Running head: VERBAL INFORMATION PATHWAY TO FEAR

"The Cuscus has White Teeth."

The Verbal Information Pathway to Fear in Non-clinically Anxious Children: No Influence of Ambiguous Information or Trait Anxiety

By

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Abstract

Twenty-nine non-clinically anxious children, aged 7-10 years old, completed the Fear Beliefs Questionnaire (FBQ; Field & Lawson, 2003) before and after the presentation of verbal ambiguous information about an unknown animal, while 32 similar children matched for trait anxiety did the same after hearing threat information. Behavioural avoidance of the animals was subsequently examined with an adaptation of the Nature Reserve Task (NRT; Field & Storksen-Coulson, 2007). Children also completed a Reduced Evidence of Danger interpretation bias task (Muris, Merckelbach & Damsma, 2000c) for ambiguous stories with generalised anxiety and social anxiety content, prior to the FBQ and NRT. Verbal threat information substantially increased FBQ ratings and NRT distance from the tagged animal, whereas ambiguous information had no effect on these measures other than a subset of children showing an avoidance of the tagged animal in the NRT. Contrary to expectations, level of trait anxiety was not related to interpretation biases, or the effect of ambiguous or threat information. In the threat group, but not the ambiguous group, two bias measures for generalised anxiety stories were associated with relative increase in FBQ ratings for the tagged animal, and a third bias measure for social anxiety stories was associated with NRT score. The associations held when controlling for gender, age, and trait anxiety, including trait anxiety used as a moderator variable. These findings support the view that verbal threat information is sufficient to induce fear of animals in children. Results are inconsistent with the current view that the effects of the verbal information pathway increase as a function of trait anxiety and that ambiguous verbal information can lead to increased fear responding. The evidence for bias – verbal threat associations suggests that future studies should examine their role in the verbal information pathway to fear and anxiety, and clarify the influence of various internalising and externalising psychopathologies beyond trait anxiety.

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"The Cuscus has White Teeth."

The Verbal Information Pathway to Fear in Non-clinically Anxious Children:

No Influence of Ambiguous Information or Trait Anxiety

General Aims of the Current Study

The current study investigated the comparative effect of threat and ambiguous verbal information on 7 – 10 year-old children's fear of novel Australian animals (the cuscus and the quoll; Appendix A). The growing body of research is summarised that shows that, beyond direct experience (e.g. Field & Storksen-Coulson, 2007) and modelling (Askew, Kessock-Philip & Field, 2008), verbally transmitted threat information is a viable environmental pathway to childhood fears (Muris & Field, 2010). Verbal threat information can reliably increase physiological anxiety symptoms, fear beliefs (using implicit and explicit measures) and behavioural avoidance of unfamiliar animals in children (Table 2). However, the importance of verbally transmitted ambiguous information, and the effects on increased fear beliefs in children as a function of trait anxiety, are two important issues that have received relatively little attention. Evidence is summarised that anxious children tend to interpret ambiguous information as more threatening than do children with lower levels of anxiety (General Interpretation bias (GIB); e.g. Cannon & Weems, 2010). Related evidence suggests that anxious children also tend to imbue ambiguity with threat more rapidly than non-anxious children, with little consideration for information that is inconsistent with threat (Reduced Evidence for Danger Bias (RED); e.g. Muris & Field, 2008a). Thus, the current study tested predictions that explicit verbal threat information would induce fear beliefs and behavioural avoidance in most children, but higher levels of trait anxiety were expected to be associated with higher fear responses when ambiguous verbal information was provided. The prediction that interpretation biases (GIB/RED) would mediate the facilitative effect of trait anxiety on the fear producing effects of ambiguous verbal information was also examined.

Childhood Fears and Anxiety

It has been suggested that fear and anxiety are acquired through the same mechanisms (Field & Purkis, 2011). Anxiety is the anticipation of a stimulus or event that is perceived as aversive, uncontrollable and unpredictable (Clark & Beck, 2010), that leads to disorganised or dysfunctional behaviour (Field & Purkis, 2011). In trait anxiety, the individual has a relatively stable (i.e. chronic) characteristic of proneness to anxiety, whereas state anxiety refers to a transient (i.e. current) experience of anxiety symptoms (Clark & Beck, 2010). Fear is a reaction to a specific threat, with the growing proximity of that threat eliciting escape or avoidance behaviour (Field & Purkis, 2011). Fear is a generally adaptive emotion (Clark & Beck, 2010). When under threat, the cognitive (e.g. the thought that "I am in peril"), physiological (e.g. increased heart rate) and behavioural (e.g. fight or flight response) aspects of the fear emotion (Lang, 1985, cited in Muris & Field, 2008a) are activated to promote survival (Muris & Field, 2008a). However, when the expressed fear is developmentally inappropriate, present in the absence of objective threat, or is disproportional to the threat, then the response has maladaptive consequences (Muris, 2007).

Fear and anxiety are particularly common and normal in childhood. Most children experience occasional mild and transient difficulties (Muris, 2007), but exaggerated anxiety and unrealistic fears represent complex and sometimes chronic problems for a significant subset of children (Clark & Beck, 2010). Clinically significant anxiety occurs in 2 - 15% of children and adolescents (e.g. Rapee, Schniering & Hudson, 2009). Furthermore, subclinical expressions of anxiety disorders may be found in a substantial proportion of children without psychiatric diagnoses (Bell-Dolan, Last & Strauss, 1990). Children and adolescents with significant anxiety are more likely than other children to experience academic and social problems, are at increased risk of substance abuse and dependence, and may experience

serious psychological problems in adulthood, such as adult anxiety and depressive disorders (Field, Cartwright-Hatton, Reynolds & Creswell, 2008).

Specific phobias are one of the most common anxiety disorders (Muris, 2007). It is estimated that approximately 5% of children will develop fears that meet the Diagnostic and Statistical Manual of Mental Disorders IV-TR (DSM-IV-TR; American Psychiatric Association, 2000) criteria for specific phobia (Ollendick, King & Muris, 2002). The DSM-IV-TR (APA, 2000) defines a Specific Phobia as an excessive and unreasonable fear that is reliably cued by the presence or anticipated presence of an object or situation. The feared stimulus is avoided by the individual or endured with acute distress. The distress experienced and the associated pattern of avoidance impairs or interferes with an individual's functioning across key domains. In children, such high levels of fear may impair academic progress (e.g. they may avoid school for fear of being exposed to feared stimuli), socio-emotional development (e.g. they may have limited contact with peers due to avoidance of feared stimuli) and affect relationship skills and relationship quality (e.g. increased stress involved with parenting a child with a specific phobia may increase the likelihood of negative parent-child interactions) (Carr, 2006). Given this range of severe consequences, much research has examined factors that may make children more vulnerable to develop anxiety disorders such as specific phobias, and what factors may maintain and/or exacerbate these problems (e.g. see Muris, 2007, for a review). Identifying and understanding such mechanisms may provide targets for treatments that may help to prevent problems later in a child's life (Reid, Salmon, & Lovibond, 2006).

Cognitive Biases and Childhood Fears and Anxiety

One important factor that may exacerbate and maintain anxiety is that anxious individuals tend to differ from non-anxious individuals in the way that they process threat relevant environmental and interoceptive information (Ouimet, Gawronski, & Dozois, 2009).

Based on Crick and Dodge's (1994) model of cognitive systems, Daleiden and Vasey (1997) suggested that anxious children have information processing distortions throughout interacting sequences of information processing. Such information processing abnormalities, termed cognitive biases (e.g. Reid et al., 2006) or distortions (e.g. Muris, 2007), have been found in both anxious adults (e.g. Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007) and children (e.g. Creswell, Shildrick & Field, 2011). Some cognitive biases manifest themselves in the early stages of information processing, and are thought to suggest unintentional, fast processes that are outside of one's awareness, while others are manifested at later, more conceptual stages (Muris, 2007). Muris (2007) states that there is evidence that anxious children show hyper-vigilance toward threatening stimuli at the early stage of information processing (*attentional bias*; e.g. Vasey, Daleiden, Williams & Brown, 1995), and have a tendency when faced with ambiguity to endorse threatening explanations or meanings in the later information processing stages (i.e. when a number of explanations are plausible: *interpretation bias*; e.g. Creswell et al., 2011). Furthermore, there is evidence that anxious children tend to make threatening interpretations with minimal confirmatory information and with limited search for disconfirmatory information, which has been termed a *reduced evidence for danger* bias (RED; e.g. Muris, Rapee, Meesters, Schouten & Geers, 2003a). There is relatively weak evidence that anxious individuals selectively remember threatening stimuli (Mitte, 2008), especially for children (Muris & Field, 2008a).

Theories of anxiety have usually described cognitive biases as factors that maintain and exacerbate anxiety (e.g. Daleiden & Vasey, 1997; Muris, 2007). Other researchers imbue cognitive biases with a dominant, etiological role in the pathogenesis of anxiety (e.g. Clark & Beck, 2010). A third view is that some types of bias may simply be an epiphenomenon of high fear and/or anxiety (Muris, 2007). If the latter interpretation is correct, then there would be an association between bias and anxiety that has little conceptual importance for the

aetiology of anxiety or fear response and bias would not mediate the path between anxiety and fear responding. Any association between bias and fear responding irrespective of level of anxiety would, however, imply that bias may be more important than anxiety in producing subsequent fear responding.

In the context of the aetiology and maintenance of childhood anxiety and fears, cognitive biases at the later, more conceptual stages of information processing, rather than the early more unintentional stages of information processing, may be a particularly fruitful focus for experimental research. Biases at the later stages of information processing have been found more consistently in studies with children, especially younger children (Muris, 2007). In addition, conceptual stage biases (e.g. interpretation bias) may be easily amenable to interventions that are associated with a reduction in self-reported anxiety symptoms (e.g. Salemink, Van de Hout & Kindt, 2009). Moreover, *attentional* bias to threat, which operates at earlier stages of information processing, can be moderated by manipulations of *interpretation* biases (e.g. Amir, Bomyea, Beard, 2010), consistent with information processing theories suggesting that inputs at a more automatic, associative level can be affected by subsequent processing, and vice versa (e.g. Ouimet et al., 2010). Furthermore, there is growing evidence to suggest that children may be trained to display interpretative biases toward particular stimuli that are associated with maladaptive avoidance behaviour that could maintain fears (e.g. Muris, Huijding, Mayer, Remmerswaal & Vreden, 2009a).

Studies investigating interpretation biases in children have often used an ambiguous story paradigm. These studies have found that anxious children tend to make threatening interpretations of hypothetical situations despite both benign and threatening explanations being possible (e.g. Barrett, Rapee, Dadds & Ryan, 1996; Creswell et al., 2011). In one variation of this task, in both European (e.g. Muris, Kindt, Bogels, Merckelbach, Gadet & Moulaert, 2000a) and Asian (e.g. Lu, Daleiden & Lu, 2007) children, those who reported

higher anxiety have shown greater levels of general interpretation bias, and required less information to decide that a hypothetical situation is dangerous (termed *reduced evidence for danger bias* (RED); Muris et al., 2000a). Thus, in anxious children, even minimal threat signals may trigger information processing that in turn promotes anxious responding (Muris et al., 2000a). For example, Muris et al. (2000a) presented children with ambiguous stories that were related to three types of anxiety (social anxiety, separation anxiety and generalised anxiety; Muris et al., 2000a). Children were told that the stories would have a "good" ending or a "bad" ending. They were required to figure out whether the outcome of the vignettes would be good or bad as quickly as possible. Stories were presented sentence by sentence, and after each sentence children were asked to guess the outcome of the story, which provided a measure of *threat threshold* (the amount of information a child needed before deciding that a situation was dangerous). Afterward, the story was re-read without interruption, and the child was asked to indicate what they thought would happen next, to measure a general interpretation bias. Finally, children used a Likert scale to rate how they would feel if they were in that situation (*negative feelings and cognitions)*. Children who were high in trait anxiety (as measured by self-report instruments and diagnostic interview) tended to have lower threat thresholds , made more threatening interpretations, and showed more negative cognitions and feelings toward the stories than children lower in anxiety. Interestingly, these threat perception abnormalities were predicted by children's level of general anxiety, rather than specific anxiety symptoms (e.g. separation vs. social anxiety). Subsequent studies have replicated these findings using ambiguous story paradigms (Table 1; Muris, Luermans, Merckelbach & Mayer, 2000b; Muris, Merckelbach & Damsma, 2000c; Muris, Rapee, Meesters, Schouten & Geers, 2003(a); Lu et al., 2007).

Several findings attest to the value of the ambiguous story paradigm. Biases measured using the RED procedure have been shown to be moderately stable over a 4 week period

(Muris, Jacques & Mayer, 2004). Trait anxiety has a stronger and independent relationship with threat perception in response to ambiguous stories than does state anxiety (Muris et al., 2003a). In addition, similar results have been found with non-verbal, pictorial ambiguous stimuli and anxiety has been found not to be associated with a tendency to give affirmative responses in these tasks (Muris & van Doorn, 2003b), suggesting that previous positive findings from the ambiguous story paradigm are not artefacts of the procedures used (Muris, 2007).

There is general agreement that cognitive biases such as RED and interpretation bias probably maintain and exacerbate fear and anxiety, presumably by promoting maladaptive anxious responding, such as avoidance (e.g. Daleiden & Vasey, 2007). In turn, anxious responding may inhibit further learning that a stimulus is actually non-threatening or that it is not as threatening as had been presumed (Muris, 2007). However, there is disagreement whether cognitive biases represent epiphenomena of high anxiety levels or whether they play a role in the pathogenesis of anxiety (Creswell et al., 2011). As most studies have been correlational in nature, they provide little evidence for the causal or maintaining role that cognitive biases may play in the development of childhood fears and anxiety (Muris, 2007). However, preliminary evidence from prospective studies has begun to address this issue. For example, Muris et al. (2004) conducted a four week prospective study examining the association between threat perception abnormalities, such as RED and interpretation bias, and anxiety symptoms in non-clinical children aged 9 –13 years old. While threat perception measures were significantly associated with anxiety symptoms at each time point, the strength of bias at time one did not predict the severity of anxiety symptoms experienced at the second time point. Muris et al. (2004) interpreted this evidence to show that biases are unlikely to be important etiological factors and should be viewed instead as epiphenomena that may have a minor role in the maintenance and exacerbation of anxiety symptoms.

However, two prospective studies used a longer, 1 year follow up period, and have found evidence for a prospective association between interpretation bias and anxiety symptoms in pre-school (aged 5 years; Warren, Emde & Sroufe, 2000) and primary school aged children (aged 10-11 years; Creswell & O'Connor, 2006). A follow up study by Creswell et al. (2011) found a similar association, but only between first time point measures and third time point measures, with no link found between second and third time point measures over a three year period. Taken together, prospective studies provide evidence that interpretation biases play a role in the development of anxiety symptoms.

Support for a causal influence of these biases is provided by experimental studies that used procedures to modify interpretation bias, which have shown that reducing interpretation bias reduces anxious responding (e.g. Salemink et al., 2009), whereas training children to display this bias may increase anxious responding (e.g. avoidance; Muris et al., 2009a). Thus, it is possible that cognitive biases such as interpretation biases represent factors that increase vulnerability to fear and anxiety. That is, they may interact with discrete fear *learning* experiences and contribute to the development of new fears in already anxious children (Murray, Creswell & Cooper, 2009). It is therefore of interest to investigate the relationship between interpretation biases and environmental pathways that experimental research suggests can lead to the development of a specific fear response, as opposed to any general effect on later anxiety (Muris et al., 2004). As far as is known, this idea remains untested.

Table 1.

Summary of studies that have used the RED paradigm with children: Sample sizes and sample characteristics, and anxiety measures used.

Study	*N*	Age	Stimuli	Anxiety Measures
Muris et al. (2000a)	105	8-13	A.S. (general, social and separation anxiety situations)	SCARED STAI-C (trait scale)
Muris et al. (2000b)	76	8-13	A.S. (social situations)	SASC-R STAI-C (trait scale)
Muris et al. (2000c)	252	8-13	A.S. (social situations)	SASC-R SCARED SCAS
Muris et al. (2003a)	299	8-13	A.S. (general, social and separation anxiety situations)	SCAS RCMAS STAI-C (state scale)**
Muris et al. (2004)	113	9-13	A.S. (general, social and separation anxiety situations)	SCAS
Muris & van Doorn (2003b)	138	8-13	Non-verbal, visual, ambiguous stimuli	RCADS
Yu et al. (2007)	1004*	9-19	A.S. (general, social and separation anxiety situations)	CBCL

Note. All of the above studies found that anxiety measure scores were associated with RED bias measures: Threat threshold, Threat frequency, Interpretation bias, Negative feelings and cognitions. A.S. = ambiguous stories. *All children were European, except *(Chinese sample), **association greater for trait than state anxiety. SCARED = Screen for Child Anxiety Related Emotional Disorders, STAI-C = State Trait Anxiety Inventory for Children, SASC-R = Social Anxiety Scale for Children Revised, SCAS = Spence Children's Anxiety Scale, RCMAS = Revised Children's Manifest Anxiety Scale, RCADS = Revised Child Anxiety and Depression Scale, CBCL = Child Behaviour Checklist.

