even after controlling for household income, dental fear was significantly associated with having characteristics associated with a vicious cycle.

Numerous studies support the idea that dental fear can result from previously traumatic or negative dental experience [28-31]. The subsequent association of dental visiting with aversive consequences is an example of classical conditioning learning. However, cognitive factors are suggested by findings that many highly anxious people can not recall an aversive event which might explain the origin of their dental anxiety [32]. In relation to other fears, the perception of vulnerability associated with the feared object is seen as critical in the determination of fear [33]. Avoidance of dental visits not only leads to the potential progression of caries or periodontal disease but also prevents people from ‘extinguishing’ the anxious or fearful state as a result of non-traumatic dental experiences.

One of the major limitations of this study is its cross-sectional design, which means that causality cannot be inferred from the results. While the results provide support for the existence of a vicious cycle in relation to dental fear, no information was available on the temporal sequencing of events. In order to test for causality a longitudinal study design is required, and this is currently being planned by the authors. However, interpretation of results from this study should be tempered by the realisation that more research is required before the causality implied by the term ‘vicious cycle’ is confirmed.

Interestingly, 12.9% of people with no dental fear also fitted the profile described by a vicious cycle of dental fear. It is likely that these people fall into the avoidance-problem-symptomatic visiting pattern as a result of different set of reasons. Research has shown that many people delay dental visiting due to issues of cost [19, 34], perceived time restraints [35] or out of apathy or lack of interest [36, 37]. These factors may have
affected service utilization by low-fear people in the current study, with implications similar to those of high-fear people who have infrequent dental service utilization. This study found that 40% of people with no dental fear who had delayed dental visiting patterns also had a perceived dental problem and usually visited for a problem. Not visiting a dentist is related to having dental problems regardless of dental fear, although a difference in negative outcome is evident across dental fear groups.

Another interesting finding was that almost 70% of people who described themselves as being very afraid of going to the dentist did not have delayed dental visiting, a perceived problem and symptomatic visiting patterns. It is certainly not the case that having high dental fear is a necessary and sufficient precondition for poor oral health outcomes. Indeed, the percentage of very fearful individuals fitting a vicious cycle profile would most likely be much higher if people with dental phobias rather than just dental fears were examined. The Diagnostic and Statistical Manual of Mental Disorders [38] distinguishes phobia from fear on the basis of the feared stimulus being avoided, or else endured with intense distress, and that the fear or avoidance results in significant impairment or distress. Given that about two-thirds of all people indicating a high dental fear also reported visiting the dentist on average at least once every two years, there is good reason to believe that although these people might have reported being very afraid of going to the dentist the majority of them would not be classified as being dentally phobic. Indeed, it is precisely those people who reported high dental fear, avoidance of visiting the dentist and significant social and functional impacts, who appear to meet the criteria for dental phobia.

Another factor that may play a central role in differentiating very dentally fearful people who fit the vicious cycle profile from those who do not is differential use of coping strategies. However, and despite a well-developed literature on coping in relation to many pain and anxiety disorders, very little work has looked at coping strategies and dental fear. In regards to children, it appears that the level of dental fear and the experience with pain at the dentist is significantly associated with both ability to cope and with choice of coping strategies [39]. Distraction is often used as a technique in dental clinics to ameliorate fear, and findings that self-distraction is one of the most common child coping strategies [39] is consistent with research showing a relationship between dental anxiety and a disposition in children to monitor or attend to threat-relevant information during a dental examination [40]. However, dental coping strategies are not straightforward, and vary by age, dental
anxiety and previous pain experience [41]. It would be of significant benefit to further develop and extend this work using both children and adults, as better understanding coping strategies for dentally fearful people may lead to significant improvements in both dental service utilization and oral health.

One limitation of this study was the use of the single-item DAQ to measure dental fear. Although this item has previously proved useful and is convenient for a telephone interviewing survey where brevity is an issue, there are other measures that might have been usefully employed. For example, the summary item from the Dental Fear Survey [42] has previously been employed in telephone surveys [43]. Also, the 4-item Dental Anxiety Scale [44] has been extensively used as an epidemiological measure of trait dental anxiety and has good psychometric properties and considerable normative data. It must be recognised that while single-item measures often relate well to full-scale scores and can be used to obtain a reasonably reliable estimate of global fear, they are generally poorly equipped to assess the many nuances and dimensions that characterise dental fear and for this reason psychometrically sound multi-item scales are preferred.

Apart from the roles that delaying dental visiting and subsequent invasive treatments are proposed to have on heightening or maintaining dental fear, a number of researchers have stressed the importance of escalating psychological factors in contributing to a vicious cycle of dental fear. For instance, catastrophizing ideations have been found among people with dental fear [45] and this is believed to impact on both the physical and emotional distress experienced during a dental examination [46] and on the perceived pain of treatment [47, 48]. It has also been argued that a strong sense of embarrassment, especially following many years of avoidance, related to feelings of self-punishment, shame and negative self-image may be an important aspect of a vicious cycle of dental anxiety [15, 18]. While this paper did not look at these various psychological factors, it is quite likely that these and other cognitive and emotional components help to facilitate the progression in the vicious cycle involving fear and dental decay.

This study found almost one in three people with high dental fear fit the profile hypothesised by a vicious cycle of dental fear, having delayed dental visiting, poorer oral health and symptomatic dental visiting patterns. The idea of a vicious cycle of dental fear can be used to describe the specific clustering of detrimental behavioural and oral health outcomes in some people, which may serve to perpetuate or even exacerbate the anxiety and fear associated with dental visiting. In future research there may be value in
attempting to differentiate between people with high dental fear and those who might have potentially diagnosable dental phobia as well as look at differences in coping strategies of both high- and low-fear people and of high-fear people who fit a vicious cycle profile and high-fear people who manage to maintain regular dental visiting patterns.

Conclusions

This study found a relatively high prevalence of 11.9 percent of people with very high dental fear in a large, representative, national sample of the Australian population. Extrapolated to the population, this equates to about two and a half million Australians suffering very high dental fear and reconfirms the scope of the problem facing dentists and policy makers in improving the generally poor oral health of, and symptom-oriented treatment received by, these people. Individuals with dental fear represent a particularly difficult population to treat and present special challenges to dental staff in terms of the management of care. While efforts are being made to reduce the incidence of dental fear among younger Australians who may be visiting the dentist for the first time, a concerted effort is also required to break what appears to be a vicious cycle of dental fear and provide assistance to those individuals with established fear-avoidance patterns.

Competing interests

The authors declare that they have no competing interests.

Acknowledgements

The study from which this paper was derived was funded by the Australian Commonwealth Department of Health and Aged Care.
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CHAPTER 12 (PAPER 9) – A PRELIMINARY
INVESTIGATION OF THE RELATIONSHIP OF DENTAL
FEAR TO OTHER SPECIFIC FEARS, GENERAL
FEARFULNESS, DISGUST SENSITIVITY AND HARM
SENSITIVITY

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Statement of authorship

A PRELIMINARY INVESTIGATION OF THE RELATIONSHIP OF DENTAL FEAR TO OTHER SPECIFIC FEARS, GENERAL FEARFULNESS, DISGUST SENSITIVITY AND HARM SENSITIVITY

Community Dentistry and Oral Epidemiology

Armfield J.M. (Candidate)

Designed study, collected data, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ................................................................. Date: ................................
Linkage of paper to body of research

One of the underlying determinants of a person’s cognitive schema related to any given stimulus is their personality or disposition. People who have low perceived control and a strong desire for control, who exhibit strong harm or disgust sensitivities, and who have a predilection for certainty and predictability, may be more likely to have concerns over the controllability, dangerousness, disgustingness or unpredictability respectively of a number of different stimuli, resulting in the development of fears and anxieties. Indeed, Study 5 demonstrated just this, with vulnerability perceptions central to the proposed vulnerability schema mediating the association between personality traits and spider fear.

Given the changing focus of this thesis to an examination of dental fear it was considered worthwhile to examine the association between dental fear and personality characteristics related to control and danger, two domains considered to be especially important in relation to dental fears. In addition, it was decided to examine how dental fear fits with other common fears by undertaking a factor analysis of a common multi-item fear scale. Traditionally, dental fear has been seen as a medical fear, which would indicate it shares similarities with other blood-injection-injury fears. However, there is good reason to believe that other factors might also be important in dental fear, and that it may in actual fact be related to fears sharing certain other characteristics relating to danger or control.
Introduction to paper and additional information

Data for this paper were also used in the earlier study in Chapter 8 (Paper 5). In that study, personality variables were related to specific vulnerability perceptions of spiders which were related to fear of spiders. However, because dental fear was assessed as part of the Geer Fear Survey Schedule, it allowed for the examination of the association of dental fear with personality variables in the current study. In particular, control and danger were selected because they have often in the literature been associated with dental fear. This is not to deny the importance of predictability and disgust, however. Study 10, for example, examines the relationship of perceptions of uncontrollability, unpredictability and dangerousness in dental fear, and finds strong bivariate associations. Future investigations will look at disgust as well.

Abstract

Objectives: People with dental fear often suffer from other psychological disorders as well as from a number of other specific fears. Fear of going to the dentist may be associated not only with general fearfulness, but also with underlying personality dispositions. This exploratory study therefore investigated the associations between dental fear and 67 other specific fears, general fearfulness, disgust sensitivity and harm sensitivity. Methods: Participants were 88 Australian adults who were administered the Fear Survey Schedule III (FSS-III), the Harm Sensitivity Index and the Disgust Sensitivity Index. Principal axis factor analysis with Promax rotation was used to examine how dental fear related to other specific fears as measured with the FSS-III. Results: Dental fear was significantly correlated with most of the other specific fears, with factor analysis indicating that it tended to load more with fears related to lack of control rather than with what have often been classed as ‘medical’ fears. Significant associations were found between dental fear and the personality dispositions of general fearfulness, harm sensitivity and disgust sensitivity, although these associations were not linear. Conclusions: Findings reveal extensive co-occurrence of other specific fears with dental fear, while the associations of dental fear with personality traits suggest enduring aspects to dental fear which may translate into difficulties in fear alleviation. Dental fear was more related to a diverse range of fears relating to a loss of control than to medical-specific fears.
Introduction

Recent epidemiological studies have reported the prevalence of high dental fear in Western countries to be about 10–15% (1-3). People with high dental fear have poorer oral health (2, 4) and often suffer significant social and psychological impacts associated with their oral state (1, 5). In addition, people with high dental fear often delay dental visiting and, as a result, may experience a further deterioration in oral health and more traumatic and invasive treatment when they are eventually forced to see a dentist, leading to a maintenance or increase in their level of dental anxiety.

People with high dental fear, or dental phobias, may also suffer from a variety of anxiety disorders, mood disorders, personality disorders and behavioural disorders as well as from multiple other specific fears (6, 7). These co-occurring fears can be determined by instruments such as the Fear Survey Schedule III (FSS-III) (8) that ask people to report their fear of a large number of items and situations. Factor analysis of the FSS-III and its variants has generally found that fear of going to the dentist groups with what are often called ‘medical fears’ (9-12). However, the relationship between dental fear and other specific fears has yet to be firmly established. For instance, the combination of fears loading on to the ‘medical fear’ factor appears to vary across studies (10, 13, 14) and the relationship of dental fears to these other medical fears has not been made explicit in the reported results.