The Verbal Information Pathway to Fear

Twin studies provide strong evidence for a genetic influence on the development of fear and anxiety. Studies have found greater concordance rates for anxiety disorders in monozygotic twins (who share 100% of the same genetic code), compared to dizygotic twins (who share around half of the same genetic code) (e.g. Gregory, Lau, & Eley, 2007). Depending on the type of fear being examined, however, up to 50% of the variance is not explained by genetic factors (Eley & Gregory, 2004, cited in Muris & Field,2010), thus

highlighting that a large proportion of the variance must be accounted for by other factors, such as environmental influences.

The idea that fears and anxiety are acquired through the process of classical conditioning was the dominant view for much of the 20th century (Hoffman, 2008). Classical fear conditioning, in its most simplified form, involves the repeated pairing of a conditioned stimulus (CS: a stimulus that does not initially evoke a fear response) with an unconditioned stimulus (US), a stimulus that evokes a natural fear response, called the unconditioned response (UR). By pairing a CS with a US, and the creation of a CS-US memory association, the CS comes to elicit a conditioned response that is similar to the UR (e.g. fear) (Field, 2006a). The early classical conditioning model, however, appeared inadequate to explain a number of findings that include: 1) Fears appear to be non-randomly distributed in that fears of evolutionarily relevant stimuli (e.g. spiders/snakes) are more prevalent than those of non-evolutionarily relevant stimuli (e.g. a toothbrush), 2) laboratory induced fears of fear-relevant stimuli may be more difficult to extinguish (through exposure) than those of non-fear-relevant stimuli, 3) Not all individuals that have aversive experiences acquire significant fears, and 4) conditioned responses may occur even when the CS and US are not associated temporally (Magalhaes-Coelho & Purkis, 2009).

To deal with these findings, Rachman (1977; 1991) developed a “neo-conditioning” model that proposes that there are three environmental pathways that are important in understanding the development of fear and anxiety. This view has been widely accepted among learning theorists (Muris & Field, 2010). Rachman’s paths are: 1) Classical conditioning, 2) Modelling, and 3) The verbal transmission of negative information, otherwise labelled the verbal information pathway to fear. In relation to fear acquisition, the influence of the classical conditioning pathway on fear cannot be fully explored for ethical reasons, but substantial experimental research with humans (e.g. Gao, Raine, Venables,

Dawson, & Mednick, 2010; Field & Storksen-Coulson, 2007a), and animals (e.g. Delgado, Ollson & Phelps, 2006), as well as evidence from naturalistic studies, suggests that it is a significant environmental pathway to fear (e.g. Field, 2006a). The second pathway, modelling, refers to a phenomenon where fear is acquired in relation to a specific stimulus following observation of significant others displaying anxious responding in response to that stimulus (Gerrull & Rapee, 2002). There is evidence from human (e.g. Askew, Kessock-Philip & Field, 2007; Gerrull & Rapee, 2002) and animal (e.g. Mineka, Davidson, Cook & Keir, 1984) experimental studies to suggest that modelling is also an important environmental pathway to fear. Rachman's (1977; 1991) third pathway to fear, the verbal transmission of threat information, is based on the idea that an individual can acquire a fear of a stimulus after reading or hearing that it is dangerous or otherwise negative in some way (Muris & Field, 2010).

The importance of verbal exchange in human development led Rachman (1977) to suggest that the verbal information pathway may be particularly relevant for understanding the development of fears and anxiety in children (Rachman, 1977). Information giving is a fundamental part of parenting that is carried out continually by parents, particularly during a child's earliest years (Rachman 1977, cited in Muris & Field, 2010). Furthermore, it is likely that children are more frequently exposed to verbal threat learning events, when compared to direct negative conditioning experiences (Muris, 2007). There is also a growing body of evidence that the content and style of the language that parents (especially mothers) use to communicate with their children will strongly influence a child's development of core cognitive and socio-emotional skills (e.g. Wareham & Salmon, 2006).

Until recently, research investigating the negative verbal information pathway to fear has been either 1) naturalistic examinations of associations between level of child exposure to threatening information in the media and relevant fear, or 2) survey-based studies that

examined the prevalence, and relative importance, of events relevant to Rachman's (1977) three pathways (Muris, 2007). Survey-based studies ask phobic children and their parents which factors (i.e. verbal threat information, modelling or conditioning experiences) the child has experienced, and which they attribute as important in terms of the development of the relevant fear (see Muris & Field, 2010, for a comprehensive review). While evidence from such studies has demonstrated that the negative verbal information pathway may be a valid pathway to fear, their methodological limitations have been criticised (Field & Lawson, 2003).

The main limitation of naturalistic designs that examine the role of threat information based on the media is that they cannot isolate verbal threat information from other, potentially important factors. For example, a child may have heard threatening information on the television news, but this coverage may have been accompanied by actual pictures/footage of a disturbing event (i.e. exposure that could constitute a direct experience/classical conditioning learning event) and may have featured onlookers who modelled fearful reactions in relation to fear relevant stimuli (Muris & Field, 2010).

Retrospective survey based studies have similarly been criticised. For example, Muris and Field (2010) argue that 1) due to a lack of control groups it is hard to know whether particular learning events (i.e. direct experience vs. modelling vs. verbal information) are more prevalent in those with fears than those without and that 2) there is potential for memory bias, not only in terms of recall problems, but also with respect to learning events, because direct experiences may be more salient and therefore more strongly encoded and thus more easily retrieved than other potentially important learning events. Another problem, 3) is poor validity when self-report instruments are used. Self-report measures may only assess a person's *beliefs* about the origin of their fear, but this may not necessarily be the cause. These

attributions may be affected by the individual's beliefs about the development of fear, as well as the culture/society in which they live (Muris & Field, 2010).

To address these shortcomings and better understand the potentially causal role of verbal threat information in the development of childhood fears, Andy Field and colleagues have developed a prospective experimental paradigm (*the verbal information paradigm*) to measure the effect of verbal threat information under controlled conditions (Table 2). The paradigm was initially developed by Field, Argyris and Knowles (2001). Children are given different types of verbal information (e.g. threatening or positive) about novel stimuli. A fear response to the novel stimuli is usually measured before and after presentation of this information, using one or more of Lang's (1968; 1985) emotion response systems (Muris & Field, 2010). The within-participant response difference reflects the experimental effect of verbal information, and this is often compared to a control novel stimulus that is not paired with verbal information. Lang (1968; 1985) proposed that an emotion such as fear is expressed through three response systems: 1) Subjective states and cognitions related to those states, such as increased self-reported fear beliefs, 2) behavioural changes, such as increased avoidance, and 3) physiological changes, such as increased heart rate. Evidence that changes can be observed on all three of Lang's (1968; 1985) response systems provides strong convergent support that verbal threat information constitutes a relevant fear pathway for children (Muris & Field, 2010). The majority of studies (e.g. Field & Lawson, 2003; Muris, van Zwol, Huijding & Mayer, 2010) have examined the development of fear in relation to novel Australian mammals (e.g. the cuscus, quoll and quokka: Appendix A) or imaginary creatures, in children ranging from six to fourteen years old. The approach has been extended in two studies to verbal threat information concerning fear of social situations, although with mixed results (Field, Hamilton, Knowles & Plews, 2003; Lawson, Banerjee & Field, 2007). Fear of animals emerges in children by about 3 years of age and the relevance of this

paradigm in young to middle childhood is supported by evidence that normative fears are focused on animals in the 6-10 year age group (Muris, 2007).

Table 2, which is an adaptation of Table 1 in Muris and Field (2010), summarises the substantial body of evidence based on the verbal information paradigm showing that verbal threat information can reliably increase fear beliefs (using implicit and explicit measures), behavioural avoidance and physiological anxiety symptoms with respect to novel stimuli in children aged 6-14 years old (i.e. all components of Lang's (1968; 1985) fear emotion). These effects have been shown to last for up to six months in both younger (6-8 years old), and older (12-13 years old) children (e.g. Field, Lawson & Banerjee, 2008). In addition, it appears that verbal positive information has a fear reducing effect for children and also reduces fear responses after exposure to verbal threat information, at least in terms of fear cognitions (subjective reports and implicit cognitions) and fear behaviour (avoidance) (Muris & Field, 2010). Table 2 also shows that, unlike threat and positive verbal information, ambiguous verbal information has been rarely used. Similarly, well accepted measures of trait anxiety for children participating in these studies have not been employed previously. Hence, as explained below, the current study compared the influence of threat and ambiguous verbal information using this paradigm and evaluated whether the influence on fear responding by these types of verbal information was related to trait anxiety in a non-clinical group of young children.

Table 2
Summary of studies using the verbal information paradigm with children

Study	*N*	Age	Stimulus	Information	Ambiguous info?	Trait Anxiety?	Outcome measure	Effects
Field and Lawson (2003)	59	6-9	Novel animals	Threat, Pos, No	N	N	Self -reported fear Avoidance Implicit fear attitude	No— Threat↑, Pos↓, No— Threat↑
Muris et al. (2003)	285	4-12	Novel animal	Threat, Pos	N	N	Self-reported fear LT	Threat↑, Pos↓
Field (2006c)	50	7-9	Novel animals	Threat, Pos, No	N	N	Self-reported fear Attentional bias	Threat↑, Pos↓, No— Threat > Pos
Field (2006b) Exp 2	60	6-9	Novel animals	Threat, Pos, No	N	N; BIS*	Attentional bias	Threat > Pos
Field (2006b) Exp 3	127	6-9	Novel animals	Threat, Pos, No	N	N; BIS*	Avoidance behaviour	Threat > Pos, No
Field & Storksen-Coulson (2007a)	51	6-8	Novel animals	Threat, No	N	N	Self-reported fear	Threat ↑> Pos↑
Field & Schorah (2007b)	26	6-9	Novel animals	Threat, Pos, No	N	N	Heart rate	Threat > Pos, No
Field et al. (2007c) Exp 1	41	6-10	Novel animals	Threat, Pos, No	N	N	Self-reported fear	Threat↑, Pos↓, No—
Field et al. (2007c) Exp 2	64	6-9	Novel animals	Threat, Pos, No	N	N	Self-reported fear	Threat↑, Pos↓ > No↓
Field et al. (2008b)	117	6-8/12-13	Novel animals	Threat, Pos, No	N	N; FSSC-R***	Self –reported fear LT Avoidance LT Implicit fear attitude LT	Threat↑, Pos↓, No— Threat > Pos, No Threat↑
Field and Lawson (2008)	120	7-9	Novel animals	Threat, Pos, No	N	N	Self-reported fear Reasoning bias	Threat↑, Pos↓, No— Threat > No
Muris et al. (2008)	159	9-13	Novel animals	Disgust, Clean	N	N	Self-reported fear	Disgust↑, Clean↓
Muris et al. (2009b)	318	9-12	Novel animal	Threat, Pos, Ambig, No	Y	N; FSSC-R***	Self-reported fear Reasoning bias	Threat > Ambig > Pos > No Threat, Ambig > Pos > No
Muris et al. (2009c) Exp2	118	9-14	Novel animal	Threat, Disgust, Clean	N	N	Self-reported fear/avoidance	Threat↑ > Disgust↑
Field and Price-Evans (2009)	54	6-10	Novel animals	Threat, Pos, No	N	N; BIS**	Self-reported fear Heart rate	Threat↑, Pos↓, No— Threat > Pos, No
Kelly et al. (2010)	107	6-8	Novel animals	Threat, No	N	N	Self-reported fear avoidance behaviour	Threat > No
Muris and Rijkee (2011)	80	9-12	Novel animals	Ambig, Pos	Y	N; FSSC-R***	Self-reported fear****	Ambig > Pos
Field et al. (2001) Exp1	40	7-9	Monster doll	Threat, Pos	N	N	Self-reported fear	Threat↑, Pos↓
Field et al. (2001) Exp2	45	7-9	Monster doll	Threat, Pos	N	N	Self-reported fear	Threat↑, Pos —
Field et al. (2003)	135	10-13	Social situations	Threat, Pos, Neutral	N	N	Self-reported fear	Threat↓, Pos↑
Lawson et al. (2007) Exp 1	118	6-8/12-13	Social situations	Threat, Pos, No	N	N	Self-reported fear	Threat —, Pos —, No —
Lawson et al. (2007) Exp 2	80	13-13	Social situations	Threat, Pos, No	N	N	Self-reported fear Implicit fear attitude	Threat↑ Pos —, No — Threat↑

Note. Exp = Experiment, Threat = Threatening information, Pos = Positive information, No = No information, Ambig = Ambiguous information, Disgust = Disgust information, Clean = Cleanliness information, LT = Long term effects, ↑ = increase in fear on this measure, ↓ = decrease in fear on the measure, — = no effect, N = No, Y = Yes, BIS = child version of BIS self-report scale, FSSC-R = Fear Survey Schedule for Children Revised, *measure moderated effects, ** measure moderated physiological fear effects, but not others, *** measure did not moderate effects. **** between groups measure, only post information measurement. Table adapted from Muris and Field (2010).

The most common primary outcome measure of fear cognition in the verbal information paradigm has the self-report using the Fear Beliefs Questionnaire (FBQ; Appendix C) originally developed by Field and Lawson (2003; Table 2). The FBQ requires children to use a Likert scale that ranges from 1 (“No, not at all”) to 5 (“Yes, definitely”) to rate how they would feel about different hypothetical situations involving a stimulus. One example is, “Would you like to have an X (e.g. cuscus, quoll or quokka) for a pet or to look after an X for a few weeks?” Studies have consistently found that FBQ ratings increase following verbal threat information and decrease following positive verbal information (Table 2). The findings could be influenced by task demand characteristics, such that children’s responses could represent their belief or awareness of the experimental demands of the task rather than their actual fear beliefs and attitudes toward the stimuli of interest (Field & Lawson, 2003), but convergent evidence makes this problem unlikely. For example, when an Implicit Association Task (IAT; Greenwald, McGhee & Schwartz, 1998) was used to measure implicit attitudes towards an animal associated with threatening information, children showed faster reaction times when associating the threat animal with a negative word than with a positive word (Field & Lawson, 2003; Field et al., 2008). The speed of reaction time also supports the contention that they have acquired a threat association rather than a simple response bias. Similar findings were reported when Lawson et al. (2007) used the Affective Priming Task (Fazio, Sanbonmatsu, Powell & Kardes, 1986). It should be noted, however, that some researchers have questioned the construct validity of implicit attitude tasks (e.g. Rothermund & Wentura, 2004). None the less, increases in heart rate response to the stimulus associated with threatening verbal information, which provide evidence that verbal threat information can produce physiological symptoms of the fear emotion, add further evidence to conclude that demand characteristics do not play a major

role in the fear information paradigm in children (Field & Schorah, 2007b; Field & Price-Evans, 2009).

Two tasks, the Touch Box Task (Field & Lawson, 2003) and the Nature Reserve Task (Field & Storksen-Coulson, 2007a), have been used to assess the behavioural component of the fear emotion (i.e. avoidance) in the verbal information paradigm. The Touch Box task requires children to approach and put their hand in one box that they are told “contains” the animal associated with threat information, and another that “contains” an animal associated with positive, or no information. Children show more hesitancy towards the box that they believe contains the animal tagged with threatening information as opposed to positive or no information (Table 2). The Nature Reserve Task is based on the Family Systems task (Gehring & Marti, 2000, cited in Field & Storksen-Coulson, 2007a), in which moveable figurines are placed on a grid to represent family members and ascertain closeness between family members and the child. In the Nature Reserve task employed by Field and Storksen-Coulson (2007a), children were presented with a model of a nature reserve made from a wooden board covered with green material and model trees and were told that each pictured animal lived at the ends of the reserve. They used a Lego figure (male figure for boys and female figure for girls) to show where they would like to be when they visited the reserve. Children placed the Lego figure at a greater distance from the animal associated with threatening verbal information, compared to the animal for which they had received no information. Taken together, the results from verbal information paradigm studies that employed behavioural measures of fear indicate that verbal threat information may be powerful enough to induce mild levels of avoidance behaviour in young children (Muris & Field, 2010).

Several studies have used the verbal information paradigm to examine whether the procedure has induced cognitive biases in non-anxious children (Field, 2006b; Field, 2006c;

Field & Lawson, 2008; Muris et al., 2009b). All of these studies evaluated a measure of either attentional (e.g. Field, 2006c) or reasoning biases (e.g. a confirmation bias: the tendency to selectively search for evidence that confirms one's belief; Muris et al., 2009b) after the child had been exposed to verbal information. That is, they measured biases related to the stimuli (novel animals) as a consequence of the stimulus-information association. The assumption is that verbal threat information may be powerful enough to induce cognitive biases similar to those found in anxious children (Muris et al., 2009b). All of these studies have found support for this idea (Muris & Field, 2010).

By contrast, however, no studies have thus far examined whether this paradigm is sensitive to trait anxiety or whether a pre-existing cognitive bias such as an interpretation bias toward threat influenced the outcome of the verbal information paradigm (Table 2). It is hypothesised that cognitive biases may represent a key factor that mediates the effect of different types of verbal information on fear induction toward novel stimuli (Field, 2006b). For example, attentional biases may cause children to preferentially attend to and encode threatening information about a stimulus, or to be unable to disengage with threatening information (Ouimet et al., 2009). Interpretation biases may also make children more likely to interpret ambiguous information about a stimulus as threatening (e.g. Barrett et al., 1996) or make children more sensitive to minor threat cues (e.g. RED bias; Muris et al., 2000a). While studies have examined the general association between anxiety and cognitive biases in children (e.g. Muris et al., 2003a), with the assumption that biases may exacerbate anxiety, no study has linked pre-existing biases (presumed to be anxiety-related) and the child's response (e.g. cognitions and behaviour) following exposure to verbal information that can promote fear and anxiety (Table 2). Factors that are related to trait anxiety, such as the cognitive biases (e.g. Creswell et al., 2011), are expected to facilitate the effect of verbal information on fear.

The Verbal Information Paradigm: Moderating Variables

Research using the verbal information paradigm has more lately focussed on variables that might moderate the verbal threat information pathway to fear in young children (e.g. Field, 2006). For example, it appears that punitive (Field et al., 2007c) and neglectful (Price-Evans & Field, 2008) maternal parenting styles may moderate the influence of verbal threat information on fear of novel animals in 6-9 year old children. The source of verbal information may also be important. For example, Field et al. (2001) found that verbal threat information about novel monster dolls lead to fear in 7-9 year olds when delivered by adults (teacher and parents), but not peers.

As mentioned, no studies using well accepted standardised psychometric scales (e.g. the trait scale of the State-Trait Anxiety Inventory for Children (STAI-C); Spielberger, 1973; Seligman, Ollendick, Langley, Baldacci & Bechtoldt, 2004) have directly examined whether level of trait anxiety is related to fear responses obtained in children tested in the verbal information paradigm (Table 2). Instead, Field and colleagues have used a self-report behavioural inhibition system measure (an age downward version of Carver & White's, 1994 Behavioural Inhibition scale), which is a temperament measure that is theoretically related to anxiety (Field, 2006b; Field & Price-Evans, 2009). Primarily on the basis of neuropharmacological and neuropsychological evidence, Gray and McNaughton (2003) suggested that the behavioural inhibition system (BIS) is a specific brain system that governs trait anxiety with respect to genetically-determined personality traits. These traits are thought to increase a child’s risk of developing anxiety problems (Muris & Field, 2010). Two studies found that the BIS measure was associated with increased heart rate when a child performed the Touch Box task in response to an animal associated with threatening information, but the relationship between BIS and the actual behavioural response produced mixed results, and there was no relationship with the increase in fear belief (FBQ) following threat information

(Field, 2006b; Field & Price-Evans, 2009). While the association between the BIS score and psychometric scales of anxiety (e.g. Screen for Child Anxiety Related Emotional Disorders (SCARED); Birmaher, Chiappetta, Bridge, Monga & Baugher, 1999) was emphasised by these authors, the level of shared variance was only 25%, suggesting that the BIS measure is only a partial measure of trait anxiety, perhaps best reflecting the underlying physiological responsiveness of an individual. Consistent with the idea that BIS is also associated with physiological arousal, Field and colleagues also reported that the BIS measure facilitated the early stage attentional bias (as measured by a dot probe task) associated with threatening information (Field, 2006b).

Scores on another measure, the Fear Survey Schedule for Children Revised (FSSC-R; Ollendick, 1983), have been consistently found to be unrelated to fear induction by verbal information (Field et al., 2008b; Muris et al., 2009; Muris & Rijkee, 2011). Although the FSSC-R measures phobic symptoms, it fails to discriminate between children with and without externally validated significant anxiety, unlike psychometric scales of anxiety such as the trait scale of the STAI-C (e.g. Perrin & Last, 1992).

Thus, it appears that there exists no study that has adequately examined the moderating effect of trait anxiety on changes in fear using the verbal information paradigm. This gap in the literature is surprising because the association between trait anxiety and its potentially facilitative effect on the verbal information pathway to fear would strengthen the ecological validity of this commonly used paradigm.

An important question addressed by the current study is whether the potential facilitative effect of trait anxiety and associated variables is most evident when children are given information that is ambiguous in content. It is generally expected that children high in trait anxiety are especially likely to show a bias toward interpreting ambiguous information as threatening (e.g. Barrett et al., 1996). Thus, ambiguous verbal information may induce

mild levels of fear in children higher in trait anxiety, but have little to no effect for children who are average to low on trait anxiety. A recent study reported that a non-clinical group of children who were given ambiguous verbal information, showed increased fear beliefs and displayed reasoning biases (e.g. covariation bias: a tendency to overestimate the link between feared stimuli and aversive outcomes) (Muris et al., 2009b). Although the observed response to ambiguous information was smaller than when children were given threatening verbal information, a substantially higher fear belief response was obtained than when children were given no information. However, gender was found to moderate the effect of ambiguous information. Girls showed greater fear responses after ambiguous information, whereas there was no gender difference when threatening or positive information was used. The explanation offered for this gender effect was that girls are generally higher in trait anxiety (Muris & Field, 2010). Indeed, girls are more likely to experience significant fears and anxiety than boys (e.g. Bernstein, Borchardt & Perwein, 1996, cited in Muris, 2007), and may therefore be more likely to show interpretation biases that would have made them more likely to interpret the ambiguous verbal information as threatening (Creswell et al., 2011).

In a follow up study, Muris and Rijkee (2011) also suggested that children given ambiguous verbal information showed increased fear beliefs in relation to a novel animal. However, the study has limitations that make the results difficult to interpret. They only tested groups of children given positive and ambiguous verbal information; but no groups of children were included who were given threatening or no information. It is therefore impossible to know whether the results reflected an ambiguous information effect or simply a contrast with the well-established positive information effect (Table 2). Also, children's fear beliefs were measured only after receiving information. A suitable control condition is essential to interpret any effect as being a result of the verbal information. Muris et al.

(2009b) failed to measure change in response to verbal information, but measured response relative to a no information condition, albeit across different children.

One interesting study (Muris, et al., 2010) presented mothers with threatening, ambiguous, or positive information about a novel animal. The mothers were given open-ended stories about confrontations with an animal, and told to tell their children what would happen next. Mothers who were given threatening information provided more threatening explanations to their children, who were found to show greater fear beliefs than children of mothers who were given ambiguous and positive information. Mothers given ambiguous information also provided more threatening narratives to their children, who showed significantly higher fear beliefs than those given positive information. Interestingly, these effects were mediated by level of parental anxiety (STAI-C trait scale; Spielberger, 1973). High anxiety mothers in the ambiguous information condition gave more threatening information to their children, which may indicate that they influence their children through a tendency to misinterpret ambiguous information as threatening. However, the idea that child's own level of trait anxiety is necessary for fear induction following ambiguous information remains untested.

The Current Study

The principal aim of the current study was to explore the role of ambiguous verbal information on the development of mild fear of novel animals in 7 - 10 year old children and to examine the relationship of this effect with trait anxiety. The main prediction is that for children who are high on trait anxiety (STAI-C trait scale), ambiguous verbal information will produce a robust increase in fear of a novel animal (either the quoll or the cuscus; Appendix A), whereas little or no effect will be evident in children with lower levels of anxiety. This prediction is supported by the findings that anxious children tend to interpret ambiguous information as threatening (e.g. see Castillo & Gonzales- Leandro, 2010, for a

review), that interpretation biases predict the severity of anxiety symptoms over time (e.g. Creswell et al., 2011), and by theoretical models of anxiety which suggest that cognitive biases play a key role in the aetiology and maintenance of fears and anxiety (e.g. Daleiden & Vasey, 1997; Clark & Beck, 2010). In contrast to ambiguous verbal information, verbal threat information was expected to produce increased fear responses in most children and this effect should be related to but less dependent on the level of trait anxiety. The latter hypothesis was supported by large body of research showing that verbal threat information can reliably produce fear in non-clinically anxious samples of children (Table 2).

The previous summary showed that a general interpretation bias (a tendency to choose a threatening explanation when faced with ambiguity; e.g. Barrett et al., 1996) and a Reduced Evidence for Danger bias towards ambiguous stories (RED; the tendency to make threatening interpretations quickly, with minimal confirmatory information and with no further search for disconfirmatory information; e.g. Muris et al., 2000a) are also expected to be more evident in higher anxious children. Hence the RED and general interpretation biases were expected to be a mediating factor for the “verbal ambiguous information effect” but not the “verbal threat information effect.”

The methodology employed in the current study was designed to produce a strong test of the main predictions. Comparison within each child between responses to an animal tagged with verbal information (ambiguous for one group of children, threatening for another) and another without information provided a within-subject measure of any verbal information effects. There is good evidence that negatively valenced (i.e. threat) information increases fear even in children with average levels of trait anxiety (Table 2), so the threat condition was expected to provide a robust experimental context to examine the relative effect of ambiguous verbal information. To avoid generalisation of effects across the two conditions, separate groups received ambiguous versus threatening information. The inclusion of threat

information is supported by findings that have been difficult to interpret when the effects of ambiguous verbal information were compared to the effects of positive information only (Muris & Rijkee, 2011).

Two measures of fear responding were used to provide convergent evidence to test these predictions. The first measure was the Fear Beliefs Questionnaire (FBQ, Field & Lawson, 2003, Appendix C) given both pre- and post-information exposure. The Nature Reserve Task (Field & Storksen-Coulson, 2007a) provided a behavioural (avoidance) measure of fear induction. Choice of both cognitive and behavioural measures addresses two of Lang's (1968; 1985) fear emotion response systems, thus strengthening any conclusions about the effect of verbal ambiguous information. Also, a behavioural response may be less likely to reflect demand characteristics than a self-reported fear belief response (Muris & Field, 2010). Scores obtained from an adapted version of an independent interpretation and RED bias task that has reliably shown threat perception abnormalities in anxious children (e.g. Muris et al., 2003a) were used to determine whether bias was associated with fear induction. The trait scale of the State Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1973) was used to measure trait anxiety, because it can reliably differentiate between clinically anxious and non-anxious children (Seligman et al., 2004).

Method

Participants

The current study was approved by the Victoria University of Wellington Human Ethics Committee. Information letters (Appendix H)/consent forms (Appendix I) were sent to parents of children from four participating primary schools in the Wellington Region, New Zealand (NZ). A final sample of 61 children (27 boys, 34 girls) aged 7 to 10 years (M = 8.75, SD =.99) was recruited and allocated (see below) to one of two information groups, exposure to threat information about a novel animal and exposure to ambiguous information about a

novel animal. The age range was selected because children's normative fears focus on animals at this developmental stage (Field & Lawson, 2003) and for comparisons with prior research in this area (see Muris & Field, 2010, for a review). NZ schools are given a 'decile' ranking based on the socio-economic status of their neighbourhood; 1 is the lowest ranking and 10 the highest ("Deciles Information", 2010). In the current study, the first school was ranked decile 7 (N = 19), the second decile 9 (N = 17) the third, decile 10 (N = 12), and the fourth, decile 10 (N = 13).

To ensure that the two information groups did not differ in terms of trait anxiety scores, child self-report trait anxiety scores on the trait scale of the State-Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1973) were classified at four levels and randomly allocated to each information condition (time constraints precluded the measurement of state anxiety). The classification used was 1 (low: N = 7; 1.0 *SD* or more below the mean), 2 (low average: N = 15; remainder scoring below the mean), 3 (above average: N = 35; above the mean but not > 1.0 *SD*) and 4 (high: N = 4; at or more than 1.0 *SD* above the mean). The animal (cuscus versus quoll) for which the children received information was randomly counterbalanced within these groups. A Latin square procedure across relevant conditions and STAI-C anxiety level was used to allocate children at the time of testing.

Materials

Animals

Pictures of two rare Australian marsupials, the quoll (5cm x 6.5cm) and the cuscus (5cm x 5cm) (Appendix A), were used. These animals were selected because their names are distinct and have been used successfully in many related studies (see Muris & Field, 2010 for a review). Children confirmed when asked at the beginning of the session that they had no prior knowledge or experience with these animals (no prior fear expectations) that might

influence the findings. Data from four children were excluded from analysis because they had read some information about the cuscus or quoll.

State-Trait Anxiety Inventory for Children (STAI-C)

Children completed the trait scale of the STAI-C (Spielberger, 1973) after the introduction at the start of the session. The trait scale of the STAI-C is designed to measure anxiety sensitivity or temporarily stable anxiety in children (Spielberger, 1973). The trait scale consists of 20 items (e.g. “I worry too much”; “I get a funny feeling in my stomach”; “I notice my heart beats fast”) and children are asked to rate the frequency of these items on a three point Likert scale as “hardly ever”, “sometimes” or “often true”. The STAI-C has been found to reliably differentiate children with significant anxiety problems from youth children without such problems (i.e. construct validity; e.g. see Seligman, Ollendick, Langley & Baldacci, 2004, for a meta-analytic review), and has good test - re-test reliability and internal consistency (scores available in the test manual; Spielberger, 1973). In the current study, the mean STAI-C trait scale score for girls was 36.58 (SD = 5.01) and the mean score for boys was 35.63 (SD = 6.18). An independent samples t-test showed that the mean STAI-C score for children in the ambiguous information group (M = 36.59, SD = 5.32) did not differ significantly from the mean STAI-C score for children in the threat information group (M = 35.69, SD = 5.80) (t (59) = .64, p >.35).

Fear Beliefs Questionnaire (FBQ)

The FBQ (Appendix C; Field & Lawson, 2003) used 7 items that are randomly presented across the two animals (e.g. “Would you find it scary to touch a cuscus/quoll?”). Children rated each question using a five point Likert scale (1 = not at all, 2 = no, not really, 3 = don’t know/neither, 4 = yes probably, 5 = yes, definitely) such that a high score (range of 7 – 35) indicates a stronger fear belief regarding an animal. Four of the seven items were reverse scored. Children completed the randomly ordered FBQs twice (before and after

presentation of information regarding one animal only). The FBQ has high internal consistency (e.g. Field & Price-Evans, 2009) and has been shown to be a reliable index of fear (Table 2). Internal consistency in the current sample (Cronbach's alpha = .88) was comparable to past research (e.g. Muris et al., 2009b). The response choice was provided using labelled buttons on a computer screen. Two practice items are used first to ensure that children understood the nature of the task. A Visual Basic.net programme (see Appendix D for screens shots) was used to present items relating to the quoll and cuscus one at a time in random order on a computer (which also recorded the child's response), beside a labelled picture of one animal (cuscus or quoll; order randomised across children).

Information

Ten ambiguous and ten threatening sentences (Appendix B) from Muris et al. (2009b) were used. These sentences have been matched for content and word frequency using the Celex Lexical Database (Centre for Lexical Information, 1993). Muris et al. (2010) reported that these sentences were correctly classified (90 - 100%) when independently rated as ambiguous or threatening by three adult and three non-participating children. Pre-recorded (mp3) sentences, read by an adult NZ female, were presented via a computer that concurrently displayed a picture of the relevant animal. The information provided, whether ambiguous or negative, or relating to the quoll or the cuscus, was always a recording made by the same female voice to equate information delivery across all children.

Nature Reserve Task (NRT)

An adapted version of the Nature Reserve Task (NRT) designed by Field and Storksen-Coulson (2007a) provided an explicit behavioural measure of fear, conducted after the second FBQ administration. The NRT was originally based on the Family System Task (Gehring & Marti, 2000; Gehring & Wyler, 1986, cited in Field & Storksen-Coulson, 2007a), in which distances between moveable 3-D figures are used to assess the relational closeness

of family members and the child. The current NRT (Appendix E) used a rectangular wooden board (60cm in length x 40cm in width) covered in realistic model grass material. The edges of the board were lined with model fences, and realistic model bushes and trees were glued in an even distribution across the far half of the board (opposite to where the child was standing), so as not to obstruct the child's response. At the centre of one side of the board was a photo of a cuscus/quoll (counterbalanced) underneath a large tree; at the centre of the other side was a photo of a quoll under a similar large tree. A straight "path" was cut in the grass material between these two trees. Children were told that the board represented a nature reserve, in which the quoll lived in a tree at one end, and the cuscus at the other. They were asked to imagine they were visiting this nature reserve and were given a Lego figure fixed on a small Lego platform to represent themselves (a boy for boys and a girl for girls). Placement of the Lego figure along the path between the two animals represented their preference or avoidance of the animals. The distance (cm) from the Lego figure to the base of the trees where the cuscus "lived" and where the quoll "lived" was measured after the child had left the room. The distance from the base of one tree to the base of the other was 53.4cm (midpoint = 26.7cm).