It has been proposed that dental fears can be classified as either exogenous or endogenous (15). Exogenous fear is believed to be based on conditioned responses to aversive experiences, whereas endogenous dental fear reflects a constitutional vulnerability to anxiety disorders and multiple fears (7). In support of the concept of endogenous fear, studies have found a high prevalence of other specific fears among dentally fearful individuals (6, 16). For example, among patients with extreme dental fear, Berggren (1992) found high percentages with fears of suffocation (53%), pain (49%), death of a loved one (43%), hypodermic needles (37%), untimely or early death (35%), sharp objects (33%), death (32%), heights (32%) and other stimuli (16).

A predisposition for general fearfulness can be seen as an aspect of a person’s general temperament or personality. Although there has been relatively little research into the relationship between personality traits and dental fear, there is at least theoretical
support for this association. There is, for example, evidence that pain sensitivity is related to dental fear (17). Certainly the experience of dental pain is considered to be highly aversive (18) and even patients undergoing routine restorative procedures frequently report pain (19, 20). Gross (1992) believes that pain sensitivity interacts with pain expectancies in dental situations resulting in fear and subsequent dental avoidance. Given that highly fearful dental patients have an overestimated fear of dental pain (21), it is quite plausible that pain sensitivity is an important component of expectations of and reactions to dental procedures.

An interesting possibility is that disgust sensitivity is also related to dental fear. Recent research indicates that disgust plays an important role in some anxiety disorders (22). Of particular relevance to dentistry is the relationship between disgust and anxiety in blood-injury-injection (BII) fears (23). BII fears form one of the four primary subtypes of specific phobias as classified by the Diagnostic and Statistical Manual of Mental Disorders IV (24) and relate to fear cued by seeing blood or an injury or by receiving an injection or other invasive medical procedure. There is considerable evidence attesting to the fear of needles experienced by many dentally phobic individuals (25, 26). It might be expected therefore that individuals with dental fear may also demonstrate disgust sensitivity. Indeed, Merckelbach and colleagues found that both dentally anxious and dental phobic individuals had higher disgust sensitivity than a sample of undergraduate students with less dental fear (27). Yet, they concluded that their data indicated that disgust sensitivity plays only a minor role in BII-related fears such as dental anxiety. A major limitation of this study, however, was that disgust sensitivity was measured using a scale that focused purely on concerns about food contamination and this may not represent a good index of general disgust sensitivity. It is important, therefore, that the specific association between fear of going to the dentist and disgust sensitivity be investigated further.

A theoretical model relating personality traits to dental fear is presented in Figure P9.1. Personality traits, such as disgust and pain sensitivity among others, are seen as impacting upon dental fear via perceptions of the dental situation. These proposed associations are based on a model of the etiology of fear presented by Armfield (28). This model proposes that anxiety and fear in relation to any given object or situation is a direct function of the perception of the object or situation as uncontrollable, unpredictable, dangerous and disgusting. These perceptions contribute to an overriding sense of vulnerability in regards to the stimulus and are the result of an accumulation of
experiences modified by personality traits related to the specific cognitive vulnerability variables. According to this model of the etiology of fear, personality traits such as pain sensitivity and disgust sensitivity can form part of the causal chain of the origin of dental fear.

This study represents a preliminary attempt to determine the relationship between dental fear and the personality predispositions of general fearfulness, pain sensitivity and disgust sensitivity. In addition, it sought to examine dental fear as it relates to a broad range of other specific fears.

![Figure P9.1. Proposed model of relationships between personality traits and dental fear](image)

**Materials and Methods**

**Participants**

The study involved 88 adult undergraduate psychology students in Adelaide, South Australia. There were 68 females (77.3%) and 19 males (21.6%) with one person not indicating his or her sex. The age of participants ranged from 18–53 years (mean = 23.3 years; SD = 8.54). Ethical approval for the study was obtained and participation in the study was voluntary.
**Dental fear and other specific fears**

Fear of dentists was assessed using the single item from the Fear Survey Schedule - III (FSS-III), which asked how much fear people have of dentists. A more comprehensive multi-item measure of dental fear was not used as this would have restricted the comparability of the factorial analysis of the FSS-III with that of other studies. Although the FSS-III originally comprised of 72 items measuring 6 domains of fear-relevant stimuli (8), social anxiety-evoking stimuli were excluded from the scale in the current study because they belong more correctly to social phobias and additional items from a subsequent Australian revision (10) were added, creating a total of 68 items. Participants were asked to indicate, for each item or situation, “…how much actual fear (not dislike or disgust) you have of it nowadays.” Answers were scored from 1 (None at all) to 5 (Very much). A general fearfulness score was obtained by calculating the mean fear score across all items (excluding the dental fear item) while a measure of high fearfulness was obtained by summing the number of items (again, excluding the dental fear item) with a fear response of 3 or greater (‘A moderate amount’, ‘Much’ or ‘Very much’).

**Harm sensitivity**

The Harm Sensitivity Index (HSI) was created by combining items from the Pain Sensitivity Index (17) and the Pain Anxiety Symptoms Scale (29), in addition to some newly developed items. The scale comprised 16 items measuring feelings about and reactions to pain and danger. Example items were: ‘It is important for me to avoid any pain’ and ‘I worry about getting hurt’. Responses range from 1 (Not at all) to 7 (Very much).

**Disgust sensitivity**

The Disgust Sensitivity Scale (30) is a modified 28-item scale measuring six domains of disgust elicitors (Food, Animals, Body products, Body envelope violations, Death, & Hygiene). One of the original disgust domains (Sex; four items) was excluded because of its potentially offensive nature. The scale is presented in two sections: Section 1 contains 14 statements with True/False responses (scored 0 or 3); Section 2 presents 14 situations and requires people to rate how disgusting they would find the situation to be.
on a 4-point scale, with responses ranging from 0 (not disgusting at all) to 3 (very disgusting).

**Statistical analysis**

Exploratory factor analysis was conducted on the 68-item FSS-III using Principal Axis Factor extraction with Promax (κ = 4) rotation and Keiser Normalization. The goal was to identify underlying latent constructs that explain the relationships between the observed variables. Factor analysis is considered to be the appropriate statistical technique for this task (31, 32). An oblique rotation method was employed as there has been no empirical support for the assumption that fears are uncorrelated (10). Because there is no completely accurate method to determine the number of factors to retain, the use of multiple decision rules is desirable. Interpretation of the Scree plot, considerations from previous research, the need to balance simplicity with good representation of the data, as well as factor interpretability were used to guide decisions on the number of factors to be extracted. Based on previous research, factor solutions with between three and seven factors were examined and interpreted. In accordance with recommendations (32), factor loadings of 0.32 or greater were considered to indicate salient factors.

Dental fear was categorised to create three fear groups corresponding to ‘None at all’, ‘A little’ and ‘A moderate amount, Much or Very much’. One-way analyses of variance, with post hoc comparisons used Scheffe’s corrections, were used to test for differences in general fearfulness, disgust sensitivity and harm sensitivity across the three groups. Pearson’s correlation coefficients were computed to examine the linear associations between dental fear and other specific fear items.
Results

Dental fear and other specific fears

Before examining the factor structure of the FSS-III, the data were analysed to assess appropriateness for factor analysis. Communalities for extracted variables were all well below one, indicating the absence of singularity and multicollinearity. In addition, Bartlett’s Test of Sphericity was significant ($\chi^2 = 5387.63, p < .001$). However, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was only .43, which does not exceed the suggested cutoff of .60 (32).

Examination of the Scree plot indicated that a 5- or 6-factor solution might best fit the data. However, because previous research has indicated differing numbers of factors for the FSS-III and for the Fear Survey Schedule for Children, a range of factor solutions were examined. Table P9.1 presents summaries of the adequacy of 3- through 7-factor solutions. While solutions with fewer factors contained higher numbers of non-salient items, solutions with higher numbers of extracted factors contained increasing numbers of complex items, making interpretability more difficult. Both examination of the factor solutions in Table P9.1 and interpretation of the meaningfulness of the structure matrix of the principle axis factor analyses indicated that the best fitting outcome involved a 5-factor solution. These factors accounted for 49.3% of the variance in loadings with all but 6 of the 68 items having rotated loadings greater than 0.32. Chronbach’s alpha was used to test the internal consistency of the extracted factors, with all factors showing good internal reliability (alphas = .92, .92, .86, .87 and .84 respectively). A number of factor correlations exceeded .32, indicating in excess of 10% overlap in variance among factors and confirming the appropriateness of employing an oblique rather than an orthogonal rotation procedure. To examine the stability of the five-factor solution, principle components analysis (PCA) with both Varimax and Promax rotation was also computed. Overall, the same five conceptual factors emerged.
Table P9.1

Characteristics of factor solutions using principal components extraction and promax rotation

<table>
<thead>
<tr>
<th>Number of factors extracted</th>
<th>Total percentage of variance explained</th>
<th>Number of complex items</th>
<th>Number of non-salient items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three</td>
<td>39.93</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Four</td>
<td>45.13</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Five</td>
<td>49.28</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Six</td>
<td>52.68</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Seven</td>
<td>55.98</td>
<td>22</td>
<td>4</td>
</tr>
</tbody>
</table>

\(^a\) \kappa = 4.

\(^b\) Complex items have pattern loadings \geq 0.32 on two or more factors.

\(^c\) Non-salient items have pattern loadings \leq 0.32 on all extracted factors.

Examination of the factor loadings from the five-factor solution revealed significant differences from previous investigations. The pattern loadings for the five-factor solution are shown in Table P9.2. Fear of dentists loaded highest on Factor I with a diverse group of items that were interpreted as relating to situations or objects involving lack of control rather than on Factor II that comprised items often classified as medical-related fears. Indeed, Factor II appeared to have more to do with blood-injury-illness and disgust-related fears than with medical/injury fears per se, which might explain why fear of doctors loaded highest on Factor III rather than on Factor II.