Reduced Evidence for Danger (RED) Bias

In the "Reduced Evidence for Danger bias" (RED bias) task, designed by Muris et al. (2000c), even very minor threat cues are expected to elicit information processing in anxious children that reflects a premature negative interpretation of a progressively evolving story. RED bias has been found to show a reliable and moderately high association with trait anxiety in Western (e.g. Muris et al., 2000a) and non-Western samples (e.g. Lou, et al., 2007) and has good test- re test reliability after one month (Muris et al., 2004). The RED task used ambiguous story vignettes. Children are told that some of these vignettes are scary (they will have a bad ending) and some are not (they will have a happy ending). Children are instructed

to find out as quickly as possible whether the story has a bad ending or a happy ending. Each vignette is presented sentence by sentence, to determine how much information a child needs before deciding that a situation is threatening. After each sentence the child is asked to indicate whether they think the story will be a scary or non-scary story and told that they can change their opinion on each subsequent sentence. Afterward, the story is re-played without interruptions and the child is asked what they think will happen next in order to measure a general interpretation bias (a tendency to choose a threatening explanation when faced with an ambiguous situation that could be interpreted in a number of benign, and threatening ways; Muris, 2007).

The current study used three audio-taped ambiguous hypothetical vignettes, relating to social anxiety, and three audio-taped ambiguous hypothetical vignettes relating to generalised anxiety (Appendix F) based on stories used by Muris et al. (2000a) and Lou et al. (2007). The stories were described by the same female voice. Three dependent measures as per Muris et al. (2000a) were used (Table 3): 1) *Threat threshold:* Defined as the moment a child first began to perceive the story as threatening (After one sentence = 1, after two = 2, etc). If a child indicated that the story was not scary after five sentences their score was 6. This number was averaged across the stories, with lower scores indicating a lower threat threshold. 2) *Threat Frequency*: Defined as the number of sentences after which the child indicated that the story was threatening summed across all six stories (scores could range from 0 – 30). 3). *General interpretation bias* (GIB)*:* Directly after the first two measures, the child was read the story again without interruptions and then asked to decide what they thought would happen next. Children's answers were recorded verbatim, and later GIB responses were coded by an independent blind rater as threatening or non-threatening interpretations (1 = threatening, 0 = non-threatening). GIB scores were summed across the six stories, yielding a score from 1 – 6.

Table 3.

Definitions and range of scores for interpretation bias measures across all stories and for general or social anxiety related stories separately.

Bias measure	**Definition**	**Range (both story type)**	**Range (each story type)**
Threat threshold	The moment (i.e. sentence) at which the child begins to perceive the story as threatening	*1 – 6	*1 – 3
Threat frequency	The number of sentences after which the child perceives the story as threatening	0 – 30	0 – 15
GIB	Threatening interpretations for story endings	0 – 6	0 – 3

Note. *Lower scores indicate a greater bias. For all other measures, higher scores indicate greater bias. GIB = General interpretation bias. Table adapted from Muris et al. (2000a).

Procedure

Four possible experimental conditions were randomly allocated to labels A (ambiguous group + quoll is the information animal), B (threat group + cuscus is the information animal), C (threat group + quoll is the information animal) and D (ambiguous group + cuscus is the information animal) and allocation of children to each of these conditions was counterbalanced on the basis of the appropriate Latin square design. In addition, to ensure adequate counterbalancing for level of trait anxiety, this Latin square design used one of four randomised start orders, applied to the four groups of children classified as showing low anxiety, low average anxiety, above average anxiety and high anxiety according to their STAI-C scores (see Participants section). The intention was to compare children in the “high” anxiety group to a single group of the remaining children, but this balance could not be assured by an unconstrained randomization of children to the various conditions. Hence this procedure ensured that each of the experimental conditions was counterbalanced in terms of anxiety score.

Testing took place in a quiet room allocated by the participating schools. Children were first introduced to the task by being told "today we are going to learn about some animals and answer some questions." To develop rapport with each child, and to encourage participation and valid responses, children were first asked to tell the researcher about a recent event, such as what they did at the weekend, and were asked open-ended questions about their interests and enjoyed activities. The researcher provided nonverbal (e.g. nodding, smiling) and verbal (e.g. "uh-huh"; "wow"; "cool") prompts to encourage each child to talk. Afterward, children completed the STAI-C trait scale.

Subsequently, Children completed the Reduced Evidence for Danger (RED) task, with instructions as per Muris et al. (2000a):

''In a moment, you are going to hear a number of brief stories. Some stories are scary: this means that these stories will have a bad end. Some stories are not scary: this means that these stories will have a good end. You have to try to guess as quickly as possible whether the story that you hear is a scary story which will have a bad end, or a non-scary story which will have a good end. You will hear each story sentence by sentence and after each sentence I will ask you whether you think that the story is scary or non-scary. Once you have told me that you think the story will be scary, you still may change your opinion after the next sentence.''

After presenting each sentence, the child was asked:

"What do you think? Is this going to be a scary story or a non-scary story?"

Finally, the story was played to the child a second time without interruption and the children were asked:

"What do you think will happen next in the story?"

Next, children were asked to sit in front of a laptop computer and introduced to the novel animals. The computer first displayed pictures of the quoll and cuscus side by side and

the child was asked whether they had heard of, or ever seen either of the animals before. The FBQ was then administered and the child answered each question by clicking on one of the 5 screen buttons, as described above. Prior to specific information about one of the animals, children were read each sentence and thus completed FBQ1 (about both animals in random order). After, a 20 second interval, children were told, "you are now going to learn about the X (cuscus/quoll)", at which point the mp3 recording (information type counterbalanced) was played, and the picture of the corresponding animal was displayed on screen followed by a 20 second interval. Children then filled out FBQ2 (counterbalanced) followed by another 20 second interval.

Children subsequently completed the Nature Reserve Task (NRT), previously hidden from view to minimise distraction during the early phase of the study. The instructions were: *"Imagine that this is a nature reserve that you are going to visit. The quoll lives in a tree at this end of the reserve* (experimenter pointed at the corresponding picture and tree), *and the cuscus lives in a tree at this end* (experimenter pointed at the corresponding picture and tree). *Imagine that this Lego figure is you. Put the Lego figure where you would like to be when you visit. You can place it anywhere along this path* (experimenter pointed at the middle of the "path")."

Special care was taken to debrief children as group once all volunteers in a class had been tested, to avoid children explaining to others the nature of the study. Children were told that the information that they had heard about the animals was not correct, and were given debriefing sheets (Appendix J) with pictures of people modelling non-anxious responses toward the animals (e.g. hugging them), and with positive information relating to both animals (Muris et al., 2010). Each child in the group was asked to read one sentence each and then the children were asked to discuss what they had learned about the animals. The positive

information used has successfully reduced fear after exposure to threatening verbal information (e.g. Kelly, Barker, Field, Wilson & Reynolds, 2010).

Results

Data Analysis

The effects of verbal information on the Fear Belief Questionnaire (FBQ) were evaluated using ANCOVA, with age as a covariate because the children varied from 7 to 10 years. The ANCOVA assessed whether the FBQ ratings in the two verbal information groups changed across time, that is, from the pre-information FBQ ratings (FBQ1) to the post-information FBQ ratings (FBQ2). It also examined whether the degree of expected change across these two time points varied as a function of type of information (threat vs. ambiguous).

The prediction that level of trait anxiety would be correlated with the change in FBQ response from pre-information to post-information required the derivation of a single measure of relative change of FBQ across time for the two animals (one given information after FBQ1 and one given no information after FBQ1). This measure of the relative change across time took into account the fact that the control condition was made to an animal about which no information was provided. A simple measure of change to the information animal alone might simply reflect a child's response when the FBQ was repeated. Thus relative change in FBQ rating was calculated using the formula, ([FBQ2 for the Information animal – FBQ1 for the Information animal] - [FBQ2 for the No information animal – FBQ1 for the No information animal]). This relative FBQ change score was preferred to a proportional change score, such as that used by Askew et al. (2008), because the FBQ1 scores were generally in the middle of the range of possible scores for all children in the current study, whereas for Askew et al. (2008) the initial FBQ measure was already raised due to prior exposure to

threat information. The same single measure of change was used for other correlation analyses when FBQ change was required.

Level of trait anxiety was examined first by classifying children who scored below the 75th percentile on the STAI-C as reporting “low to average trait anxiety” (ambiguous group, N = 25; threat group, N = 23), and those who scored at or above the 75th percentile as reporting “high anxiety” (ambiguous group, N = 7; threat group, N = 6). A median split of trait anxiety scores was also assessed.

For the Nature Reserve Task (NRT), the presence of both animal stimuli and a single straight “path” meant that a single approach-avoidance score was possible. The distance to the animal tagged with information provided a suitable NRT measure. A ratio of the distance between the two animals where children placed their figure on the path was not considered because it had a clearly non-normal distribution (P-P plot).

Potential differences between the two groups of children (exposure to threat information vs. exposure to ambiguous information) with respect to their RED bias and GIB measures were examined using ANCOVA, with age as a covariate because the children varied from 7 to 10 years.

To determine whether interpretation bias was associated with fear responses, correlations with trait anxiety, relative FBQ change and the NRT measure were examined for both types of ambiguous story vignettes combined and then for each type separately (generalised anxiety and social anxiety). Regression analyses examined whether any observed associations were independent of age, gender and trait anxiety, and whether high or low trait anxiety had a moderating influence on these associations. A path analysis that followed the approach used by Muris et al. (2010) was planned to examine whether RED/GIB score was a mediator in the predicted relationship between trait anxiety (STAI-C) and (separately) each fear response dependent measure (change in FBQ; Nature Reserve

Task). The possibility that level of anxiety moderated the influence of interpretation bias on fear responses to verbal information was assessed by entering the product of STAI-C score and interpretations bias score, as detailed later.

The Fear Beliefs Questionnaire (FBQ)

To assess whether threat or ambiguous information changed children's FBQ ratings relative to that made for the animal when no information was supplied, the ANCOVA assessed the within-participant effects on FBQ of Time (pre-information [FBQ1] vs. post-information [FBQ2]) and Exposure (information provided vs. not provided), and the between participant effects of Type of Information (Threat vs. Ambiguous group), specific animal about which information was given (quoll vs. cuscus) and gender of child (male vs. female). The main finding was that there was a significant three way interaction for Time x Exposure x Type of Information (F (1, 52) = 20.47, $p < 0.001$). As shown in Figure 1A and 1B, both groups of children showed similar pre-information FBQ ratings (baseline) and little change in FBQ2 ratings for the animal about which no information was given (after information had been given for the alternate animal). Although some increase in FBQ2 rating was expected after ambiguous information, the influence of verbal information was evident only in the group that received threat information, in which the post-information mean approached the maximum possible rating (i.e. 35).

To follow up this 3-way interaction in more detail, one ANCOVA examined the Ambiguous group alone and a second ANCOVA examined the Threat group alone. For the Ambiguous group, no significant two way interaction for Time x Exposure was found (F (1, 27) <1.0, $p > 0.5$), confirming that ambiguous information did not induce an overall change in mean FBQ ratings relative to no information in this group (Figure 1B). No other significant interactions were evident (all $F < 1.0$), so neither the type of animal about information was given nor gender of child influenced the lack of effect of ambiguous information.

In contrast, analysis of FBQ scores in the Threat group produced a significant Time x Exposure interaction (F (1, 25) = 43.73, $p < 0.0001$) due to the large increase in rating between pre-information to post-information for the animal about which threat information was given (Figure 1A). There was no influence on the effect of threat information by type of animal or gender of child when the threat group was analysed (all F <1.0).

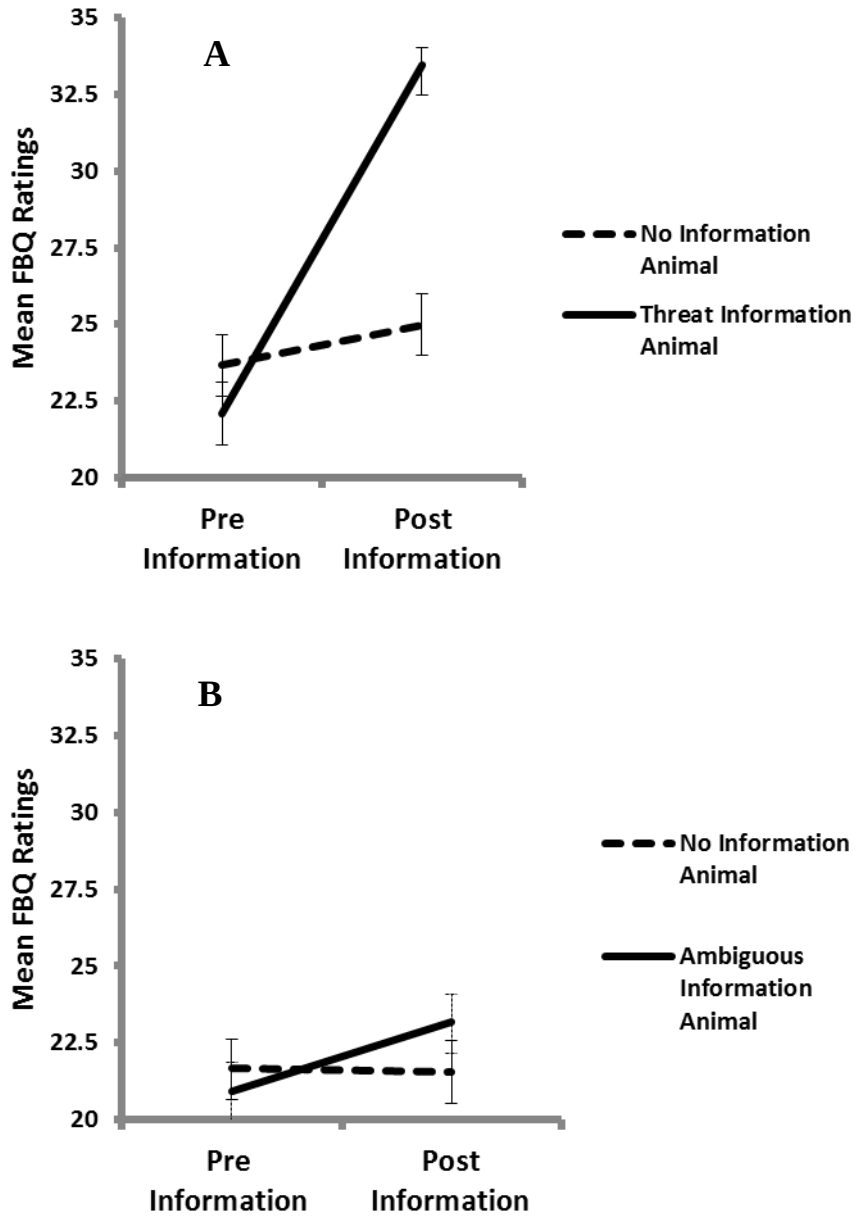
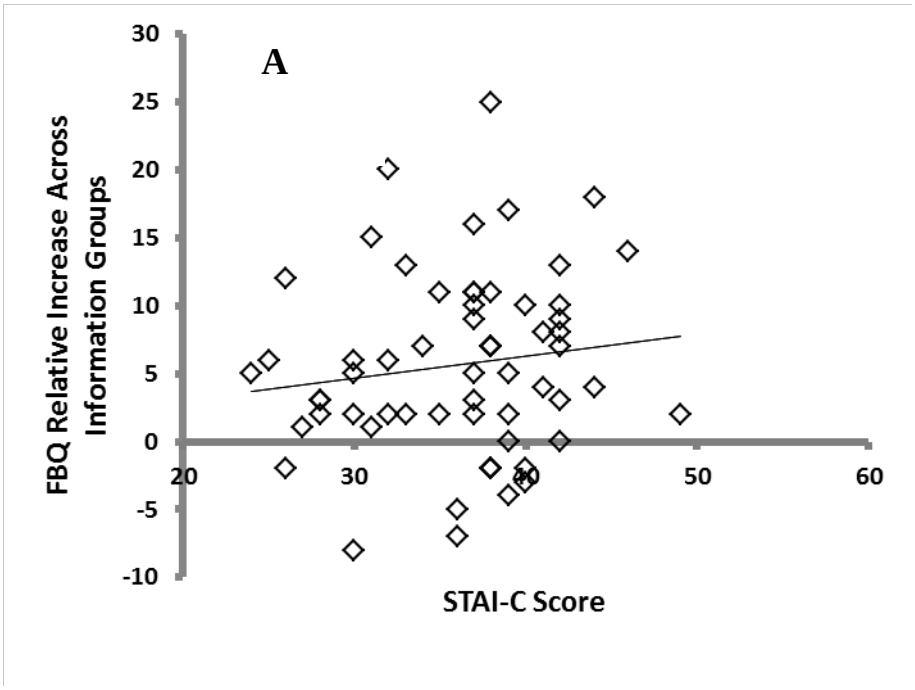
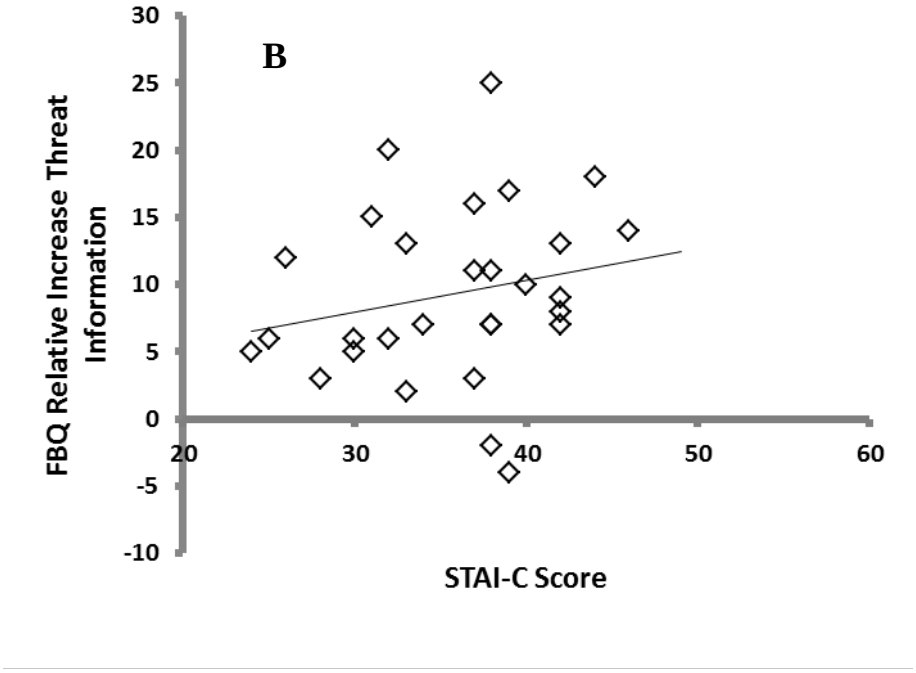


Figure 1. Change in Fear Belief Questionnaire ratings in the Threat group (A) and the Ambiguous group (B). Information was provided after an initial rating (Pre-information) for one of two animals. Error bars = ± SEM.

The current study predicted that the verbal information paradigm would produce changes in fear belief that were greater in 7-10 year old children who reported an elevated level of trait anxiety, especially when ambiguous information was provided. High trait anxiety was expected to have a greater relative influence in the context of ambiguous , so low

anxiety reported by the majority children could partly explain the weak overall effect in the Ambiguous group. This prediction was, however, not supported. There was no relationship between the children's STAI-C raw score and the measure of relative change in FBQ score (change for the information animal relative to change for the no-information animal) across both groups combined (Pearson $r = .13$, $p > .29$; Figure 2a). The same conclusion was evident when the Threat and the Ambiguous groups were examined separately (Figure 2b and 2c; $r = .22$, $p > .27$ and $r = .21$, $p > .23$, respectively). As Figure 2 shows, there was no indication that the high-anxious children (normed scores at the 75th percentile or higher), both male and female, showed any greater influence of either threat or ambiguous information compared with other children. Indeed, many children who had average STAI-C scores were among those who showed high changes in FBQ ratings, giving rise to non-significant high vs. low anxious group effects when an ANCOVA was conducted on either the Threat group (F (1, 24) <1.0, $p > 0.5$) or the Ambiguous group (F (1, 27) = 2.50, $p < .13$). Similarly, the considerable overlap in FBQ change scores between those at or below the median and those above the median score in both groups of children (*Mdn* = 37 in each case) shows that even larger samples of high and low STAI-C scores did not separate the level of FBQ change observed (Figure 2). This observation was supported by the absence of a STAI-C median-split group effect on the relative FBQ change score for either the Threat group (F (1, 24) < 1.06, $p > 0.3$) or the Ambiguous group (F (1, 27) < 1.0, $p > .5$).


A
FBQ Relative Increase Across Information Groups
STAI-C Score
30
25
20
15
10
5
0
-5
-10
20
30
40
50
60


B
FBQ Relative Increase Threat Information
STAI-C Score
30
25
20
15
10
5
0
-5
-10
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30
40
50
60

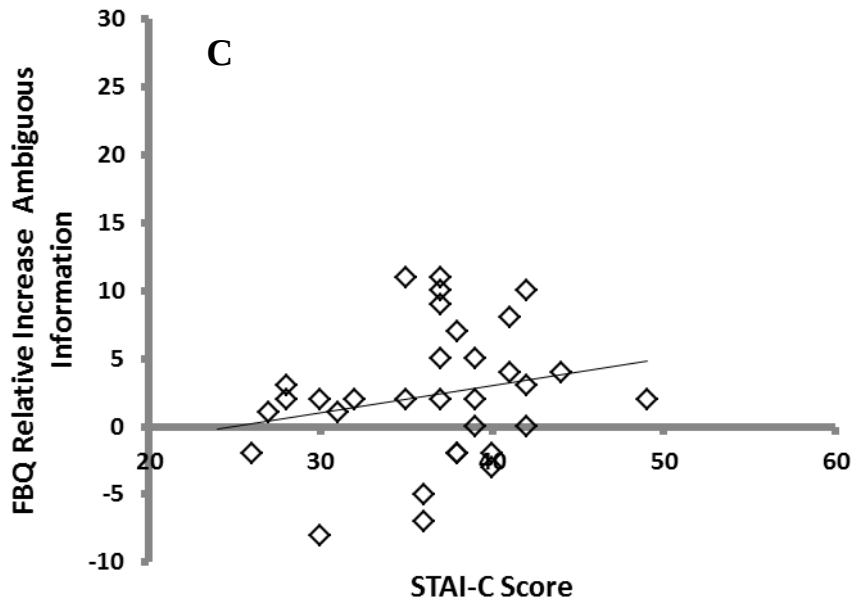

Figure 2. Association between STAI-C score and relative change in Fear Belief Questionnaire (FBQ) rating across time (change for the information animal relative to change for no information animal) for (A) all children combined, (B) those given threat information about one animal, and (C) those given ambiguous information. The STAI-C has a minimum score of 20 and a maximum score of 60. The 75th percentile for normed data for the STAI-C is 41 for females, and 42 for males. The median score for the STAI-C in this group of children was 37 for both the Threat group and the Ambiguous group.

Nature Reserve Task

After the second FBQ had been completed, the Nature Reserve Task (NRT) examined the children's behaviour when asked to pretend that they were in a park near the two animals. To assess whether threat or ambiguous information changed children's behavioural response to the two animals, a three way, 2 (Animal: cuscus vs. quoll) x 2 (Gender: male vs. female) x 2 (Information group: ambiguous vs. threat) ANCOVA (with age) was conducted on the distance between the child's figure and the animal tagged with information. As shown in

Figure 3, the Threat group placed their figure further away from the information animal than did the Ambiguous group (F (1, 52) = 5.05, $p < .03$). The mean of the Threat group was significantly different to the midpoint on the path (one sample t (28) = 6.05, $p < .0001$), whereas this was not the case for the Ambiguous group (one sample t (31) = 1.46, $p > .15$). Gender of child was also significant (F (1, 52) = 6.08, $p < 0.02$), with male children placing their figure further away from the information animal. Neither the type of information animal (F (1, 52) = 1.80, $p > .15$) nor any interactions reached significance (all $F < 1.40$, $p > .20$).

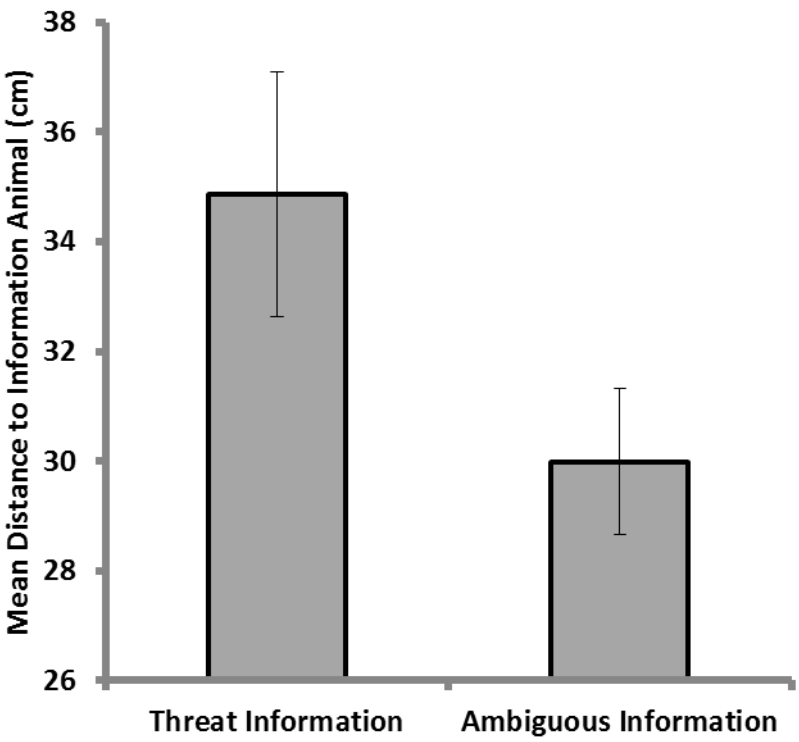

Figure 3. Mean Nature Reserve Task score (± SEM) for the children who received threat information about one animal (left bar), and the group of children who received ambiguous information (right bar). The score was the distance from the information animal that the child placed their figure on the path in the model park. The midpoint between the two animals was 26.7cm.

The NRT measure did not show a significant correlation with STAI-C score for either all children ($r = 0.15$, $p > .20$), the Threat group ($r = -0.04$, $p > .5$) or the Ambiguous group ($r = 0.30$, $p < .09$). An association between the NRT measure and the relative FBQ change score was found when all children were analysed ($r = 0.40$, $p < .002$), but this was driven primarily by a significant association in the Ambiguous group ($r = .51$, $p < .003$; Figure 4A) because there was no relationship between these measures in the Threat group ($r = 0.14$, $p > .40$; Figure 4B).

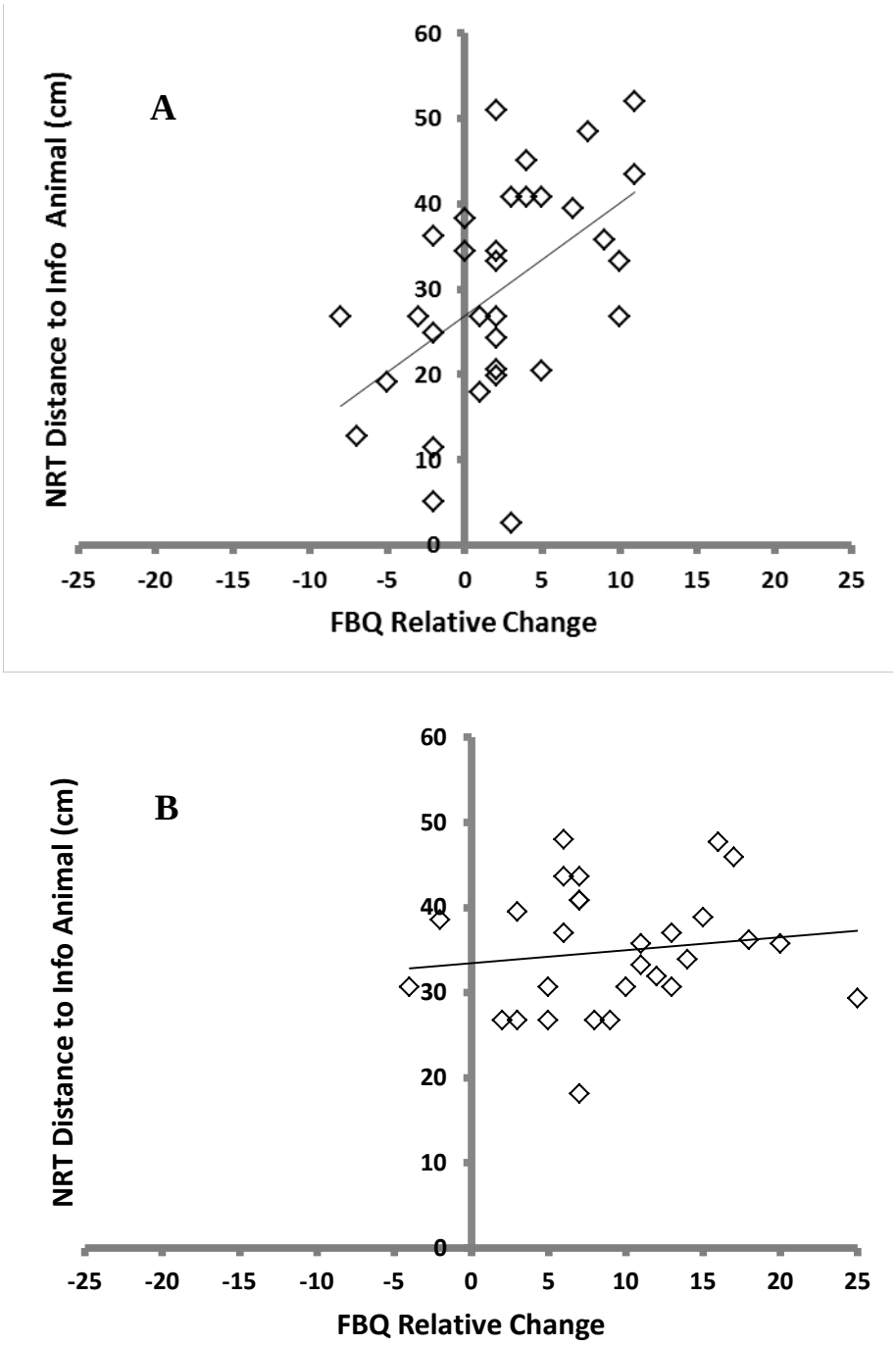

Figure 4. Association between distance to the information animal in the Nature Reserve Task and relative change in Fear Belief Questionnaire (FBQ) rating across time (change for the information animal relative to change for no information animal) for (A) children given threat information about one animal, and (B) those given ambiguous information.

Interpretation Biases Task

Mean interpretation bias measures for the two information groups are shown in Table 4. To assess whether unintended differences emerged across the two groups, each of the three interpretation bias measures were subjected to ANCOVA using a 2 (between-participant: Information Group, Threat vs. Ambiguous) x 2 (within-participant: Type of Story, Generalised anxiety story vs. Social anxiety story) design. There was no difference between Information Groups across the two stories (all F (1, 59) < 1.0) and no Information Group x Type of Story interactions (all F (1, 59) < 1.50, p > .20) on any of these interpretation bias measures. However, generalised anxiety stories elicited significantly stronger bias score than did the social stories for each measure (Type of Story: Threat threshold, (F (1, 59) = 100.48, p < .0001; Threat frequency, (F (1, 59) = 101.89, p < .0001; Generalised Interpretation Bias, (F (1, 59) = 5.42, p < .023).

Table 4.

Interpretation bias scores (Mean, SD) for all children and each information group.

Measure	**All children (*N* = 61)**	**Threat group (*N* = 29)**	**Ambiguous group (*N* = 32)**
All stories			
Threshold	2.72 (.09)	2.75 (.83)	2.74 (.98)
Frequency	15.52 (5.6)	15.48 (5.15)	15.56 (5.97)
G.I.B.	3.52 (1.5)	3.66 (1.54)	3.41 (1.39)
Generalised anxiety stories			
Threshold	2.12 (1.1)	2.05 (.93)	2.19 (1.15)
Frequency	9.64 (3.5)	9.93 (3.28)	9.38 (3.78)
G.I.B.	1.93 (.90)	2.00 (.96)	1.88 (.79)
Social anxiety stories			
Threshold	3.34 (1.0)	3.43 (1.09)	3.27 (.93)
Frequency	5.93 (2.7)	5.66 (2.61)	6.19 (2.72)
G.I.B.	1.59 (1.0)	1.69 (1.04)	1.5 (.92)

Note. Threshold = threat threshold, Frequency = threat frequency, G.I.B. = general interpretation bias. No significant difference on any measure was found between the two groups of children (all $t < 1.0$, all $p > 0.50$).