While 43.2% of people expressed no fear of the dentist, 34.1% indicated a little fear, 12.5% a moderate amount of fear, 8.0% much fear, and 2.3% indicated extreme fear. There were significant correlations between dental fear and a wide range of other FSS-III items (Table P9.2). Although dental fear correlated moderately with items such as fear of receiving an injection ($r = 0.42$) and fear of the prospect of a surgical operation ($r = 0.45$), it also had moderate correlations with numerous items unrelated to dental procedures, such as fear of cockroaches ($r = 0.61$), failure ($r = 0.52$), wasps or bees ($r = 0.50$), lightning ($r = 0.47$), doctors ($r = 0.47$), darkness ($r = 0.45$) and weapons ($r = 0.44$).
Table P9.2

Structure loadings for the five-factor solution with promax rotation and correlations of dental fear with each item

<table>
<thead>
<tr>
<th>Factors and items</th>
<th>Pattern matrix factor loadings</th>
<th>Corr. with dental fear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor I</td>
<td>Factor II</td>
</tr>
<tr>
<td>Factor I. &quot;Fears involving loss of control&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure</td>
<td>.69</td>
<td>-.04</td>
</tr>
<tr>
<td>Seeing a fight</td>
<td>.63</td>
<td>.03</td>
</tr>
<tr>
<td>Making mistakes</td>
<td>.61</td>
<td>-.09</td>
</tr>
<tr>
<td>Losing control of yourself</td>
<td>.60</td>
<td>-.28</td>
</tr>
<tr>
<td>Being in a strange place</td>
<td>.60</td>
<td>.03</td>
</tr>
<tr>
<td>Darkness</td>
<td>.60</td>
<td>-.04</td>
</tr>
<tr>
<td>Fire</td>
<td>.59</td>
<td>.19</td>
</tr>
<tr>
<td>Falling</td>
<td>.57</td>
<td>.30</td>
</tr>
<tr>
<td>Loud voices</td>
<td>.53</td>
<td>-.06</td>
</tr>
<tr>
<td>Sudden noises</td>
<td>.52</td>
<td>.09</td>
</tr>
<tr>
<td>One person bullying another</td>
<td>.51</td>
<td>-.11</td>
</tr>
<tr>
<td>Weapons</td>
<td>.51</td>
<td>-.03</td>
</tr>
<tr>
<td>Sight of deep water</td>
<td>.50</td>
<td>-.19</td>
</tr>
<tr>
<td>Dentists</td>
<td>.43</td>
<td>.13</td>
</tr>
<tr>
<td>Being alone</td>
<td>.43</td>
<td>.17</td>
</tr>
<tr>
<td>Thunder</td>
<td>.41</td>
<td>.03</td>
</tr>
<tr>
<td>Enclosed places</td>
<td>.39</td>
<td>.15</td>
</tr>
<tr>
<td>Sick people</td>
<td>.39</td>
<td>.36</td>
</tr>
<tr>
<td>Heights</td>
<td>.33</td>
<td>.17</td>
</tr>
<tr>
<td>Factor II: &quot;Blood-injection-injury and disgust-related fears&quot;</td>
<td>.48*</td>
<td></td>
</tr>
<tr>
<td>Blood (human or animals)</td>
<td>-13</td>
<td>.82</td>
</tr>
<tr>
<td>Open wounds</td>
<td>.12</td>
<td>.75</td>
</tr>
<tr>
<td>Seeing other people injected</td>
<td>.01</td>
<td>.75</td>
</tr>
<tr>
<td>Witnessing surgical operations</td>
<td>-.09</td>
<td>.71</td>
</tr>
<tr>
<td>Receiving injections</td>
<td>.13</td>
<td>.70</td>
</tr>
<tr>
<td>Medical odours</td>
<td>-.23</td>
<td>.66</td>
</tr>
<tr>
<td>Dead people</td>
<td>.29</td>
<td>.61</td>
</tr>
<tr>
<td>Hospitals</td>
<td>-.02</td>
<td>.59</td>
</tr>
<tr>
<td>The prospect of a surgical operation</td>
<td>.15</td>
<td>.58</td>
</tr>
<tr>
<td>Cats</td>
<td>-.36</td>
<td>.46</td>
</tr>
<tr>
<td>Cemeteries</td>
<td>.10</td>
<td>.43</td>
</tr>
<tr>
<td>Dead animals</td>
<td>.20</td>
<td>.43</td>
</tr>
<tr>
<td>People with deformities</td>
<td>-.10</td>
<td>.38</td>
</tr>
<tr>
<td>Sharks</td>
<td>.26</td>
<td>.34</td>
</tr>
<tr>
<td>Journeys by aeroplane</td>
<td>.16</td>
<td>.33</td>
</tr>
<tr>
<td>People who seem insane</td>
<td>.22</td>
<td>.31</td>
</tr>
<tr>
<td>Sirens</td>
<td>.23</td>
<td>.29</td>
</tr>
</tbody>
</table>

Note: Bold indicates a salient (≥.32) loading; * p < 0.05
Table P9.2 cont.

Structure loadings for the five-factor solution with promax rotation and correlations of dental fear with each item

<table>
<thead>
<tr>
<th>Factors and items</th>
<th>Pattern matrix factor loadings</th>
<th>Corr. with dental fear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor I</td>
<td>Factor II</td>
</tr>
<tr>
<td>Factor III: “Fears related to possible precursors of harm or illness”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journeys by bus</td>
<td>-.13</td>
<td>-.00</td>
</tr>
<tr>
<td>Journeys by car</td>
<td>-.12</td>
<td>.10</td>
</tr>
<tr>
<td>Fish</td>
<td>-.07</td>
<td>.13</td>
</tr>
<tr>
<td>Crossing streets</td>
<td>.00</td>
<td>.28</td>
</tr>
<tr>
<td>Dull weather</td>
<td>.11</td>
<td>-.11</td>
</tr>
<tr>
<td>Being in an elevator</td>
<td>-.14</td>
<td>.16</td>
</tr>
<tr>
<td>Dogs</td>
<td>.07</td>
<td>-.06</td>
</tr>
<tr>
<td>Journeys by train</td>
<td>-.26</td>
<td>.26</td>
</tr>
<tr>
<td>Germs</td>
<td>.35</td>
<td>.05</td>
</tr>
<tr>
<td>Lightning</td>
<td>.31</td>
<td>.02</td>
</tr>
<tr>
<td>Automobiles</td>
<td>.21</td>
<td>.12</td>
</tr>
<tr>
<td>Noise of vacuum cleaners</td>
<td>.31</td>
<td>.11</td>
</tr>
<tr>
<td>Doctors</td>
<td>.17</td>
<td>.33</td>
</tr>
<tr>
<td>Dirt</td>
<td>.12</td>
<td>-.10</td>
</tr>
<tr>
<td>Factor IV: “Animal fears”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cockroaches</td>
<td>.29</td>
<td>.03</td>
</tr>
<tr>
<td>Worms</td>
<td>.00</td>
<td>-.27</td>
</tr>
<tr>
<td>Frogs</td>
<td>-.21</td>
<td>-.18</td>
</tr>
<tr>
<td>Moths</td>
<td>.16</td>
<td>-.15</td>
</tr>
<tr>
<td>Harmless spiders</td>
<td>.11</td>
<td>.19</td>
</tr>
<tr>
<td>Bats</td>
<td>.00</td>
<td><strong>.36</strong></td>
</tr>
<tr>
<td>Mice or rats</td>
<td>.09</td>
<td>.13</td>
</tr>
<tr>
<td>Jellyfish</td>
<td>.17</td>
<td>.27</td>
</tr>
<tr>
<td>Wasps or bees</td>
<td>.14</td>
<td><strong>.37</strong></td>
</tr>
<tr>
<td>Harmless snakes</td>
<td>.00</td>
<td><strong>.34</strong></td>
</tr>
<tr>
<td>Birds</td>
<td>.13</td>
<td>.10</td>
</tr>
<tr>
<td>Imaginary creatures</td>
<td>.20</td>
<td>-.16</td>
</tr>
<tr>
<td>Factor V: “Improbable fears”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terrorist attack</td>
<td>.11</td>
<td>-.15</td>
</tr>
<tr>
<td>Nuclear war</td>
<td>.21</td>
<td>-.07</td>
</tr>
<tr>
<td>Feeling angry</td>
<td>.20</td>
<td>-.09</td>
</tr>
<tr>
<td>Wolves</td>
<td>.24</td>
<td>.07</td>
</tr>
<tr>
<td>Strange shapes</td>
<td>.26</td>
<td>-.13</td>
</tr>
<tr>
<td>Fear of large open spaces</td>
<td>-.18</td>
<td>.08</td>
</tr>
</tbody>
</table>

Note: Bold indicates a salient (≥.32) loading; * p < 0.05
Dental fear and personality traits

As people’s dental fear increased so did their general fearfulness as measured by their mean FSS-III score, $F (23.20), p < 0.001$ (Table P9.3). In addition, increased dental fear was associated with people having a greater number of high fears, $F (26.53), p < 0.001$. However, the difference between people with a little fear and those with moderate to high fear did not reach statistical significance, using Scheffe’s post hoc comparisons. Similarly, although people with no dental fear had significantly fewer higher fears (mean = 7.03) than people who were either a little afraid (mean = 19.97) or moderate to very afraid (mean = 23.75), there was no significant difference in the mean number of high fears of people with a little dental fear compared to those who were moderate to very much afraid.

Both the HSI and DSS showed high internal consistencies as measured by Cronbach’s alpha (0.91 and 0.88 respectively). Table P9.4 shows that dental fear was significantly associated with both harm sensitivity, $F (13.61), p < 0.001$, and with disgust sensitivity, $F (5.95), p = 0.004$. However, this relationship was not linear, with no statistically significant difference in either harm or disgust sensitivity between people with a little dental fear or those with higher levels of dental fear.

Table P9.3

<table>
<thead>
<tr>
<th>Dental fear</th>
<th>FSS total</th>
<th>FSS high scores†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean</td>
</tr>
<tr>
<td>None</td>
<td>38</td>
<td>1.45$^{a,b}$</td>
</tr>
<tr>
<td>A little</td>
<td>30</td>
<td>1.96$^a$</td>
</tr>
<tr>
<td>Moderate–Very Much</td>
<td>20</td>
<td>2.23$^b$</td>
</tr>
<tr>
<td></td>
<td>F = 23.20, p &lt; 0.001</td>
<td>F = 26.53, p &lt; 0.001</td>
</tr>
</tbody>
</table>

Note: Same superscripts for means indicate significant differences ($p < 0.05$) using Scheffe’s post hoc corrections for multiple comparisons. Means that do not show superscripts are not significantly different.

† Mean number of FSS items with a score $\geq 3$ (Moderate, High, Very high)
Table P9.4

Relationship between dental fear, harm sensitivity and disgust sensitivity

<table>
<thead>
<tr>
<th>Dental fear</th>
<th>Harm Sensitivity</th>
<th>Disgust Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>SD 95% CI</td>
</tr>
<tr>
<td>None</td>
<td>38</td>
<td>3.15 (^{a,b}) 1.01</td>
</tr>
<tr>
<td>A little</td>
<td>30</td>
<td>4.34 (^a) 0.85</td>
</tr>
<tr>
<td>Moderate–Very Much</td>
<td>20</td>
<td>3.98 (^b) 0.98</td>
</tr>
</tbody>
</table>

F = 13.61, p < 0.001  
F = 5.95, p = 0.004

Note: Same superscripts for means indicate significant differences (p < 0.05) using Scheffe’s post hoc corrections for multiple comparisons. Means that do not show superscripts are not significantly different.

Discussion

It is often assumed that dental fear is related to other medical fears and that its etiology is contingent upon an aversive experience with an emphasis on fear-relevant stimuli such as injections and drills. However, in this study, dental fear was found to be grouped with fears such as fear of failure, fear of losing control and fear of heights rather than with fear of doctors or fear of receiving injections as has been previously found (11, 12). Although perceived or desired control was not measured in this study, it appears that items loading on to Factor I with fear of dentists all relate to situations or stimuli where a person’s perceived control might be compromised. Given research indicating that lack of control is one of the most salient fear-relevant features associated with going to the dentist (33, 34) this is, in hindsight, not surprising. Indeed, it has been argued that perceptions of uncontrollability associated with an event may be more aversive than the event per se (33).

The labelling of factors in this study was influenced by the Cognitive Vulnerability Model of the etiology of fear, which proposes that it is perceptions of a stimulus’s uncontrollability, unpredictability, dangerousness and disgustingness which are causal in the determination of anxiety and fear (28). There is emerging evidence that these vulnerability perceptions are related to fear so it makes intuitive sense that a number of the
factors should relate to these stimulus characteristics. Nonetheless, there is a strong subjective element to the naming of factors, and the sample size in this study was relatively small, so it will be important to replicate these results with a larger sample.

Given the low Keiser-Meyer-Olkin test score, the factorisability of the data may be seen as poor and the results should therefore be properly viewed as preliminary and in need of corroboration with a larger sample. Such a replication should be seen as a necessary precondition before accepting the interpretation of the factor structure provided here. Indeed, it might also be worthwhile to extend the study to a selected population of highly dentally anxious individuals or even to those people with dental phobias. Nonetheless, and despite the small sample size in this study, the pattern of results was robust and the position of dental fear in the factor structure was consistent and independent of the number of factors extracted, the extraction technique and the method of rotation adopted. This provides some preliminary support for the derived factor structure and the relatedness of dental fear, not with BII and disgust-related fears, but with fears relating to a perceived lack of control.

Dental fear was significantly correlated with a large number of other specific fears. This has implications for studies using measures such as the Dental Fear Scale (35), which incorporate fear of dentally-related stimuli such as needles, and also for research that assumes a causative pathway for an association between dental and needle fears (36). Clearly, people with dental phobias are more likely to express other fears, and this is borne out by the strong relationship between dental fear and general fearfulness, as measured using the FSS-III. While fear of injections or undergoing a surgical operation might contribute to the aversiveness of a dental visit it has also been argued that these fears relate more to other painful treatment generally than to dental fear specifically (37). In support of this contention, research in New Zealand found that although fear of the dentist and fear of needles commonly co-occurred they were not synonymous, and it was recommended that cognitive-behavioural treatment strategies should therefore be aimed at both these fears (25).

A final implication of the finding that dental fear is often related to many other specific fears is the need of clinicians to be aware of the strong likelihood that individuals with dental fear also harbour other relevant fears, and that these may present various complications for treatment. There is a need to screen and then introduce appropriate strategies for patients with other dentally-relevant fears such as confined spaces, sudden
noises, being in a strange place, blood, germs or medical odours. This underlines the importance of teaching cognitive-behavioural techniques for dealing with fearful patients to dental undergraduates. Clinicians should also be aware of some patients’ fear of dentist behaviours and other anxious preoccupations. For instance, while people with dental fears commonly report fear of both pain and specific procedures, fear of dental personnel behaviour (rough, incompetent or unsympathetic dentists) and patient’s fear of their own emotional responses are also common (38). Other research has found embarrassment to be a common complaint among people with extreme dental anxiety or phobia (39). It should be recognised that perceived vulnerability in dental anxiety has a strong social component and this is especially the case in dental phobias.

The relationships between dental fear and the personality variables of harm sensitivity and disgust sensitivity were statistically significant, albeit small in magnitude. This is to be expected given that personality traits probably only set the overall limits of situational-specific dental stress factors (20). Also, according to the Cognitive Vulnerability Model, the relationship between personality traits and a specific fear is mediated by perceptions of the stimulus relevant to the personality traits (as shown in Figure P9.1). However, no information on perceptions of dental visits as being uncontrollable, unpredictable, dangerous or disgusting was obtained in this study. Future research might usefully gauge these perceptions so that the hypothesised pathway to fear expression could be better examined.

It should be noted that the current study used a single-item measure of dental fear from the FSS-III to enable comparisons with previous factorial studies. It might be argued that using a more comprehensive measure would more accurately assess dental anxiety. For example, Corah’s Dental Anxiety Scale (DAS) (40), the most widely used measure of trait dental anxiety in epidemiological research, has been found to have good psychometric properties (41). Although the DAS has been criticised for lacking a clearly defined conceptual underpinning (41), the existence of extensive normative data makes its use advantageous. Single-item measures of dental anxiety similar to that used in the current study have been found to have only fair to moderate agreement with the DAS (42). Efforts to compare the level of dental fear demonstrated by participants in this study to those in other epidemiological studies are therefore problematic. The Dental Fear Scale has also been widely used to measure aspects of dental fear and relates to self-assessed behavioural, physiological and cognitive reactions to typical dentally related events and
stimuli (43). Although these various aspects of dental anxiety are highly correlated (44) they each contribute to an individual’s overall fear experience and this should be recognised when dealing with people with dental anxiety.

Dental fear is a multiply determined reaction, often complicated by co-morbidity with other anxiety and mood disorders and co-occurring with numerous other specific fears. The relationship between personality traits, such as disgust and harm sensitivity, and dental fear suggests an enduring element to dental fear that would hinder the possibility of ready fear extinction. Both co-existing fears and personality traits help to determine an individual’s dental fear experience. Awareness of this more extensive psychological ‘environment’ provides an opportunity for dental professionals to better address an individual’s fear of going to the dentist, leading to improvements in client oral health and future service utilization.
References


CHAPTER 13 (PAPER 10) – COGNITIVE VULNERABILITY AND DENTAL FEAR

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*BMC Oral Health 2008, 8: 2.*
Statement of authorship

COGNITIVE VULNERABILITY AND DENTAL FEAR


Armfield J.M. (Candidate)
Conceived paper, conducted statistical analyses, wrote manuscript and acted as corresponding author.

Signed: ……………………………………………………………….   Date: ………………………….

Slade, G.D.
Designed and coordinated study and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ……………………………………………………………….   Date: ………………………….

Spencer A.J.
Designed study and contributed to writing the manuscript.
I give consent for J. M. Armfield to present this paper for examination towards the Doctor of Philosophy.

Signed: ……………………………………………………………….   Date: ………………………….
Linkage of paper to body of research

The final paper in this thesis is perhaps one of the most important, given that it specifically ties the examination of dental fear to the Cognitive Vulnerability Model, linking Part 3 dealing with dental fear to Part 2 which relates to animal fears and highly specific tests of the model. The previous three studies (Chapters 10–12) on dental fear do not specifically test the associations between vulnerability perceptions and dental fear, but examine dental fear as an important and complex emotional state as well as its association with personality characteristics. This study therefore brings the work on dental fear back to the Cognitive Vulnerability Model.
Introduction to paper and additional information

It should be noted that this paper looked at the association between dental fear and perceptions of uncontrollability, unpredictability and dangerousness – perceptions of disgust were not measured. The study involved a questionnaire mailout following on from a national computer-assisted telephone interview with randomly selected participants. There is competing space for measures, scales and questions in the questionnaire, which is necessarily limited in page size. It was decided that there was only space for three questions related to vulnerability perceptions in the questionnaire, and a choice was made as to which three of the four vulnerability related perceptions would be included and which would be excluded. In the end, uncontrollability, unpredictability, and dangerousness were included because of the belief that these might have the strongest relationship with dental fear and because there is currently very little work looking at the relationship of dental fear to disgust.

It should be noted that there is research being planned at the time of writing of this thesis which will develop a more comprehensive set of questions for each of the four vulnerability related perceptions and will use more than one measure of dental fear to examine further the associations found in this current paper. In this way, although the current paper is limited to some extent by the questions asked, it provides important initial confirmation of the existence of associations between vulnerability perceptions and dental fear, providing justification for further research in the area.
Abstract

Background: The Cognitive Vulnerability Model proposes that perceptions of certain characteristics of a situation are critical determinants of fear. Although the model is applicable to all animal, natural environment and situational fears, it has not yet been applied specifically to dental fear. This study therefore aimed to examine the association between dental fear and perceptions of dental visits as uncontrollable, unpredictable and dangerous. Methods: The study used a clustered, stratified national sample of Australians aged 15 years and over. All participants were asked in a telephone interview survey to indicate their level of dental fear. Participants who received an oral examination were subsequently provided with a self-complete questionnaire in which they rated their perceptions of uncontrollability, unpredictability and dangerousness associated with being in a dental chair. Results: 3937 participants were recruited. Each of the three vulnerability-related perceptions was strongly associated with the prevalence of high dental fear. In a logistic regression analysis, uncontrollability and dangerousness perceptions were significantly associated with high dental fear after controlling for age, sex, and each of the other vulnerability-related perceptions. However, perceptions of unpredictability did not have a statistically significant independent association with dental fear after controlling for all other variables. Conclusions: Results are consistent with the Cognitive Vulnerability Model of the etiology of fear, with perceptions of uncontrollability, unpredictability and dangerousness each showing a strong bivariate association with high dental fear prevalence. However, more extensive measures of vulnerability perceptions would be valuable in future investigations.
Background

People with high dental fear and dental phobias often experience a range of aversive psychological, emotional and social problems [1]. Although dental fear is a diagnosable psychological condition with associated psychological symptoms [2], it also has important and challenging physical health implications. People with dental fear often have poorer oral health than people with no dental fear [3-6], and in some cases the long-term deferment of dental treatment may lead to the development of oral pain and the need for invasive and potentially painful dental treatment. Indeed, research has consistently shown that people with dental fear are more likely to delay dental appointments [7, 8] and there is some evidence that this may set up a vicious cycle of dental fear, whereby delayed dental visiting allows the continued progression of oral disease which may lead to the requirement for emergency treatment which then serves to exacerbate or maintain the person’s dental fear [9-12]. Dental fear has a high prevalence in many western countries [13, 14] yet it is the serious oral health consequences of dental fear that stand it apart from many other specific fears and which make it such an important area of study.

It is often assumed, by practitioners and the lay public alike, that dental fear is a result of having had a painful or unpleasant past experience associated with a dental examination or procedure. Consistent with this belief, many studies have found instances of aversive past dental experiences among dental phobics [15-19] and interviews with dental phobics often reveal numerous traumatic experiences, sometimes spanning decades [20]. Such a view is consistent with the classical conditioning model of the etiology of fear, which has its origins in studies of animals reacting to painful stimuli. While the conditioning model of the genesis of fear and its various subsequent revisions appear to account for some cases of dental fear, it does not account for a number of troublesome aspects of dental fear. First, many people have undergone dental treatment yet only some people develop dental fear [21]. Second, there are a number of people who have never had or can not recall a traumatic dental experience yet report being afraid of going to the dentist [22]. Finally, being afraid of the dentist appears to relate to a number of other fears [23-25], which we would not expect where it merely a function of learning experiences.
In an effort to address some of the more intractable issues related to explaining specific fears, Armfield has proposed a model of the etiology of fear, termed the Cognitive Vulnerability Model, which positions cognitions, rather than experiences, as the central element in fear acquisition and expression [26]. It is proposed that it is a person’s perceptions of a stimulus or situation which are crucial in the etiology of fear. Specifically, perceptions of uncontrollability, unpredictability, dangerousness and disgustingness are argued to create a powerful feeling of vulnerability. Borrowing from cognitive psychological theory, vulnerability-related perceptions are believed to be incorporated into a schema, a cognitive structure that serves to filter information and guide experiences, beliefs, emotions and behaviours. An individual enters any given situation with a pre-existing schema, which serves to shape the behavioural, psychological and physiological experience of that situation.