Associations between Trait Anxiety, Fear Responses and Interpretation Biases

Children who had higher ratings on the STAI-C trait scale were expected to decide that the ambiguous stories were scary after less information (a lower threat threshold), decide the stories were scary more often after each sentence (a greater threat frequency), and make more threat interpretations of the ambiguous story endings (general interpretation bias). Table 5 shows, however, that only weak and non-significant correlations were found between STAI-C trait scale scores and any of the interpretation bias measures whether responses to all stories were combined across or whether each type of story was analysed separately.

Fear responses (FBQ change; NRT) were also expected to be related to the level of threat threshold, frequency for threat perception and general interpretation bias. With both types of story combined, the only significant correlations found were for the Threat

information group, in which threat frequency was significantly correlated with increase in fear belief when both story types were combined (FBQ; $r = .44$, $p < .05$; Table 5).

Given the significant differences between interpretation bias measures for generalised anxiety stories as opposed to social anxiety stories, separate correlations were also examined for the relationship between each interpretation bias measure and each of the two types of story for FBQ and NRT scores. As shown in Table 5, threat threshold and threat frequency for generalised anxiety stories, but not general interpretation bias for these stories, showed moderate and significant correlations with FBQ scores in the Threat information group. Conversely, only general interpretation bias for the social anxiety stories showed a significant correlation with NRT score in the Threat information group. Only weak and non-significant associations were evident in the Ambiguous information group.

Table 5.

Correlations between interpretation bias measures for generalised and social anxiety stories and STAI-C trait scale, Fear Beliefs Questionnaire and Nature Reserve Task scores.

Measure	STAI-C	FBQ	NRT	FBQ (T)	NRT (T)	FBQ (A)	NRT (A)
All stories							
Threshold	-.19	-.14	.08	-.27	-.03	-.08	.13
Frequency	.17	.23	-.07	.44*	-.03	.12	.08
G.I.B.	.17	.13	.20	.20	.37	-.04	.10
Generalised anxiety stories							
Threshold	-.18	-.29*	.18	-.45*	.13	-.17	.24
Frequency	.20	.30*	-.13	.49**	-.09	.14	-.19
G.I.B.	.21	.12	.16	.08	.11	.13	.19
Social anxiety stories							
Threshold	-.12	-.01	-.08	-.03	-.15	-.09	-.08
Frequency	.09	.09	.04	.26	-.09	.07	.06
G.I.B.	.10	.14	.17	.25	.42*	-.09	.01

Note. * = statistically significant (two-tailed) at the .05 level, ** = statistically significant (two tailed) at the .01 level. Threshold = threat threshold, Frequency = Threat frequency, G.I.B. = general interpretation bias. FBQ = change in Fear Beliefs Questionnaire, NRT = Nature Reserve Task, (A) = ambiguous information group, (T) = threat information group.

Regression Analyses

As there were only weak, non-significant correlations between STAI-C and either FBQ change or the NRT measures, the intended mediator analyses using interpretation bias measures as a mediating variables were not conducted (no association to mediate).

Regression analyses examined whether the significant correlations between bias measures and FBQ score in the Threat information group were maintained when controlling for age, gender, and STAI-C scores. Threat perception threshold and threat frequency for generalised anxiety stories remained significant predictor variables for FBQ score in this group ($\beta = -.42$, $p < .05$ and $\beta = .48$, $p < .05$, respectively). Level of general interpretation bias for social anxiety stories showed a trend towards significance as a predictor variable for the NRT in the Threat information group when controlling for STAI-C, age and gender ($\beta = .37$, $p < .06$).

The final analysis examined whether the relationship between interpretation bias measures and fear outcome (separately for the dependent variables, FBQ change and NRT) was moderated by level of trait anxiety (STAI-C), despite the lack of simple relationship between anxiety and fear outcome. This question was analysed by generating a new interaction variable (a moderator variable) obtained by taking the product of scores (simple multiplication of variable X, such as threat frequency, by variable Y, STAI-C) for each child. However, centered values for each predictor variable used for the moderator (interaction) variable were calculated to minimise collinearity problems across the original predictor variables and the new interaction variable (Kraemer and Blasey, 2006). Centering expressed each child's score as a difference relative to the mean score obtained by all children in that group. For example, the product of the STAI-C centered score by the centered score of threat frequency (for generalised anxiety story) derived the moderator measure (interaction term) across these two variables. Then this new moderator variable and the original two non-centred variables were examined using model 2 in the SPSS linear regression module to determine the moderator's regression value. Using this analysis, no evidence was found in the Threat information group that STAI-C scores moderated the effect of threat threshold (moderator, $\beta = -.23$, $p > .05$) or threat frequency (moderator, $\beta = .15$, $p > .05$) on FBQ

scores, or that STAI-C moderated the effect general interpretation bias of social anxiety stories on the NRT (moderator, $\beta = -.19$, $p > .05$).

Discussion

Summary of Key Findings

The current study addressed questions concerning the influence of explicit threat and ambiguous verbal information on two different fear response measures in a non-clinical sample of 7-10 year old children. Unlike previous studies, it assessed whether level of trait anxiety, and propensity to show an interpretation biases when exposed to ambiguous verbal stories, are associated with fear responses in the context of the verbal information pathway to fear in young children.

Verbal threat information produced a robust effect on both fear beliefs (Fear Beliefs Questionnaire, FBQ; Field & Lawson, 2003) and behavioural avoidance (Nature Reserve Task, NRT; Field & Storksen-Coulson, 2007a) of novel animals in these children. These findings replicate a growing body of research (e.g. see Muris & Field, 2010, for a review) that verbal threat information reliably increases children's fear of novel animals across both cognitive (e.g. Muris & Field, 2010) and behavioural (e.g. Field & Storksen-Coulson, 2007a) components of Lang's (1968; 1985) fear emotion. The prediction that there would also be an increase in children's fear beliefs and greater behavioural avoidance for an animal tagged with ambiguous verbal information was, however, not supported.

Predictions that trait anxiety would be associated with fear responses received no support. The main prediction that the effect of ambiguous verbal information would be more evident in children with high trait anxiety was not found, irrespective of whether the group was divided using either a cut off at the 75th percentile of normed data or a median split of the sample. There was also no evidence that level of trait anxiety and fear belief response or behavioural avoidance were associated measures in the group of children who received verbal

threat information. In addition, it was expected that more anxious children would show more cognitive bias, reflected by Reduced Evidence for Danger biases (RED) and general interpretation (GIB) measures when presented with ambiguous story vignettes, but again only minor and unreliable associations were obtained between anxiety and these variables.

Associations between these bias measures and fear responding were found in the threat information group only, not in the ambiguous information group. These associations in the threat group remained after controlling for age, gender and anxiety, whether anxiety was used as a main predictor or it was analysed as a moderator variable to test for an interaction between level of anxiety and level of bias in predicting fear response. However, the association between bias measure and fear response in the threat group varied as a function of specific bias measure and type of story. For generalised anxiety stories, the two RED measures (Table 3) but not the GIB measure showed an association with FBQ change, but not with NRT response, in the threat information group. For social anxiety stories, the GIB measure but not the two RED measures showed an association with NRT response, but not with FBQ change in this group.

Comparisons with Previous Research

The presence of a clear verbal threat information effect suggests that the lack of an effect with ambiguous verbal information was probably not due to any procedural limitations. The two information groups were carefully matched using stratified randomisation across level of trait anxiety and gender, and were highly similar in terms bias measures obtained from the Reduced Evidence of Danger paradigm (RED) and baseline FBQ. The FBQ scores following verbal threat information were similar to that reported by previous studies, even though the pre-information scores were slightly higher in the current study than those reported in the majority but not all previous studies (e.g. Field & Lawson, 2003; Field & Price-Evans, 2009; Kelly et al., 2010).

In contrast to the current findings, two previous studies reported that ambiguous verbal information was associated with greater child fear beliefs to novel animals in non-clinically anxious children (Muris et al., 2009b; Muris & Rijkee, 2011). One of these studies, however, only compared the FBQ response to ambiguous verbal information by comparison to positive verbal information and did not provide a baseline measure (Muris & Rijkee, 2011). This comparison allows no conclusion to be made concerning any causal link between ambiguous information and greater fear beliefs uncertain, because positive verbal information reliably reduces fear beliefs as measured by the FBQ (e.g. Kelly et al., 2010). The second study also used no baseline control but comparisons were made across groups of children exposed to negative (threat), ambiguous, positive and no information (Muris et al., 2009b). In that study, the mean response to ambiguous information was intermediate between that to threat information and that when no information was given, thus providing a stronger inference that ambiguous information leads to relatively increased FBQ scores.

The reasons for the difference between the current findings and those of Muris et al. (2009b) are not clear, especially when considering that the verbal information used in the current study was taken directly, word for word, from Muris et al. (2009b). The same ambiguous sentences were also used by Muris and Rijkee (2011). One difference is that Muris et al. (2009b) and Muris and Rijkee (2011) used a slightly different FBQ to the one used in this study. Specifically, the FBQ used in their studies was ten items long, instead of the more common seven items, and differed slightly in content and wording, for example by including questions relating to disgust. The FBQ difference with the current work seems an unlikely reason for the discrepancy, because the current study used the same FBQ as is widely used in previous research (e.g. Field et al., 2001; Field & Lawson, 2003; Field & Schorah, 2007b; Field & Price-Evans, 2009).

Closer scrutiny of Muris et al. (2009b) and Muris and Rijkee (2011), however, reveals inconsistencies between the mean FBQ responses to ambiguous information across these two studies and by comparison to their contrast conditions. Children who responded without having discussion with a peer showed similar mean FBQ when positive information was provided in these two studies by Muris and colleagues (18 and 17, respectively; minimum score = 10 in their studies). However, the difference in the Muris et al. (2009b) study between ambiguous information (27, a high score indicating greater fear, given that threat information produced a score of 31/50) and no information (22) contrasts with an even lower mean response to ambiguous information (20) in the Muris and Rijkee (2011) study. Unlike the common practice of testing FBQ in children individually (e.g. see Muris & Field, 2010, for a review), Muris et al (2009b) tested children collectively in a classroom, so it is possible that peer presence encouraged a higher FBQ response when ambiguous information was provided in that study, for example through a social referencing phenomenon (Carr, 2006). Another difference is that both Muris et al. (2009b) and Muris and Rijkee (2011) found differences in the effect of ambiguous information across boys and girls, with girls reporting higher fear especially when tested together rather than individually, whereas in the current study no gender differences were found. Given the methodological limitations of the two studies (Muris et al., 2009b; Muris & Rijkee, 2011) that claimed to find an ambiguous verbal information effect, and the stronger methodology used in the current study, it can be concluded that ambiguous verbal information may be generally insufficient to reliably produce substantial fear of novel animals in 7-10 year children who do not show clinical levels of anxiety.

As far as is known, the current study is the first test of the idea that a pre-existing tendency to show interpretation biases or pre-existing level of trait anxiety may be related to fear following ambiguous and threatening verbal information. Indeed, the current view is that

the effect of verbal threat information varies as a function of trait anxiety (Field & Purkis, 2011). Echoing this belief, Muris and Rijkee (2011) suggested that the ambiguous verbal information effect found in their study and in Muris et al. (2009b) can be attributed to the fact that children, especially those that are high in trait anxiety, tend to interpret ambiguous stimuli as threatening (an "interpretation bias"; Muris & Field, 2008). However, neither study measured pre-existing interpretation biases or trait anxiety. The current study used a well validated (e.g. Perrin & Last, 1992) measure of trait anxiety (the State-Trait Anxiety Inventory for Children; STAI-C; Spielberger, 1973) but found no association between behavioural avoidance or an increase in fear beliefs in a group of non-clinical children that received verbal threat information, or in a group of children that received ambiguous verbal information.

The two studies used to support the claim that trait anxiety moderates the verbal information pathway to fear in non-clinical children (Field, 2006b; Field & Price-Evans, 2009) only measured trait anxiety with a seven item age downward version of Carver & White's Behavioural Inhibition Scale (BIS; 1994). This BIS scale shared only 25% of variance with a well-accepted and validated measure of trait anxiety (Screen for Child Anxiety Related Emotional Disorders; Birmaher et al., 1999). Field (2006b) reported that verbal threat information led both to avoidance and an attentional bias toward the threat animal that was moderated by the child BIS scale, but fear beliefs were not themselves assessed. Field & Price-Evans (2009) found that the effect on verbal threat information on fear beliefs and behavioural avoidance *was not* moderated by the BIS child scale, although the scale did moderate the effect on physiological arousal. Given the current findings, and the limited evidence from the two previous studies (Field, 2006b; Field & Price-Evans, 2009), level of trait anxiety may be less important as a facilitative factor for the verbal information pathway to fear than was previously thought, at least in relation to behavioural avoidance and

fear beliefs in children with non-clinical levels of anxiety. The moderating effect of the child BIS scale on attentional bias and physiological reactivity, however, suggests that further research using well validated measures of trait anxiety is warranted before concluding that trait-anxiety is not a vulnerability factor in the verbal information pathway to fear.

There is growing evidence that children who have high trait anxiety tend to show an attentional bias toward threatening stimuli (e.g. Vasey et al., 1995; Amir et al., 2010), and to disproportionately imbue ambiguity with threatening explanations when benign explanations are plausible (e.g. Muris & Field, 2008). However, the current study found no evidence that trait anxiety was related to either a general interpretation bias (GIB; a tendency to choose a threatening explanation when faced with ambiguity; e.g. Barrett et al., 1996) or a reduced evidence for danger bias towards ambiguous stories (RED; the tendency to make threatening interpretations quickly, with minimal confirmatory information and with no further search for disconfirmatory information; e.g. Muris et al., 2000a). No association with trait anxiety was found when all ambiguous stories were collapsed together for analysis, or when examining general anxiety related stories and social anxiety related stories separately. This finding is inconsistent with previous research using the same paradigm with Western children (e.g. Muris et al., 2000b; 2000c; 2003a; 2004; Muris & van Doorn, 2003b), one study with a large sample of non-Western, Chinese children (Lu et al., 2007), and the majority of studies that have used other experimental paradigms with children (see Castillo & Gonzalez-Leandro, 2010, for a review).

The lack of associations between trait anxiety and RED bias and GIB measures in the current study was unexpected and the reason for this discrepancy is unclear. The current study found similar mean bias scores to those previously reported (e.g. Muris et al., 2003a; 2004), which suggests that the procedure used produced the expected level of response for the stories used. Six of the seven studies examining RED bias and GIB employed sample

sizes ranging from 105 – 1004 participants (Lu et al., 2007; Muris et al., 2000a; 2000b; 2000c; 2003a; 2004; Muris & Van Doorn, 2003b), compared to the 61 participants in the current study. One consideration, then, is whether the current study was under-powered to detect the anxiety-GIB correlation reported by previous studies (~r = 0.2). The two-tailed power that the current study would identify a similar association is only 35% (i.e. a 65% chance of not finding that level of association). It is, however, unlikely that the sample size in the current study was too small to produce a reliable effect for the larger association reported previously using RED bias measures (~r = 0.4), because the two-tailed power for the current study = 92%, that is, only an 8% chance of not finding the effect if it exists. Indeed, one study found similar associations between trait anxiety and RED biases/GIB using a sample of only 76 participants (Muris et al., 2000a).

One difference was that the majority of previous studies (see Table 1) included one to two stories that were either ostensibly positive or threatening, which were not used in the current study. Specifically, these additional stories actually had a bad or good ending, as opposed to an ambiguous one. Such additional stories may maintain the credibility of the task. The lack of explicitly positive or threatening stories may not have greatly affected the current results, however, because one other study that only included ambiguous stories reported similar trait anxiety – RED biases/GIB associations as previous studies (Muris et al., 2000a). The number of experimental tasks each child had to complete within a limited time frame for the current study meant that these explicitly positive or threatening stories were not used in the current study.

A more important factor may be that the current sample was younger and with a more limited age range (7-10 year olds) compared to previous research, which has predominantly featured 8-13 year olds (e.g. Muris et al., 2000a; 2000b; 2003a). Indeed, it is possible that interpretational biases may rely on a conceptual stage of information processing and thus may

only reliably emerge in anxious children at later stages of cognitive development (Muris & Field, 2008). However, while age is a possible explanation for the lack of trait anxiety-biases associations in the current study, there is evidence that trait anxiety is related to interpretational biases in children as young as five (e.g. Warren et al., 2000) and seven years old (e.g. Barrett et al., 1996) using an ambiguous story paradigm.