A summary of the Cognitive Vulnerability Model as it relates to the elicitation of dental fear is provided in Figure P10.1. In line with the model, encountering a dental stimulus or situation invokes a rapid and pre-conscious automatic affective reaction which primes a susceptible individual for a flight or fight response. Simultaneously, a person’s vulnerability schema is activated and this feeds into a slower and more cognitive general evaluation of the significance of the situation to the person. The general evaluation is also influenced by other cognitive factors such as coping mechanisms and attentional biases. Both the automatic affective reaction to the dental situation and the general evaluation give rise to a suite of physiological, behavioural and cognitive/emotional responses in a fearful person, which may include nervousness, panic, sweating, a strong desire to leave the situation, catastrophic thoughts, worry, panic etc. The dental visiting experience, as well as the associated perceptions and emotions, feed back into the vulnerability schema, affecting continued exposure to the fear-relevant stimulus and determining future reactions to visiting the dentist.
The Cognitive Vulnerability Model has received support from a number of studies investigating fear of animals. High correlations have been found between fear of a number of different animals and perceptions of those animals as uncontrollable, unpredictable, dangerous and disgusting [27, 28]. Also, experimental manipulation of perceptions of spiders as uncontrollable, unpredictable and dangerous has been found to have a significant effect on fear of encountering a spider [29, 30]. However, the Cognitive Vulnerability Model has not yet been investigated in relation to dental fear. The current study therefore aimed to provide a preliminary investigation of the association between fear of going to the dentist and perceptions of uncontrollability, unpredictability and dangerousness associated with dental visiting. It was hypothesised that vulnerability-related perceptions would be significantly associated with dental fear after controlling for other possible confounding variables.
Methods

Study participants were from a larger computer assisted telephone interview (CATI) survey of the Australian public contacted as part of the National Survey of Adult Oral Health (NSAOH), conducted in Australia between 2004 and 2006 [31]. Those people who were offered and received an oral examination as part of the NSAOH were subsequently sent a self-complete questionnaire. Data on individuals who completed the questionnaire were matched to information gathered from the telephone interview component of the survey to obtain the data used in this study.

The sampling frame for the NSAOH comprised an electronic version of the Australian national telephone listings. Fifteen strata were created, with probability proportional to size selection. The strata entailed metropolitan and non-metropolitan areas of seven of the eight Australian states and territories (New South Wales, Victoria, Queensland, Western Australia, South Australia, Tasmania and the Northern Territory) plus the single stratum of the Australian Capital Territory. The primary sampling unit was postcode and the secondary sampling unit was household. Thirty households were selected per metropolitan postcode while 40 households were selected per non-metropolitan postcode. One adult (15+ years) per household was selected.

Prior to initiating the CATI, a primary approach letter was mailed to each selected household. Initial telephone contact identified whether or not the number represented a residential dwelling and allowed for the random selection of one adult aged 15+ years. At the completion of the CATI, people aged ≥15 years who reported having natural teeth were asked to attend a dental examination. However, a small number of people in some remote postcodes were excluded from examinations due to logistical considerations.

Dental fear was assessed in the CATI by the global question “Would you feel afraid or distressed when going to the dentist?” with response categories being ‘Not at all’ (1), ‘A little afraid or distressed’ (2), ‘Moderately afraid or distressed’ (3), ‘Very afraid or distressed’ (4) and ‘Extremely afraid or distressed’ (5). Responses were dichotomised to create the categories low fear (little or no fear) and high fear (moderate to extreme fear), for the purposes of multivariate analyses.

The self-complete questionnaire was mailed to participants and contained one question each relating to perceptions of control, predictability and likelihood of harm or
danger when at the dentist, with responses ranging from ‘Strongly disagree’ (1) to ‘Strongly agree’ (5) The items were “I don’t feel in control when I’m in the dental chair”, “I don’t feel like I know what’s going to happen next when I’m in the dental chair” and “I believe I will be hurt when I’m in the dental chair”. Due to space restrictions in the questionnaire, an item concerning disgust was not included in the self-complete questionnaire.

Data were weighted by state/territory and metropolitan/non-metropolitan residence to correct for varying probability of selection. Post hoc adjustments to the weighting by age and sex also occurred. Final weights were computed so that the sample characteristics approximated those of the Australian population. To account for design effects associated with the survey’s sample design, and to control for the inflationary effects of weighting up the data, results for this study were computed using the SPSS™ Version 13 Complex Samples module.

The NSAOH was reviewed and approved by both the University of Adelaide Human Research Ethics Committee and the Australian Institute of Health and Welfare Ethics committee. The nature of the interview was explained to subjects at their time of selection and verbal consent was obtained prior to asking questions.

Results

A total of 36,931 telephone numbers were randomly sampled from the ‘electronic white pages’ which contained 28,812 in-scope telephone numbers. Out-of-scope refers to disconnected numbers, business and fax/modem numbers. In all, 14,123 completed interviews were conducted, a response rate of 49%. Among interviewed subjects, 12,606 people satisfied the inclusion criteria for the dental examination. Completed dental examinations numbered 5,505 which represented 46.7% of participants considered in-scope for examination. From participants who had received an oral examination, questionnaire data were subsequently obtained on 3,937 Australians aged 15 years and over. This represents 31.2% of those people who completed the telephone interview and met the inclusion criteria.

The mean age of participants was 44.0 years (SD = 17.2) with an age range of 15–90 years old. Slightly more than half of the participants were female (52.2%).
comparison of the study sample characteristics with those of the Australian population as reported in the 2001 Census of Housing and Population are provided in Table P10.1. The only notable difference between the study sample and the Australia population was in terms of employment status, with a higher percentage of the study sample being unemployed than in the Australian population and a lower percentage being students or retired than in the Australian population.

The majority of participants indicated that they felt no fear or distress when going to the dentist (57.5%). However, 21.9% of participants said that they were a little afraid or distressed, 11.8% that they were moderately afraid or distressed, 4.7% that they were very afraid or distressed, and 3.9% that they were extremely afraid or distressed. There were differences in the distribution of peoples’ responses to how they felt when they were in the dental chair regarding perceptions of uncontrollability, unpredictability and dangerousness (Figure P10.2). Some 44.4% of people agreed or strongly agreed that they did not feel in control when in the dental chair, 33.4% agreed or strongly agreed that they did not know what might happen next, while only 24.8% were of the belief they would be harmed.

The relationships between prevalence of dental fear and perceptions of uncontrollability, unpredictability and dangerousness are presented graphically in Figure P10.3. All three variables show a strong association with dental fear prevalence. Univariate analysis of variance confirmed that dental fear was significantly associated with perceptions of uncontrollability (Wald $F = 81.22, p < 0.001$), perceptions of unpredictability (Wald $F = 40.93, p < 0.001$) and with perceptions of the likelihood of harm (Wald $F = 107.11, p < 0.001$).
Table P10.1

A comparison of the study (questionnaire) sample characteristics with those of the Australian population aged 15+ in 2001

<table>
<thead>
<tr>
<th></th>
<th>Study sample</th>
<th>Australia 2001†</th>
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<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
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</tr>
<tr>
<td>15–24</td>
<td>593</td>
<td>15.1</td>
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<tr>
<td>25–39</td>
<td>1,104</td>
<td>28.0</td>
</tr>
<tr>
<td>40–64</td>
<td>1,703</td>
<td>43.3</td>
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<tr>
<td>65–79</td>
<td>456</td>
<td>11.6</td>
</tr>
<tr>
<td>80+</td>
<td>81</td>
<td>2.1</td>
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<tr>
<td><strong>Sex</strong></td>
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<tr>
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<td>1,884</td>
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</tr>
<tr>
<td>Female</td>
<td>2,053</td>
<td>52.2</td>
</tr>
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<td><strong>Language spoken at home</strong></td>
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<td></td>
</tr>
<tr>
<td>English</td>
<td>3,521</td>
<td>89.4</td>
</tr>
<tr>
<td>Language other than English</td>
<td>416</td>
<td>10.6</td>
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<tr>
<td><strong>Income</strong></td>
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<td>&lt;$20,000</td>
<td>488</td>
<td>12.4</td>
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<tr>
<td>$20,000–$39,999</td>
<td>766</td>
<td>19.5</td>
</tr>
<tr>
<td>$40,000–$59,000</td>
<td>680</td>
<td>17.3</td>
</tr>
<tr>
<td>$60,000–$79,000</td>
<td>564</td>
<td>14.3</td>
</tr>
<tr>
<td>$80,000+</td>
<td>1,041</td>
<td>26.5</td>
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<td>Missing</td>
<td>397</td>
<td>10.1</td>
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<td><strong>Employment status</strong></td>
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<td>583</td>
<td>14.8</td>
</tr>
<tr>
<td>Part-time</td>
<td>870</td>
<td>22.1</td>
</tr>
<tr>
<td>Full-time</td>
<td>1,549</td>
<td>39.4</td>
</tr>
<tr>
<td>Student/retired</td>
<td>758</td>
<td>19.2</td>
</tr>
<tr>
<td>Missing</td>
<td>177</td>
<td>4.5</td>
</tr>
</tbody>
</table>

† Based on the Australian Bureau of Statistics Census of Population and Housing for Australia, 2001

a Australian data uses entire population for Language Spoken at Home

b Income categories for Australian data are: <$20,748 (<$399/wk); $20,749–$41,548 ($400–$799/wk); $41,549–$62,348 ($800–$1,199/wk); $62,349–$77,948 ($1,200–$1,499/wk); >$77,949 (> $1,500/wk)
Figure P10.2. Distribution of responses regarding perceptions of uncontrollability, unpredictability and dangerousness associated with going to the dentist.

Figure P10.3. Prevalence (and 95% CI) of participants with high dental fear (moderate to extreme) by perceptions of uncontrollability, unpredictability and dangerousness.
In an effort to identify possible confounders for subsequent multivariate analyses, General Linear Modelling was used to examine the association between dental fear and a number of demographic and socio-economic variables which have previously been found to have a relationship with dental fear [13]. Age was significantly associated with dental fear ($F = 13.29, p < 0.001$), with the prevalence of high dental fear increasing from approximately 10% of 15–24-year-olds to 27.1% of middle aged adults (age 40–64) before reducing to 7.6% of the oldest age group (Table P10.2). Sex was also significantly

Table P10.2
Prevalence of high dental fear (standard error and 95% confidence intervals) by demographic and socio-economic characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Prevalence</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>*<em>Age</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24</td>
<td>9.97</td>
<td>2.66</td>
<td>4.74, 15.19</td>
</tr>
<tr>
<td>25–39</td>
<td>17.27</td>
<td>1.78</td>
<td>13.77, 20.76</td>
</tr>
<tr>
<td>40–64</td>
<td>27.10</td>
<td>1.26</td>
<td>24.61, 29.58</td>
</tr>
<tr>
<td>65–79</td>
<td>19.35</td>
<td>1.98</td>
<td>15.46, 23.25</td>
</tr>
<tr>
<td>80+</td>
<td>7.64</td>
<td>3.89</td>
<td>0.00, 15.29</td>
</tr>
<tr>
<td>*<em>Sex</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14.33</td>
<td>1.29</td>
<td>11.79, 16.88</td>
</tr>
<tr>
<td>Female</td>
<td>26.07</td>
<td>1.19</td>
<td>23.74, 28.40</td>
</tr>
<tr>
<td><strong>Income</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$20,000</td>
<td>24.44</td>
<td>2.10</td>
<td>20.31, 28.57</td>
</tr>
<tr>
<td>$20,000–$39,999</td>
<td>20.69</td>
<td>1.62</td>
<td>17.50, 23.88</td>
</tr>
<tr>
<td>$40,000–$59,000</td>
<td>23.04</td>
<td>2.27</td>
<td>18.58, 27.50</td>
</tr>
<tr>
<td>$60,000–$79,000</td>
<td>19.35</td>
<td>2.50</td>
<td>14.44, 24.25</td>
</tr>
<tr>
<td>$80,000+</td>
<td>19.36</td>
<td>1.98</td>
<td>15.46, 23.26</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
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<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>20.60</td>
<td>2.34</td>
<td>15.98, 25.221</td>
</tr>
<tr>
<td>Part-time</td>
<td>22.54</td>
<td>1.88</td>
<td>18.84, 26.24</td>
</tr>
<tr>
<td>Full-time</td>
<td>20.70</td>
<td>1.68</td>
<td>17.40, 24.00</td>
</tr>
<tr>
<td>Student/retired</td>
<td>20.61</td>
<td>1.67</td>
<td>17.33, 23.89</td>
</tr>
</tbody>
</table>

* Wald $F, p < 0.001$
associated with dental fear, with more females (prevalence = 26.1%) reporting high dental fear than males (prevalence = 14.3%), Wald $F = 41.30, p < 0.001$. No significant difference in the prevalence of high dental fear was noted across either income categories or employment types.

To test for the significance of the associations between dental fear and the three vulnerability-related variables after controlling for the possible confounding variables, a logistic regression analysis was undertaken with dental fear (none or little/moderate to extreme) as the dependent variable. Age and sex were entered into the model as these were significantly associated with dental fear in the bivariate analyses. Overall, the model accounted for just over one-third of the variance in high dental fear, with a Nagelkerke $R^2$ of 0.363. The summary output from the regression analysis is shown in Table P10.3. After controlling for all variables in the analysis, only perceived unpredictability did not show a significant independent association with dental fear. People who strongly agreed that they felt out of control when in the dental chair had 7.38 the odds of being moderately to extremely afraid, in comparison to people who strongly disagreed that they felt out of control when in the dental chair. The association with perceived dangerousness was even stronger, with those people strongly believing they would be harmed having 31.27 the odds of having high dental fear compared to people who strongly believed that they would not be harmed while in the dental chair.

Following from the results of the logistic regression it was suspected that high correlations between the three cognitive vulnerability variables may explain why perceptions of unpredictability were not found to have a significant independent association with dental fear. Indeed, Spearman’s rho correlation coefficients were 0.64 between uncontrollability and unpredictability, 0.50 between uncontrollability and dangerousness, and 0.50 between unpredictability and dangerousness, with all correlations being significant at $p < 0.001$. In an attempt to tease apart the associations, another series of logistic regression models were run. First, unpredictability was entered with just age and sex. As expected, people who perceived dental examinations as being highly unpredictable were much more likely to have high dental fear than people who perceived the dental examination as being highly predictable (OR = 23.2, $p < 0.001$). All possible responses were significant when compared to the reference category ‘Strongly disagree’. Two more models were then tested, the first with unpredictability entered with age, sex and uncontrollability and the second with unpredictability entered with age
Table P10.3

Adjusted odds ratios (ORs) and 95% confidence intervals of vulnerability-related perceptions and demographic variables on moderate to extreme dental fear

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
</tr>
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<tr>
<td>Uncontrollability*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>1.42</td>
<td>0.89,2.29</td>
</tr>
<tr>
<td>Neutral</td>
<td>2.76</td>
<td>1.60,4.75</td>
</tr>
<tr>
<td>Agree</td>
<td>3.56</td>
<td>2.01,6.30</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>6.81</td>
<td>2.29,20.26</td>
</tr>
<tr>
<td>Unpredictability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>0.90</td>
<td>0.51,1.58</td>
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<tr>
<td>Neutral</td>
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</tr>
<tr>
<td>Agree</td>
<td>1.08</td>
<td>0.60,1.96</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>0.87</td>
<td>0.31,2.43</td>
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<td>Dangerousness*</td>
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<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>2.79</td>
<td>1.66,4.69</td>
</tr>
<tr>
<td>Neutral</td>
<td>6.45</td>
<td>3.93,10.59</td>
</tr>
<tr>
<td>Agree</td>
<td>15.38</td>
<td>9.06,26.11</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>29.13</td>
<td>12.45,68.15</td>
</tr>
<tr>
<td>Age*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>Ref.</td>
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<tr>
<td>65–79</td>
<td>0.51</td>
<td>0.13,1.98</td>
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<td>40–64</td>
<td>0.36</td>
<td>0.10,1.36</td>
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<td>25–39</td>
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<td>0.17,2.47</td>
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<tr>
<td>15–24</td>
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<td>0.37,6.90</td>
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<tr>
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<tr>
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<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2.28</td>
<td>1.74,3.00</td>
</tr>
</tbody>
</table>

* Wald $F, p < 0.001
age, sex and dangerousness. In both cases, while unpredictability was significantly associated with dental fear, the corresponding odds ratios were considerably reduced. In addition, only those responding ‘Agree’ or ‘Strongly Agree’ had significant odds of high dental fear compared to the reference category ‘Strongly disagree’. It appears then, that unpredictability did not have a significant independent association with dental fear (Table P10.3) because of its high relatedness to both dangerousness and uncontrollability.

**Discussion**

This study found that perceptions of uncontrollability, unpredictability and dangerousness had appreciable bivariate associations with dental fear, however only perceived uncontrollability and dangerousness had a significant association with dental fear after controlling for the other vulnerability variables and age and sex. The substantial bivariate associations between dental fear and perceptions of uncontrollability, unpredictability and dangerousness are consistent with the Cognitive Vulnerability Model of the etiology of fear [26] which proposes that how an individual perceives a situation is a crucial determinant of fear in that situation. Only 3–6% of people who perceived being in a dental chair as being highly controllable, highly predictable and highly safe had moderate to extreme dental fear. However, the prevalence of high dental fear among people who regarded the dental examination as being either highly uncontrollable, highly unpredictable or highly dangerous was 51.0%, 49.8% and 72.9% respectively.

Many studies have looked at the variables of control, danger and, to a lesser extent, predictability in relation to dental fear so it is perhaps not surprising that these perceptual characteristics of the dental environment showed an association with dental fear. Milgrom, for instance, identified lack of control as a primary concern of dental phobics [32] and a number of studies have confirmed its importance. For example, Milgrom and colleagues found that the probability of a stressful experience resulting in fear and avoidance is enhanced when perceptions of control are low [33]. Similarly, dental patients with high desire for control, but who perceive little actual control, report higher levels of expected pain before treatment than do other patient subgroups [34]. The importance of control as an issue in dental fear has also been acknowledged in the development of belief scales. The Dental Beliefs Survey [32], for example, which has ‘lack
of control’ as one of the identified factors [35], has been reported as being highly related to dental fear [36]. In relation to depression, it has been speculated that perceptions of uncontrollability related to an aversive event may be more important than the event per se [37], and the same may be the case for anxiety disorders such as dental phobia.

Concerns over pain and harm when attending a dentist often revolve around the receipt of injections and use of the drill [38, 39]. However, even non-invasive procedures such as prophylaxis may be considered painful or unpleasant [40]. Although there has been an increasing emphasis placed on the importance of non-invasive dentistry, many patients are still concerned by the level of pain and discomfort associated with visiting the dentist and this is underlined by the strong association between dental fear and concerns about being harmed found in this study. While approaches such as the iatrosedative technique, which relies on the dentist’s promises and actions to protect the patient from what is perceived as dangerous [41, 42], can address patient concerns of expected pain, such techniques are not commonly employed in dentistry at this time.

While many studies have previously looked at the association between dental fear and control, the major focus of most of this research has been on the use of control as an intervention to modify fear once it is already established rather than on control, or lack of, as an antecedent of fear. Whereas many researchers and clinicians accept that affording patients some control over the dental environment reduces fear and anxiety, the Cognitive Vulnerability Model places perceived lack of control as a core cognitive variable in the etiology of fear [26]. Similarly, it is the perceptions of dangerousness associated with going to a dentist which are relevant to the cause of dental fear rather than whether or not a person has experience a painful or traumatic incident per se.

Little research has looked at the role of unpredictability in relation to dental fear although it does make intuitive sense that such an association would exist. Dental patients can not view what is happening in their own mouth and are for the most part unable to anticipate when pain might occur. If the dentist does not adequately explain the procedure, the patient may also find the treatment process to be unpredictable, adding to his or her fear. Indeed, it is quite likely that lack of predictability and controllability, coupled with anxiety over pain, operate in combination, each adding to the effect of the other to generate the fear response. However, this study found no independent association between perceptions of unpredictability and dental fear in the multivariate analyses in this paper, despite a strong bivariate association. Presumably the reason for this was because
perceptions of uncontrollability, dangerousness and unpredictability all overlap to a considerable extent. Despite the failure of this study to find a statistical association between perceptions of unpredictability and dental fear, it is still likely that from an individual person’s point of view that all the vulnerability-related perceptions would need to be addressed to effectively alleviate dental fear.

While this study looked at perceptions of uncontrollability, unpredictability and dangerousness, the fourth characteristic comprising the vulnerability-related dental schema, disgust, was not examined. In general, there has been very little work done investigating the role of disgust in the fear of dental visits, although there is some evidence that it may relate to issues with the smell associated with dental surgeries [43] and fear of contamination with germs or disease [44]. Certainly there is a strong association between disgust and fears and phobias relating to blood, injections and injuries [45] and this may be relevant to the experience of some dental procedures. In reality, however, it is probably the case that disgustingness has less of a role in the etiology of dental fear than perceptions of uncontrollability, unpredictability and dangerousness. The Cognitive Vulnerability Model proposes that fear of any given stimulus is related to a specific combination of the vulnerability variables [26]. Whereas some fears may centre more on disgust (e.g. fear of maggots or slugs) others may centre more on the other variables, or indeed each perceptual characteristic may contribute relatively equally. Nonetheless, further investigation of the role of disgust in dental fear is warranted as this may be a salient characteristic of the dental fear experience for some people.

An important aspect of this study was that all participants had undergone a dental examination prior to receiving the self-complete questionnaire. Because people with high dental fear or who have dental phobias are less likely to attend a dental examination, it is quite probable that a number of high fear individuals may have dropped out from the study at the point of the examination. This would have resulted in fewer people with high dental fear and may have impacted on the statistical analyses. It is quite possible that stronger effects would have been found had those extra high-fear individuals been questioned. The fact that all participants had recently attended the associated dental examination also means that a person’s dental fear and their perceptions of uncontrollability, unpredictability and dangerousness associated with dental visits may have been influenced by the examination process. In particular, the examination component of the study comprised no treatment and great care was taken by examiners to
explain all procedures prior to carrying them out, which may have effected both perceptions of dangerousness and perceptions of unpredictability respectively.