A more likely explanation for the lack of RED biases/GIB - trait anxiety associations is that unmeasured factors influenced the current findings. For example, there is evidence that when using the same ambiguous story paradigm that was used in the current study, RED biases and GIB are also found in children who show depressive symptoms, even when controlling for trait anxiety (Muris et al., 2000b). Depression, however, is less common thatn anxiety in children (Carr, 2006). Furthermore, another study found that children high in aggression tended to show an even greater tendency than anxious children to interpret ambiguous stories as threatening (e.g. Barrett et al., 1996). In fact, there is little evidence to suggest that cognitive biases across the modalities of attention, judgement (i.e. interpretation) and memory are specific to certain childhood disorders, but rather, may be experienced by children who show a range of internalising and externalising psychopathology (e.g. Reid et al., 2006). Thus, in the current study, it is possible that children who were low in trait anxiety, but high in either aggression or depressive symptomology (or both), may have obscured any potential associations between trait anxiety and RED biases/GIB, although it is unclear why this would not also occur in other samples reported by the literature. In addition, RED biases and GIB have been found to be related to state anxiety, independently of trait anxiety, albeit to a significantly lesser degree (Muris et al., 2003a). Hence, in the current study, it may have been that children who were in a current anxiety state, but that did not generally show this tendency (low trait anxiety), scored higher on RED/GIB measures, thus obscuring the potential relationship between the measures and trait anxiety.

It was expected that children who showed greater levels of RED biases/GIB would show greater levels of fear beliefs and behavioural avoidance of the animals after hearing ambiguous verbal information, as they were expected to interpret the information as threatening, and require less information (and be less inclined to search for disconfirmatory information) to decide the animal was dangerous. However, children's level of GIB and RED biases was not associated with increased fear beliefs or greater behavioural avoidance in the ambiguous verbal information group when examining all stories, and when the stories were separated according to anxiety type (stories with general anxiety related content and those with social anxiety related content). An interesting contrast was that RED bias measures for general anxiety stories, but not social anxiety stories, were significantly associated with increase in fear belief in the verbal threat information group. In addition, GIB for social anxiety stories, but not general anxiety stories, was significantly associated with behavioural avoidance in the verbal threat information group. As stated earlier, these associations remained significant when using regression analyses to control for age, gender, and trait anxiety. Furthermore, level of trait anxiety did not moderate these effects. As there were no associations found between trait anxiety and increased fear beliefs and greater behavioural avoidance, possible mediation of these fear measures by GIB and RED biases was not a viable issue for analysis.

Previous literature that has examined the relationship between interpretation biases and fear and anxiety has been largely cross-sectional in nature (Castillo & Gonzalez-Leandro, 2010). As such, this evidence offers few clues as to whether interpretation biases are simply an epiphenomenon of high trait anxiety (e.g. Muris & Field, 2008) or whether they may actually maintain or even be causally related to fears and anxiety (e.g. Clark & Beck, 2010). The current finding that level of interpretation biases are related to the verbal threat information pathway to fear offers some tentative evidence to suggest that these biases may

play a role in the development or maintenance of fear and anxiety. This notion is consistent with research that draws on techniques that aim to experimentally train or induce participants to show interpretative cognitive biases (termed Cognitive Bias Modification; CBM; Mathews & Macintosh, 2000). CBM procedures have been used successfully with adults (e.g. Matthews & Macintosh, 2001) and more recently with children (e.g. Lester, Field & Muris, 2011). Experimentally inducing interpretation biases may increase anxious responding such as behavioural avoidance (e.g. Lester et al., 2011) and inducing a positive bias (away from threat) may reduce anxious responding (e.g. Salemink et al., 2009). There is also evidence from longitudinal studies to suggest that interpretation biases may play a role in the maintenance and development of fear and anxiety (e.g. Warren et al., 2000; Creswell et al., 2011).

General and Theoretical Implications

Learning theories of the development of fear and anxiety in humans have often focussed on the importance of classical conditioning (e.g. Rachman, 1977; 1996; Davey, 1997; Mineka & Zinbarg, 2006). It should, however, be noted that human classical conditioning is no longer regarded as simply a reflexive style of learning where an individual learns the association between a conditioned stimulus (CS) and an unconditioned stimulus (US). Instead, conditioning has been conceptualised as a complex form of learning where an associative link is formed in memory between a CS and a US, and the strength and nature of this formation depends heavily on contextual variables and learning history (e.g. Field & Purkis, 2011). Cognitive factors have been implicated in this process (e.g. Davey, 1997; Lovibond & Shanks, 2002; Hoffman, 2008). However, theorists differ in their views as to whether a direct experience (classical conditioning) is necessary to establish a fear response (e.g. Field & Purkis, 2011). For example, one idea is that verbal threat information will not lead to fear per se, but rather, that it establishes expectancies (vulnerabilities) prior to a direct

experience with a CS, or can lead to an inflation of the aversive nature of the unconditioned stimulus (US) post experience (US inflation) that facilitate the fear conditioning process (Field & Purkis, 2011). An alternative proposal is that while verbal information probably interacts with other pathways (e.g. Field & Storksen-Coulson, 2007) it can also directly lead to fear without direct exposure (e.g. Mitchell, De Houwer & Lovibond, 2009; Field & Purkis, 2011).

This alternative view is supported by the current study, and similar previous studies that show that verbal threat information can reliably induce fear across all three of Lang's (1968; 1985) cognitive, behavioural and physiological emotion response systems (see Table 2). The importance of verbal information is also consistent with compelling evidence (e.g. Lovibond & Shanks, 2002) that fear learning in humans tends to rely on conscious awareness of a CS-US contingency, and the assertion (Mitchell et al., 2009) that all three of Rachman's (1977; 1991) pathways may rely on propositional reasoning (i.e. higher level cognitive processes). Propositional reasoning, the reasoning about the relationship between events, is influenced by prior knowledge (beliefs) of events and their relations (Lovibond & Shanks, 2002). In short, direct experience with stimuli is not necessary for learning (Mitchell et al., 2009). Thus, it follows that cognitive biases at the higher order, conceptual stage of information processing (i.e. RED/GIB biases; Muris & Field, 2008) might moderate the effect of verbal threat information on fear. This is an important question because whether cognitive biases represent important vulnerability factors related to the aetiology of fear and anxiety (e.g. Clark & Beck, 2010), or are simply epiphenomena of high levels of trait anxiety (e.g. Muris, 2007), is a contentious issue that carries important clinical implications.

The current study did not manipulate level of RED/GIB bias so no firm conclusions can be drawn from the current findings as to the potential moderating role that these biases have on the verbal threat information pathway to fear and anxiety. However, the associations

found in the current study offer tentative evidence for a causal role and require consideration. Children in the current study who 1) required less information to decide general anxiety related stories were threatening, and 2) more often interpreted ambiguous sentences as threatening (RED bias measures), showed a greater fear belief response following verbal threat information. The weakness in this assertion is that these associations were relatively modest and might be expected to be stronger if bias has a causal role in fear induction, given that most of the children in the threat information group showed increased fear responding judging by their FBQ scores.

A potential explanation why the association between bias and fear response is not a simple one can be found in some information processing theories of anxiety (e.g. Kendall & Chansky, 1991; Daleiden & Vasey, 1997; Clark & Beck, 2010). According to Beck and Emery (1985) and Clark and Beck (2010), threat appraisal involves two stages. The first stage is concerned with the identification of threat. If the situation or object is identified as threatening, this supposedly elicits a second stage of appraisal of the individual's ability to cope with the identified threat, with a negative discrepancy leading to a fearful or anxious response. Clark and Beck (2010) suggested that interpretation biases can arise at both appraisal stages. These biases are the products or processes of beliefs, or schemata, related to the likelihood and prevalence of threat and the self as vulnerable and as likely to have insufficient resources to cope with threats. Schemata are conceived as stored bodies of knowledge that guide information processing in a way that is consistent with their content and disrupt processing of incongruent information, leading to a number of content congruent cognitive biases such as interpretation biases (Daleiden & Vasey, 1997). Furthermore, they are proposed to be cognitive vulnerabilities for the development of fear and anxiety that arise from an interaction of other vulnerabilities such as genetic and biological factors and an

individual's learning experiences. Schemata lie dormant until activated by personally relevant perceived or anticipated distress.

It is possible that the instructions for the RED/GIB task and the subsequent verbal threat information primed children who possessed a cognitive vulnerability to display a biased information processing style (e.g. children were told they were going to hear scary stories). Thus, the RED biases - fear belief association following verbal threat information may have been a result of those children registering the animal as threatening, but interpreting that threat as greater than their ability to cope with it, due to activated beliefs of the self as vulnerable and ineffectual (Clark & Beck, 2010). This is consistent with the idea that experiences of aversive events as unpredictable and uncontrollable leads to low self-efficacy beliefs that interact with negative events (e.g. verbal threat information) and contribute to problematic fears and anxiety (Barlow, 2002).

Another possibility why RED biases were related to fear beliefs following verbal threat information is that susceptible children may have also shown a tendency to be less able to disengage from the threatening information (Bar-Haim, Morag & Glickman, 2011). Information processing theories that suggest that cognitive biases at different stages of information processing may be intimately related in that inputs at more automatic, associative levels (e.g. attention) may affect subsequent processing (e.g. judgement/interpretation), and vice versa (e.g. Ouimet et al., 2010). In support of this idea, there is experimental evidence to suggest that attentional biases toward threat can be reduced by attenuating interpretation biases (e.g. Ami et al., 2010). Accordingly, it is possible that RED biases were related to the effect of verbal threat information because those children also showed a related attentional bias which caused them to be less able to disengage with that information.

It is unclear why RED biases for general anxiety stories were related to fear belief change but not to greater behavioural avoidance in the NRT following threat information in

the current study. Conversely, it is puzzling that a general interpretation bias for social anxiety stories was positively related to behavioural avoidance following threat information, but not to fear belief change. One partial explanation is that children who showed greater RED bias in relation to general anxiety stories possessed the cognitive vulnerability to fear and anxiety for these situations (Clark & Beck, 2010), but insufficiently developed patterns of anxious responding such as behavioural avoidance that typify significant fears and anxiety (Rachman, 2004). Conversely, it may be that children who showed GIB bias with social anxiety stories were indeed significantly socially anxious, as social anxiety was not measured in the current study. That is, they may have well learned/readily available behavioural patterns (i.e. avoidance) that they utilise to cope when faced with perceived threats. Social anxiety, like other fear and anxiety disorders, is strongly related to avoidance behaviour (Rachman, 2004) that may paradoxically perpetuate these conditions by precluding exposure to feared stimuli (Vasey & Daleiden, 1997). One weakness with this explanation, however, is that it does not explain why GIB with social anxiety stories was not related to fear beliefs in the verbal threat condition. In addition, social anxiety is highly comorbid with trait anxiety (Carr, 2006).

Another possibility is that the behavioural avoidance task was one that had a greater social aspect to it because of the role and presence of the experimenter, so that it elicited social anxiety and hence a connection with general interpretation bias to social anxiety stories. Social anxiety is typified by fears around negative social evaluation (Carr, 2006). That is, fears of negative evaluation may have interfered with NRT performance.

The extent to which Lang's (1968; 1985) fear emotion response systems (cognition, behaviour and physiology) relate to each other within individuals, or show concordance, is another area of theoretical interest that has received attention (e.g. Zinbarg, 1998; Field & Schorah, 1997; Ollendick, Allen, Benoir & Cowart, 2011). While activity in one response

system (e.g. fear beliefs) may activate activity in another system (e.g. avoidance) it has been observed that this is not always the case (e.g. Ollendick et al., 2011). Hodgson and Rachman (1974) proposed that the strength of emotional arousal might moderate concordance across these response systems. Zinbarg (1998) suggested that fear and anxiety is a hierarchical construct in that it may be more unitary at higher levels, and more multidimensional at lower levels. Of note, no studies using the verbal information paradigm (Table 2) have reported within-participant concordance between cognitive, behavioural or physiological measures. Instead, evidence that, as a group, children show fear across these three measurement systems has been highlighted as support for the notion that verbal threat information can induce strong fear-emotion responses (Field & Schorah, 2007). The current study appears to be the first to report intra-individual concordance between fear belief and behavioural measures of fear following verbal information in young children.

An association between the NRT measure and the relative FBQ change score was found when all children were analysed, but interestingly, this was driven primarily by a significant association in the ambiguous group. There was no relationship between these measures in the threat group, but this is the group in which fear responding was changed by information and thus the one that would be expected to show concordance across the two measures. Inspection of the scatter-grams (Figure 4) suggests that the difference between the correlations for NRT and FBQ between the threat and ambiguous groups may be more apparent than real. The association in the ambiguous group was driven in part by a mild preference for the information animal across both measures in some children and varying degrees of high behavioural avoidance of the information animal in other children in this group despite only mild increases in relative FBQ change. The scatter of points within the more restricted range of FBQ and NRT scores that show overlap for individual children across the two scatter-grams was relatively similar. The lack of association between the two

measures in the threat group could in part be related to the psychometric properties of the measures. For example, ceiling effects were evident for the FBQ in particular, because a near maximum increase was obtained in many children in this group for the FBQ post verbal threat information. Thus when higher levels of FBQ change occurred, as in many in the threat group, these children show a similar range of medium to high behavioural avoidance of the information animal in the NRT. In summary, it may be the case that the NRT provided a more sensitive index of fear response, evident in some of the children who were exposed to ambiguous information, and was less prone to ceiling effects than was the FBQ. It would be interesting to know whether the relatively high FBQ2 scores in the threat information group was in part due to prior priming of threat because the RED task was undertaken first. It seems unlikely that the procedure of using the RED task first was responsible for the lack of FBQ change in the group exposed to ambiguous verbal information about animals.

Limitations of the Current Study and Future Research

The current study suffered from some limitations. For example, a relatively small sample of non-clinical children was used, and only four children met the STAI-C criteria for showing clinically significant anxiety. It could be that the effect of ambiguous verbal information on fear beliefs and behavioural avoidance only reliably emerges for children who meet the criteria for clinically significant anxiety. It should be noted, however, that the four children who met this criteria at the level of their STAI-C scores in the current study showed similar increases in fear beliefs and behavioural avoidance as children with much lower STAI-C scores, in both the ambiguous and threat information groups. There might also be a greater likelihood of finding a RED/GIB biases association in a clinically anxious population. This is inconsistent, however, with the body of research that has reliably found RED/GIB associations in samples of non-clinically anxious children (Table 1), and one study that used a similar sample size of non-clinical children as the current study (Muris et al., 2000a).

A further limiting factor is that the finding that some RED/GIB measures were associated with fear belief increase and behavioural avoidance following verbal threat information was solely correlational. Thus, while it suggests that further investigation is warranted to explore this potential relationship, no causal claims can be firmly made as the current study did not manipulate the level of pre-existing RED/GIB bias through, for example, cognitive bias modification (CBM) methods (e.g. Lester et al., 2011).

Thus, future studies could seek to recruit a larger sample, to re-examine relationship between RED/GIB biases trait anxiety, and the verbal information pathway to fear. More children in the low clinically anxious range would be expected in a larger sample. From the whole sample, however, it would be of value to select a final sample of children who show a strong tendency to show RED/GIB biases to have a focus on bias rather than just trait anxiety. These children could then be randomly assigned to two groups, one a waitlist-control condition, and one an experimental condition that will involve an intervention such as a cognitive bias modification procedure (e.g. Lester et al., 2011) or another intervention, such as individual cognitive behaviour therapy for children (e.g. Reinecke, Dattilio & Freeman, 2006), aimed at reducing interpretational biases. If interpretational biases are an important causal or moderating factor for the verbal threat information pathway, such procedures may serve as an inoculation to the verbal threat or ambiguous information pathway to fear. As such, the waitlist control group would be expected to show the expected increase in FBQ and NRT scores between baseline measures and follow-up time points. However, the treatment condition group should show significantly less fear compared to baseline on a second administration of the FBQ and NRT following verbal threat information at follow up. Careful monitoring of the high anxious children would be needed.

Another limitation is that due to unforeseeable circumstances, the experimenter was not blind to child level of trait anxiety. Six children were administered the STAI-C by a

second confederate, but their scores were not different to other children. As in all prior research, the FBQ and NRT were administered in the presence of the researcher. It is therefore possible that a priori expectations and perceived demands by the children may have influenced the current results (Rosenthal, 1963). While it is impossible to know the extent to which demand characteristics influenced performance on the FBQ and NRT in this study, other research suggests that physiological changes are also found using the verbal information pathway paradigm (Field & Schorah, 2007; Field & Price-Evans, 2009), which supports the idea that results from this paradigm are unlikely to be procedural artefacts. Also, the lack of an ambiguous verbal information effect, and the lack of trait anxiety – RED/GIB biases associations, cast doubt on this limitation. If the task was affected by experimenter and demand characteristics then these relationships would be expected to have been found in the ambiguous group also. The researcher did not read out any of the information about animals or the stories, reducing experimenter effects. Further research in this area could ensure that experimenters are blind to level of trait anxiety or other symptomology that is theoretically linked to cognitive biases and the effect of verbal threat information.