One of the limitations of this study is the use of a single-item measure of dental fear and of single-item measures of uncontrollability, unpredictability and dangerousness. While single-item measures of dental fear often correlate with multi-item scales, kappa statistics indicating agreement corrected for chance show only fair to moderate agreement [46]. General fear items are also incapable of picking up the many nuances of what is a multifactorial condition. In addition, further work in this area requires the development of a more extensive set of questions assessing perceptions of uncontrollability, unpredictability, dangerousness and disgustingness. Similar scales which have been developed for spiders and other animals [27] should ideally be applied for investigations of dental fear.

Another limitation of the study is the use of a cross-sectional design which does not allow for a determination of cause and effect. However, given that this paper is intended as a preliminary investigation of the Cognitive Vulnerability Model as it applies to dental fear, the cross-sectional data provide a useful initial confirmation of the existence of relationships between dental fear and vulnerability-related perceptions. Nonetheless, it would be valuable to confirm these associations, and determine the direction of causality, using a more appropriate longitudinal design.

Conclusions

This paper presents findings linking perceptions of uncontrollability, unpredictability and dangerousness to fear of going to the dentist and provides preliminary support for the use of the Cognitive Vulnerability Model in better understanding the phenomenology of dental fear. An understanding of vulnerability-related perceptions is important as these perceptions relate to key areas where effort should be directed to prevent or alleviate an individual’s dental fear. It has long been acknowledged that affording dental patients a sense of control and freedom from pain and discomfort can limit or help manage dental fear. However, the Cognitive Vulnerability Model provides a theoretical framework on which to base and further explore these suggestions and recommendations. Given the high prevalence of dental fear in the community and the
detrimental social, psychological and physical consequences accompanying the avoidance of dental care, there is a pressing need to unravel the issues at the core of this problem.

**Competing interests**

The authors declare that they have no competing interests.

**Acknowledgements**

The National Survey of Adult Oral Health was funded by grants from the National Health and Medical Research Council, the Australian Government Department of Health and Ageing, and the Australian Dental Association and received in-kind support from Colgate Oral Care and Australian State and Territory dental services.
References


PART FOUR
CHAPTER 14 – CONCLUSION

The peer-reviewed portfolio of papers presented in this thesis represents an attempt at providing empirical support for a new theory of the etiology of fear, termed the Cognitive Vulnerability Model. Because the model applies to both the etiology and expression of fear there are numerous implications applicable to empirical testing. An effort was made to test a broad spectrum of these implications, with both questionnaire and laboratory studies and using both small and large samples. Overall, almost all the results in this thesis are consistent with the model and provide extensive support for the conceptualisation of the etiology of specific fears and phobias as presented. That such consistent evidence has been found is indicative of the potential usefulness of the model.

Summary of findings

Most of the studies reported in this thesis looked at a different element of the Cognitive Vulnerability Model, with the findings from each study often adding to an understanding of the totality of the model rather than building on the findings from the previous study. The first empirical study (Paper 2) looked at the association between fear and avoidance of high-fear and low-fear animals and perceptions of the animals as uncontrollable, unpredictable, dangerous and disgusting. Perceptions of dangerousness, disgustingness and uncontrollability were significantly associated with fear and avoidance of both high- and low-fear animals while perceptions of unpredictability were significantly associated with fear of high-fear animals and avoidance of both high- and low-fear animals. Conditioning experiences were found to be unrelated to fear or avoidance of any animals. In multiple regression analyses, perceived loomingness, an alternative theoretical construct believed also to be related to the etiology of fear, did not account for any of the variance in fear beyond that accounted for by the cognitive vulnerability variables. However, the vulnerability variables accounted for between 20 and 51% of the variance in fear of low- and high-fear animals beyond that accounted for by perceptions of the animals as looming. Perceptions of dangerousness, uncontrollability and unpredictability were highly predictive of the uneven distribution of animal fears.
The second and third studies (Papers 3 and 4) reported on attempts to experimentally manipulate perceptions of uncontrollability, unpredictability and dangerousness related to an imaginal and in vivo encounter with a spider in order to determine whether there was an effect on self-rated predicted spider fear. Experimental manipulations involved differing information in relation to both a spider and a proposed spider-related task. In Paper 3, the control, predictability and dangerousness manipulations all had significant main effects on task-related spider fear (TRSF). Measures of the perception of the spiders as uncontrollable, unpredictable and dangerous were also significantly associated with TRSF and accounted for 42% of the variance in predicted fear beyond that accounted for by the experiment manipulations. Results from Paper 4 indicated a greater effect on TRSF for in vivo exposure ($R^2 = .258$) compared to imaginal exposure ($R^2 = .053$). Perceptions of spiders as uncontrollable, unpredictable and dangerous accounted for much of the variance in spider fear beyond that accounted for by the experimental manipulations.

The study reported in Paper 5 examined whether the relationship between spider fear and the personality traits of perceived control, desire for control, desire for predictability, disgust sensitivity and harm sensitivity are mediated by perceptions of spiders as being uncontrollable, unpredictable, disgusting and dangerous, respectively. Statistical testing of the mediation effect using a bootstrapping approach provided strong support for the mediation model. In addition, vulnerability perceptions were found to be highly correlated to spider fear and the measured personality traits were found to be significantly correlated with general fearfulness. No significant interaction effect between perceived control and desire for control was observed, although this was not reported in the study. This study suggests a role for personality variables in the development of specific fear responses, with personality traits affecting fear of any given object or situation by impacting upon the perceptions of those objects or situations as uncontrollable, unpredictable, dangerous and disgusting.

The fifth study, reported in Paper 6, involved both recall and recognition tests of word lists related to: (1) babies; (2) spiders; and (3) spider characteristics related to uncontrollability, unpredictability, dangerousness and disgustingness. Self-rated spider fear was not significantly associated with recall or recognition of baby or spider related words. However, greater spider fear was significantly associated with better recall and recognition of high-fear schema relevant words even after controlling for a number of possible
confounding variables. The results provide partial support for the hypothesis that spider fear is associated with a bias towards recall and recognition of spider related information salient to a person’s fear experience and are consistent with the idea of the existence of a cognitive schema.

The next study (Paper 7) marked a change from research into animal fear to studies of dental fear. It aimed to describe both the prevalence of dental fear in Australia and to explore the relationship between dental fear and a number of demographic, socio-economic, oral health, insurance and service usage variables. It was argued that dental fear represents a socially significant example of a specific fear or phobia and that it is first necessary to describe some of the characteristics of dental fear before moving on to examining the Cognitive Vulnerability Model in relation to dental fear. The study found the prevalence of high dental fear in the entire sample to be 16.1% with high fear prevalence more common for females and for adults aged 40–64 years old. There were also differences between low fear and high fear (HF) groups in relation to socio-economic status (SES), with people from higher SES groups generally having less fear. People with HF were more likely to be dentate, have more missing teeth, be covered by dental insurance and have had a longer time since their last visit to a dentist.

Paper 8 examined a hypothesised vicious cycle of dental fear, whereby the consequences of fear are believed to maintain that fear. People with higher dental fear were found to visit the dentist less often and indicated a longer expected time before visiting a dentist in the future. Higher dental fear was associated with greater perceived need for dental treatment, increased social impact of oral ill-health and worse self-rated oral health. Visiting patterns associated with higher dental fear were more likely to be symptom driven with dental visits more likely to be for a problem or for the relief of pain. All the relationships assumed by a vicious cycle of dental fear were significant. In all, 29.2% of people who were very afraid of going to the dentist had delayed dental visiting, poor oral health and symptom-driven treatment seeking compared to 11.6% of people with no dental fear.

The eighth study, described in Paper 9, investigated the associations between dental fear and a number of other specific fears as well as with general fearfulness, disgust sensitivity and harm sensitivity. Dental fear was significantly correlated with most of the other specific fears, with factor analysis indicating that it tended to load more with fears related to lack of control than with ‘medical’ fears. Significant associations were found
between dental fear and the personality dispositions of general fearfulness, harm
sensitivity and disgust sensitivity. Findings revealed an extensive co-occurrence of other
specific fears with dental fear, while the associations of dental fear with personality traits
suggested enduring causative factors responsible for potential difficulties in fear
alleviation.

The final study brought the investigation of dental fear back full circle to the
Cognitive Vulnerability Model with an examination of the association between dental fear
and perceptions of dental visits as uncontrollable, unpredictable and dangerous.
Consistent with the hypotheses, dental fear was significantly associated with the three
vulnerability-related perceptions. In a hierarchical linear regression analysis, perceptions
of uncontrollability, unpredictability and dangerousness accounted for 32.4% of the
variance in dental fear after controlling for age, sex, socioeconomic status and oral health.
However, perceived unpredictability did not have an independent statistically significant
effect after controlling for perceptions of uncontrollability and dangerousness.

Vulnerability perceptions and fear

This thesis started with the idea that how a person perceives an object or situation
is a central determinant of the fear he or she feels in relation to that object or situation. It
was proposed that feeling out of control, being unable to predict what might occur, being
in actual or perceived danger, and feeling disgusted are all aversive experiences which
relate directly to the experience of fear, a biological survival-relevant emotional,
physiological and behavioural state. While perceptions of uncontrollability,
unpredictability, dangerousness and disgustingness may have a strong grounding in the
reality of a situation, they are by no means solely determined by an impartial and
objective assessment of the characteristics of the situation. It is felt lack of control, felt
unpredictability, felt danger and felt disgust which are important to the determination of
fear. In this way, to understand the phenomenology of the fear is to understand the fear
itself.

Taking an individualist and phenomenological perspective to the etiology of fear is
certainly at odds with much of the current theorising on the development of fear. It also
sits akimbo from the currently accepted diagnostic criteria, as expounded by the American
Psychiatric Association (1994), that Specific Phobia represents an “excessive or unreasonable” (p. 410) marked and persistent fear. Indeed, that “adults with this disorder recognize that the phobia is excessive or unreasonable” (p. 406) is stated as an explicit diagnostic criteria of the disorder. For this reason, many specific phobias are thought of as being ‘irrational’ fears. By implication, those people suffering these fears are regarded as being irrational. Such positioning implies a gold standard by which the rationality or irrationality of any individual’s beliefs or feelings can be judged. Perhaps grief can also be dismissed as irrational. Maybe love or hate or pride or any other human emotion or feeling can be regarded as an aberration or abrogation of reason or rationality. The Cognitive Vulnerability Model is not so harsh on human emotion. If an individual fears say spiders or dentists, then the factors responsible for that fear are very real to the individual and are not to be dismissed as irrational. Lack of objective danger does not mean lack of objective concern as many theories would contend. Perceptions of uncontrollability, unpredictability, dangerousness and disgust, to varying degrees and in varying combinations, are felt as real to any individual and should be acknowledged as being so.

The vulnerability-related perceptions described in the Cognitive Vulnerability Model have shown themselves to be highly associated with fear in a number of studies in this thesis. Some correlations are so high that they have attracted criticism that they must be measuring the same concept as tapped by the fear measure. That is, it has been claimed, for example, that to measure uncontrollability is actually to measure fear. Perhaps this is an expression of disbelief that such associations in behavioural science research could really be so strong without there being some major methodological problem responsible. Yet, perceptions of uncontrollability, or dangerousness or any of the vulnerability-related variables, can be clearly theoretically discriminated from feelings of fear and anxiety.

Limitations

The various papers in this thesis have several limitations which should be acknowledged. Having been peer-reviewed, more than once for some papers, these papers have often been extensively critiqued and the various issues or limitations have either been addressed in article revisions or have been discussed in the Discussion section.
of the individual papers. It should be noted that detailed reviewer correspondence pertaining to each of the papers has been provided in a document accompanying this thesis. In some cases, manuscripts were submitted to a number of journals before they were accepted meaning that rounds of criticism were required to be addressed across the entire submission process. Specific issues shall not be dealt with here as they have been addressed in individual papers; rather, the more general limitations shall be discussed.

One of the major limitations identified in many of the papers related to the specific measures used. Because of the need to use measures of constructs which had not previously been created, a number of reviewers across many of the papers were critical of the measures used. Some reviewers were also critical of single-item measures of fear, arguing that these were insufficient to adequately tap the intended construct and suggesting longer and already existing scales or indices. The need to develop new scales for most studies was a major problem with this research. Although the measures were invariably found to have good internal reliability, their construction was primarily a function of face validity. There is work to be done in this area in the future and the development of psychometrically tested scales will be an important aspect of driving this line of research forward.

Now that a body of research has given support for the central tenets of the Cognitive Vulnerability Model there is an opportunity to more fully develop scales to measure both the cognitive vulnerability perceptions and fear itself. This might seem like putting the cart before the horse, but without preliminary verification of the model there would be no need to spend the time and effort required to develop a number of new measures. Of course, this approach ran the risk of failing to find significant results precisely because the scales were not well developed. Fortunately though, this was not the case, and providing preliminary veracity of the Cognitive Vulnerability Model clears the way for a more detailed development of measures for the various relevant constructs in the future.

Many of the studies reported in this thesis use a cross-sectional design and it is important that more longitudinal or randomised experimental designs are employed in the future. Although longitudinal designs are generally more expensive and time consuming this is more than compensated for by the quality of the data received. The overwhelming majority of research into the etiology of fear uses retrospective data or experiments to impute possible causative associations. Papers 3 and 4 in this thesis were lauded by one of
the manuscript reviewers as providing a new methodology to testing cause and effect in relation to specific fears and it is important that this approach be extended to other fears and other situations so that causation can be more firmly established across a range of situations.

Many of the individual studies reported here have various limitations and may be criticised on several grounds, however it is hoped that the diversity of approaches and overall weight of the body of studies provides some relief from any one critique which might bring into question the results of a particular study. Indeed, the aim of this series of studies was always to cast the net widely and examine at the outset as many of the implications of the Cognitive Vulnerability Model as possible. Of course, this approach may itself be seen as a limitation of the work. However, it is also possible that even more criticism may have resulted from a narrower approach which would have left many elements of the model untested. In any event, having provided some groundwork and initial support for the theory the challenge is now to develop each of the possible directions of enquiry to provide for a strong base of evidence for the applicability of the model in explaining various specific fears.

**Future investigations**

It is important that research into the Cognitive Vulnerability Model continues or else the model may fail to gain scientific support and acceptance. Theoretical models tend to be imbued with inertial properties – the harder they are pushed the more accepted they may become whereas models with no continuing empirical support seem to be passed over and forgotten, sometimes in spite of their usefulness. Fortunately, there are many possible avenues for further research investigating the model. In addition, the model can be used to guide cognitive-behavioural treatments, and the effectiveness of this approach could be assessed. Some additional studies are already being conducted, others are at a formative stage, and others still are future possibilities. Some of the future possible investigations are discussed below.

While retrospective cohort and cross-sectional studies are useful and provide evidence of associations, causality can only really be inferred from randomised experiments or prospective cohort studies. One future study, which is already being
planned, is a questionnaire-based longitudinal study examining the change in dental fear prior to and following a child’s dental examination. The questionnaire is to have sections on (1) child’s fluoride toothpaste use, dietary habits, previous dental visiting experiences, and level of anxiousness, (2) both parents’ oral health behaviours, dental fear, perceptions of vulnerability associated with dental visiting, self-rated oral health, service utilisation, and social impact of oral health, (3) household characteristics and income, parent’s education and residence information on child, and (4) the child’s perceptions of dental visits, perceptions of vulnerability associated with dental visiting, and oral health impact. Any changes in dental fear can be related to differences in changes in vulnerability perceptions, dental experiences and treatment. The study would ideally involve children prior to their first dental visit, with information obtained on both children and their parents. The study could involve the cooperation of one of the school dental services (SDS) in Australia who provide free or subsidised care to the majority of the Australian child population. It would be hypothesised that: (1) variations in children’s fear of going to a dentist, prior to a dental visit, will relate to personality characteristics and parental fear characteristics; (2) that changes in fear following a dental visit will be accompanied by changes in perceptions of dental visits as being uncontrollable, disgusting, unpredictable, and dangerous (vulnerability perceptions); (3) that parents’ dental fear will be significantly correlated with vulnerability-related perceptions of dental visits; and (4) that the relationship between changes in dental fear and treatment will be moderated by perceptions of the treatment.

There is also a need to more rigorously develop a measure of the components of the cognitive vulnerability perceptions. It is important that future work be based on an instrument of proven validity and reliability. Because the Cognitive Vulnerability Model proposes new constructs, existing measures are ill-suited and co-opting or combining them into new measures has been criticised by reviewers. In addition, for other researchers to take up the model a psychometrically validated scale is almost essential. An area of initial interest will be creating a scale that measures perceptions of uncontrollability, unpredictability, dangerousness and disgustingness in relation to dental visits. While Paper 10 in this current portfolio used one question each for perceptions of control, predictability and danger/harm as a preliminary investigation of the model in relation to dental fear, future studies should employ a better developed measure.
It would be very useful to revisit some of the studies published in this portfolio and extend them with new ideas and approaches. Studies which have looked at animal fears might be replicated using some other situational fears such as fear of heights, flying or deep water. Studies which only looked at perceptions of uncontrollability, unpredictability and danger should also include perceptions of disgustingness associated with stimuli. The factor analytic study of the Fear Survey Schedule in Paper 9 (Chapter 12) requires a larger sample to test that the results were not merely a function of that particular group of people. Also, Paper 2 (Chapter 5) which looked at fear and perceptions of vulnerability in relation to 8 different animals could be extended to look at associations across a much larger number of animals or across different situations to test the idea that the distribution of fears in the population are a direct function of the perceptions of the feared stimuli as uncontrollable, unpredictable, dangerous and disgusting. There are numerous other examples where the studies described in this thesis could be used as a basis for the incremental extension or replication using different populations or fears.

One area of the Cognitive Vulnerability Model which did not receive any empirical investigation was the role of coping mechanisms in interacting with the general evaluation of the significance of the stimulus. There is only a modest literature on the nature and role of coping mechanisms in specific fears and phobias. For example, while there is evidence that both children and adults use coping strategies when undergoing dental examinations, understanding the relationship of these strategies and their effectiveness to perceptions of vulnerability would be a fascinating piece of research. The implications for understanding the experience of fear, its manifestation, and possible treatment would be significant. It is likely that some coping strategies may be more effective than others and the identification of particular approaches that provide comfort or that lead to reductions in delayed dental visits or cancellations of appointments would be important.

Another area which needs more clarification is exactly how the vulnerability-related perceptions combine. It is proposed that the four relevant perceptions combine in different ways for different fears, and indeed for different people, yet the elaboration of this process remains largely unexplored. It is likely that for any given fear, vulnerability-related perceptions are roughly in accord with what many people might regard as being the objective characteristics of the situation. However, it must be kept in mind that individual learning events and a person’s personality traits also impact upon these
perceptions. Yet, we still might find general combinations of variables are more important
generally for some stimuli than for others. Such work would help flesh out what is a
largely unexplored area and enable a greater understanding of both individual differences
in fear acquisition and the uneven fear distribution in the population.

Publication impact

One way to judge the importance or usefulness of a journal paper is to count the
number of publication citations it has received. More pertinent papers will be cited more
often in the scientific literature than less pertinent papers. Unfortunately, given the one to
two year lag common between the submission of an article and its publication, there will
always be a period of ‘citation inactivity’ immediately following any given publication. For
this reason it is hard to judge the likely impact of the portfolio of papers in this thesis in
regards to future citation activity. Other articles are still working their way through the
submission process. As at the middle of 2008, the longest any of the articles had been in
print for was about 28 months. With these caveats in mind, citations range from none for
the most recently published papers to nine for Paper 7. There had been seven citations for
Paper 1.

While citations might be one way of marking the impact of any given article, this
is not the only way. For instance, Paper 7 in this thesis, which was published in the
Australian Dental Journal, was judged by the University of Adelaide to be worthy of an
accompanying media release upon its publication. The press release was picked up and
reported on by numerous print media outlets and radio interviews were conducted on
radio stations around Australia. Results from the study have since been printed and cited
in numerous paper and magazine articles.

In addition to media interest, some of the publications in this thesis have been
highlighted in other ways. Papers 2 and 8, for example, published in BMC Psychiatry and
BMC Oral Health respectively, were both featured as a ‘research highlight’, an honour
reserved for only a small number of papers in each of the journals over the course of a
year. Data from the publisher of Paper 8 indicates that across the 6-month period that the
paper was featured, it was accessed approximately 2,500 times, had been accessed more
than 3,500 times within the first year, and had been accessed over 4,700 times in the first
16 months. Paper 2 was accessed almost 500 times in the first month. Also, Paper 9 was featured in the news section of a dental magazine, DPR Europe which has a circulation of over 60,000 dentists in 24 European countries. The assistant editor of DPR Europe and DPR Asia expressed extreme interest in reporting on the article which took the form of an “original article to inform our readers about the effects your research may have on the dental industry as a whole”.

Final remarks

The contents of this thesis represent a portfolio of research built on a number of years of theorising and empirical work. While some studies have involved the secondary analysis of data, others required the active recruitment of participants, the building of experimental apparatus, the creation of computer software, and often the management of all phases of the study. The saying that life is a journey not a destination could be equally applied to this research. Of course, the end of this thesis is not an end to the research relating to the Cognitive Vulnerability Model. Now that the model has garnered some scientific support it must show itself to have validity and continued scientific utility. Hopefully it will prove of interest to other researchers who may employ it either theoretically to guide their research or will incorporate elements into their study methodology. Of course, the reality is that some of the contemporary theories of the etiology of specific fears are widely accepted and many have decades of research behind them. A large amount of scientific investigation, from a host of different perspectives, will continue to explore the development of specific fears. If nothing else I do hope that the Cognitive Vulnerability Model will stimulate further enquiries and ultimately help in our understanding of specific phobias which are, to many people, an enormously burdensome and distressing psychological affliction.