Another key limitation was that, due to time constraints, factors that have been shown to be related to RED/GIB biases such as state anxiety (Muris et al., 2003a), depressive symptoms (Muris et al., 2000b) and aggression (e.g. Barrett et al., 1996), that may in turn be related to fear induction following verbal information, were not measured and thus not addressed. Future research could control for these factors by, for example, using a broader screening measure such as the Child Behaviour Checklist (Achenbach, Dumenci & Rescorla, 2003). More positively, these measures could be used explicitly in mediator and moderator analyses to evaluate their impact in the current experimental approach to the verbal transmission of fear.

Summary and Conclusions

A robust increase of fearful responses to novel animals for both cognitive and behavioural measures was found after exposure to threat information. However, the proposal that higher trait anxiety is an important facilitative factor for the verbal information pathway to fear, even in non-clinically anxious children (Field & Purkis, 2011), was not supported by the current study. The similar idea that trait anxiety may be particularly important in the case of ambiguous verbal information (e.g. Muris & Rijkee, 2011) was also not supported. Thirdly, the assumption that trait anxiety is important in the case of ambiguous information because those children have an interpretation bias toward threat when faced with ambiguity (Muris & Rijkee, 2011) was also at odds with the present results.

The current study has replicated a now large body of research that verbal *threat* information is sufficiently potent to instil fear beliefs and engender behavioural avoidance of animals for which children have no prior experience (see Table 2). The current study provided tentative evidence that interpretation biases might be a facilitative factor, independently of trait anxiety, for the verbal *threat* pathway. The evidence for this relationship was correlational, not causal, but it highlights a need for future research to address this issue more directly. Such work would help determine the whether cognitive biases are simply an epiphenomenon of high fear and anxiety, important maintaining factors, or important factors in the aetiology of anxiety in children (e.g. Muris, 2007; Clark & Beck, 2010; Creswell et al., 2011).

It is recommended that the role of threat and ambiguous verbal information for childhood fears be examined in the context of cognitive biases as the key variable of interest, rather than trait anxiety. While the examination of a greater number of high anxious (low clinical level) children would be useful, the role of other childhood psychopathology that may influence the expression of anxious responses is also warranted. Furthermore, it is crucial that

future studies that are investigating the potential role of cognitive biases in the verbal pathway to fear manipulate biases so that firm conclusions can be drawn as to their importance. Such research would have significant implications for the treatment of clinically significant anxiety and fears. If cognitive vulnerabilities underpin fear learned via verbal threat information, efforts could be made to inoculate children against future verbal threat information exposure by using evidence based bias reduction methods.

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Appendix A

Photos used as novel stimuli in the current study.

Cuscus

Quoll

Appendix B

Verbal information

Ambiguous:

The cuscus/quoll has white teeth.

The cuscus/quoll eats all sorts of things.

The cuscus/quoll can jump.

The cuscus/quoll has a unique smell.

The cuscus/quoll is noticeable.

The cuscus/quoll lives like some other animals.

The cuscus/quoll makes noises.

The cuscus/quoll likes to drink all sorts of things.

The cuscus/quoll has claws and scratches trees.

You never know what the cuscus/quoll will do.

Negative:

The cuscus/quoll has long sharp teeth.

The cuscus/quoll eats scary insects.

The cuscus/quoll can jump up at your throat.

The cuscus/quoll stinks.

The cuscus/quoll is dangerous.

The cuscus/quoll kills other animals.

The cuscus/quoll makes frightening noises.

The cuscus/quoll likes to drink blood.

The cuscus/quoll has sharp claws and scratches your skin.

The cuscus/quoll will attack you.

Appendix C

Fear beliefs questionnaire (Field & Lawson, 2003).

Items are rated on a 5-point Likert scale with (1) = No, not at all, (2) = No, not really, (3) = Yes, maybe, (4) = Yes, probably, and (5) = Yes, definitely. A total fear belief score can be computed by summing the ratings on all items (range 7–35).

1. Do you think a cuscus and a quoll would get on well together? (Practice)
2. Do you think a cuscus/quoll would like to live in New Zealand? (Practice)
3. Would you be happy to have a cuscus/quoll for a pet or look after a cuscus for a few weeks?*
4. Do you think a cuscus/quoll would hurt you?
5. Would you go up to a cuscus/quoll if you saw one?*
6. Would you go out of your way to avoid a cuscus/quoll?
7. Would you be happy to feed a cuscus/quoll?*
8. Would you be scared if you saw a cuscus/quoll?
9. Would you be happy if you found a cuscus/quoll in your garden?*

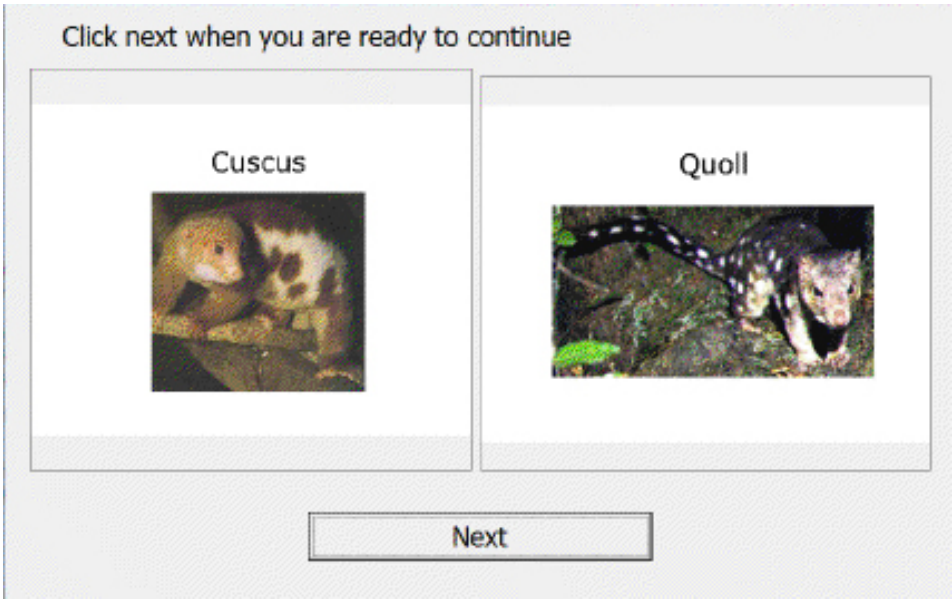
---

*Reversed scored (e.g. “No, not at all” = 5, “Yes, definitely” = 1).

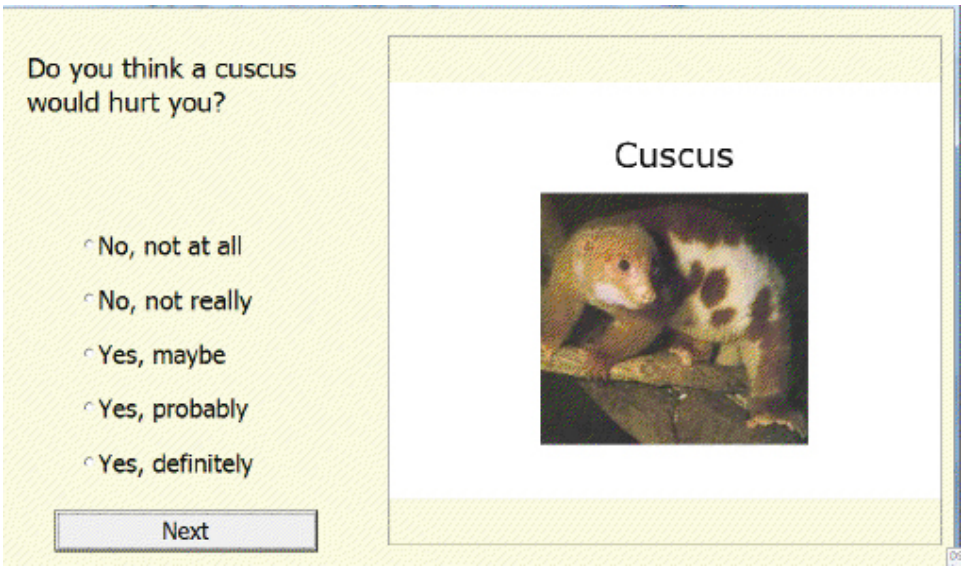
Appendix D

Example Screen shots of the Visual Basic.net program (written by Kenese Lautusi) used to administer and score the Fear Beliefs Questionnaire, and to deliver verbal information.

Introduction screen (accompanied by verbal instructions):



Example of Fear Belief Questionnaire screen (questions read when needed):



Screen displayed while child received information (screen displayed corresponding animal):

Appendix E

Photos of The Nature Reserve Task (adapted from Field & Storksen-Coulson, 2007a)

Appendix F

Ambiguous Stories Used in the Reduced Evidence for Danger/Interpretative Bias Task (adapted from Muris et al., 2003a; Yu et al., 2007).

Generalised Anxiety 1:

1. You ride your bike slowly because you are carrying a heavy bag.

2. You ride on a street without a bike lane.

3. It is a very busy street.

4. The cars that pass you drive really fast.

5. Behind you, you hear a big truck coming.

Generalised Anxiety 2:

1. On the way to school you begin to feel funny in your stomach.

2. Usually you don't feel funny in your stomach.

3. This morning you ate a lot of your favourite food.

4. It is about time to line up for class

5. You still feel funny in your stomach.

Generalised Anxiety 3:

1. You are in bed at night

2. You hear a noise by the door.

3. You get up.

4. You go to see what it is.

5. You see a black furry thing.

Social Anxiety1:

1. You are at school. It's morning tea time.

2. You see a group of students from another class playing a cool game.

3. You know some of them.

4. You walk over because you want to join in.

5. As you get closer, you hear them laughing.

Social Anxiety 2:

1. You come home from school and in the hall you hear voices of people that you don't know.

2. Your mum calls you in.

3. A man and woman that you don't know are sitting in the living room.

4. Your mum introduces you to these people.

5. Mum goes to get coffee from the kitchen and you stay in the room with these people

Social Anxiety 3:

1. You have decided to join a sports club.

2. You are in the changing room of the sports club for the first time.

3. There you see a group of children waiting in a row.

4. You don't know any of them.

5. They all look at you.

Appendix G

Letter to Primary School Principals

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

The effect of verbal information on children's response to novel animals

Dear Principal,

We are conducting a study that is looking at whether children's characteristic ways of responding in the world (e.g. temperament), influences how they interpret different types of verbal information. We would like to invite your students, aged 7 to 9 years, to participate in this study. We are writing to seek your permission and support to recruit children through your school, and to conduct our research at school.

What is the purpose of this research?

The purpose of this study is to provide knowledge regarding how a child interprets benign but ambiguous information that may help explain why some children are more fearful than others. Studies such as this can tell us how individual differences shape children's developing understanding of, and response to, their world

Who is conducting the research?

This study is being conducted by researchers from the School of Psychology at Victoria University, Wellington. Stefan Dalrymple-Alford, a post-graduate student, is conducting this study under the supervision of Associate Professor Karen Salmon. The Victoria University School of Psychology Human Ethics Committee has approved this study.

What is involved if you give consent for your students to participate?

- An information sheet about the study (attached) will be sent to parents of students in the age range 7 – 9 years. The children will be seen individually while at school.
- The session with the child will involve the following five phases:
    - Each child will first complete a short questionnaire asking how he or she would respond in specific situations.
    - We will ask the child specific questions about two unfamiliar Australian animals (a cuscus and a quoll) before and after giving them information about one of these animals. Some children will hear ambiguous statements such as "The cuscus has white teeth"; other children will hear mildly negative statements such as "The cuscus has sharp teeth."
    - We will assess how each child views the animals by asking him or her to demonstrate how closely they would place a small figure between pretend enclosures "housing" the two animals.
    - We will engage each child in a short task that requires them to respond to ambiguous stories.
    - Finally, we will give the child positive information about the animals and carefully check that they understand that the animals are not frightening.
- Involvement in this study should take approximately 25 minutes per student.
- The child can withdraw by saying that they do not wish to proceed at any stage of the study. Dr Karen Salmon has used this paradigm and materials in previous research, and children found it engaging and enjoyable.

Privacy and Confidentiality

Consent forms and data from the study will be kept for five years after publication.
The data will be coded by numbers and therefore data of an individual child will never be identified.
Coded data may be shared with other competent professionals upon request.
The data of the child may be used in other studies.
The coded data of the child will be securely stored in the laboratory of Associate Professor Karen Salmon.

What happens to the information that you provide?

We may publish the results of the study in a scientific journal or present them at a conference. No child will be identified in the results and will remain confidential. The overall findings will form the project for a master's degree by Stefan Dalrymple-Alford, which will be submitted for assessment.
The results of the study should be available approximately December 2011. A summary of the results will be sent out to you upon completion.
If you have any further questions regarding this study, you are most welcome to contact the supervisor of this study, Associate Professor Karen Salmon, ph 463 9528 or Karen.Salmon@vuw.ac.nz.
Thank you for your time in considering this request.
Yours sincerely,
Stefan Dalrymple-Alford
Karen Salmon, PhD., Dip.Clin.Psych
Associate Professor in Psychology at Victoria University of Wellington.

Appendix H

Letter to Parents

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

The effect of verbal information on children's response to novel animals

Dear Parent,

We are conducting a study that is looking at whether children's characteristic ways of responding in the world (e.g. temperament), influences how they interpret different types of verbal information. We would like to invite your child to participate in this study.

What is the purpose of this research?

The purpose of this study is to provide knowledge regarding how a child interprets benign but ambiguous information that may help explain why some children are more fearful than others. Studies such as this can tell us how individual differences shape children's developing understanding of, and response to, their world

Who is conducting the research?

This study is being conducted by researchers from the School of Psychology at Victoria University, Wellington. Stefan Dalrymple-Alford, a post-graduate student, is conducting this study under the supervision of Associate Professor Karen Salmon. The Victoria University School of Psychology Human Ethics Committee has approved this study.

What is involved if you give consent for your students to participate?

- Children will be seen individually while at school.
- The session with your child will involve the following five phases:
    - Each child will first complete a short questionnaire asking how he or she would respond in specific situations.
    - We will ask each child specific questions about two unfamiliar Australian animals (a cuscus and a quoll) before and after giving them information about one of these animals. Some children will hear ambiguous statements such as "The cuscus has white teeth"; other children will hear mildly negative statements such as "The cuscus has sharp teeth."
    - We will assess how each child views the animals by asking him or her to demonstrate how closely they would place a small figure between pretend enclosures "housing" the two animals.
    - We will engage each child in a short task that requires them to respond to ambiguous stories.
    - Finally, we will give the child positive information about the animals and carefully check that they understand that the animals are not frightening.
- Involvement in this study should take approximately 25 minutes per student.
- Your child can withdraw by saying that they do not wish to proceed at any stage of the study. Dr Karen Salmon has used this paradigm and materials in previous research, and children found it engaging and enjoyable.

Privacy and Confidentiality

Consent forms and data from the study will be kept for five years after publication.

The data will be coded by numbers and therefore data of an individual child will never be identified.
Coded data may be shared with other competent professionals upon request.
The data of each child may be used in other studies.
The coded data of your child will be securely stored in the laboratory of Associate Professor Karen Salmon.

What happens to the information that you provide?

We may publish the results of the study in a scientific journal or present them at a conference. No child will be identified in the results and will remain confidential. The overall findings will form the project for a master's degree by Stefan Dalrymple-Alford, which will be submitted for assessment.
The results of the study should be available approximately December 2011. A summary of the results will be sent out to you upon completion.
If you have any further questions regarding this study, you are most welcome to contact the supervisor of this study, Associate Professor Karen Salmon, ph 463 9528 or Karen.Salmon@vuw.ac.nz.
If you do wish for your child to participate, please return the signed statement of consent on the following page to your school.
Thank you for your time in considering this request.
Yours sincerely,
Stefan Dalrymple-Alford

Karen Salmon, PhD., Dip.Clin.Psych
Associate Professor in Psychology at Victoria University of Wellington

Appendix I

Consent Forms

Statement of consent

I have read all the information above and any questions I wanted to ask have been answered to my satisfaction. I understand that I will get a feedback letter about the findings of this study upon its completion.

I agree to the participation of my child in this research. I understand that I can withdraw my child's consent at any time prior to participation, and that my child can withdraw at any time prior to the end of his/her participation.

Parent's name: _____

Child's name: _____

Child's date of birth: _____

Address: _____

Email address: _____

Phone: _____

Signature: _____

Date: _____

Appendix J

Debrief Sheets

The cuscus and the quoll

People in Australia love the cuscus

And they love the quoll

But people in Australia are worried because the cuscus and the quoll are endangered ☹

Here is what some people in Australia said about the cuscus and the quoll:

The cuscus and the quoll are always good natured

The cuscus and the quoll like to play with other animals

The cuscus and the quoll hop around

The cuscus and the quoll have nice tiny teeth

You can have fun with the cuscus and the quoll

The cuscus and the quoll smell nice

What have you learned about the cuscus and the quoll?

How do people in Australia feel about the cuscus and the quoll?

Why are people in Australia worried?