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Selective Attention and Childhood Anxiety: The Associations Among Attention, Memory, Interpretive Biases and Anxiety

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SELECTIVE ATTENTION AND CHILDHOOD ANXIETY: THE ASSOCIATIONS AMONG ATTENTION, MEMORY, INTERPRETIVE BIASES AND ANXIETY

A Thesis

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements of the degree of

Master of Science
in
Psychology

by

Sarah E. Watts

B. A., Loyola University New Orleans 2002

December, 2005

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Abstract

This paper examined the links between selective attention, memory bias, interpretive bias, and anxiety problems in a community sample of 81 children (38 females) aged 9-17 years. Cognitive biases were assessed using a word and picture Dot Probe Discrimination task to assess selective attention, a memory task to assess a memory bias, and the CNCEQ to assess interpretive bias. Childhood anxiety was assessed using the parent and child versions of the RCMAS and RCADS. Significant associations were found between the three cognitive biases and childhood anxiety problems. In addition, selective attention was found to be associated with the selective abstraction subscale of the CNCEQ. The results did not support the mediation of selective attention and interpretive bias by memory bias. Finally, the results supported a cognitive model that posited that interpretive bias may be predictive of childhood anxiety problems beyond what is predicted by selective attention and memory bias.

Introduction

Anxiety disorders are among the most prevalent emotional disorders in childhood with prevalence rates ranging from 2.4-18% in community samples (Albano, Chorpita, & Barlow, 1996; Anderson, 1994; Anderson, Williams, McGee, & Silva, 1987; Kashani & Orvaschel, 1988; 1990; Labellarte, Ginsburg, Walkup, & Riddle, 1999). Although anxiety in childhood and adolescence is often considered transient, a large number of children and adolescents contend with chronic anxiety problems (Keller, Lavori, Wunder, Beardslee, & Schwartz, 1992; Last, Perrin, Hersen, & Kazdin, 1996; Messer & Beidel, 1994; Ollendick & King, 1994; Orvaschel, Lewinsohn, & Seeley, 1995). Additionally, anxiety disorders are related to several negative outcomes. For example, anxiety disorders are associated with poor academic and social functioning in youth (Bernstein, & Borchardt, 1991; Bernstein, Borchardt, & Perwien, 1996; Silverman & Ginsburg, 1998). There is also evidence suggesting that children with anxiety disorders are at an increased likelihood of comorbid disorders in childhood as well as an increased risk for psychopathology in adulthood (Last et al., 1996; Orvaschel et al., 1995; Pine, Cohen, Gurley, Brook, & Ma, 1998). Lastly, longitudinal studies have suggested that childhood anxiety disorders have lasting effects on the functioning of individuals into adulthood (Buitelaar, Ban Andel, Duyx, van Strien, 1994; Hagopian & Ollendick, 1997; Keller et al., 1992; Ollendick, Lease, & Cooper, 1993; Woodward & Furgusson, 2001). Due to the widespread nature of anxiety disorders in childhood and the negative impact they can have on the lives of children and adolescents, it is important to understand the processes through which anxiety disorders develop and are maintained.

There have been a number of studies suggesting that cognitive and information processing biases play an important role in the etiology and maintenance of anxiety disorders in

adults (e.g., Mathews, & MacLeod, 1994; Mogg & Bradley, 1998). Similarly, anxiety and anxiety disorders in children are thought to be associated with differences in the way children process information. These differences in cognitive processing have been termed "cognitive biases". Selective attention has emerged as a potentially important specific cognitive bias in childhood anxiety (see Vasey & Daleiden, 1996). Selective attention involves focusing attention toward a category of stimuli (e.g., threatening stimuli) when such stimuli are placed in a context with other categories of stimuli (e.g., neutral or other non-threatening stimuli). However, it is not clear what role selective attention plays in childhood anxiety problems. For example, selective attention may be merely associated with anxiety problems in children or may work in concert with other cognitive biases to predict anxiety problems in children. Additional research is needed to better understand the manner in which selective attention is associated with anxiety. In particular, further research is needed to explore the linkages between selective attention and other cognitive biases, such as, memory biases (i.e., a bias towards the recall of threatening information), and interpretive biases (i.e., having disproportionately negative interpretations of neutral or ambiguous stimuli) to better understand the link between anxiety and the way children process information. In the following sections, the existing literature on selective attention and memory and interpretive biases is reviewed.

Selective Attention and Childhood Anxiety

It has been suggested that emotional stimuli can attract attention over non-emotional stimuli. As noted, several theorists have suggested that selective attention towards threatening stimuli may play a large role in the etiology and maintenance of anxiety symptoms and disorders in both children and adults (e.g., Eysenck, 1992; Mathews, 1990; Weems & Watts, 2005; Williams et al., 1988). For example, Mathews (1990) theorized that one of the fundamental

characteristics of anxiety was the scanning of an individual's surroundings with a predisposition for attending to and processing potentially threatening stimuli, suggesting that those who are vulnerable to high levels of anxiety have such a tendency.

The majority of research on the relation between childhood anxiety problems and selective attention has examined this tendency utilizing one of two methods. The first procedure, a modification of the Stoop Color-Naming task (Stroop, 1935) has been used widely in research but has yielded inconsistent results (e.g., Kindt, Bierman, & Brosschot, 1997; Kindt & Brosschot, 1999; Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish, 1999; Moradi, Neshat-Doost, Taghavi, Yule, & Dalgleish, 1999; Taghavi, Dalgleish, Moradi, Neshat-Doost, & Yule, 2003). The modified Stroop Color-Naming task measures attention through the presentation of words (e.g., house, gate, or throw) in various colors (e.g., red, yellow, green, or blue), asking the participant to name the color of each word, and calculating the latency in naming the color. The theory behind the task is that the longer it takes for a person to name the color the more they are attending to the word. Therefore, longer latencies for threat-related words as opposed to neutral words indicate a bias towards threat related words over neutral words.

Taghavi et al. (2003) found evidence supporting a relation between attention biases and anxiety using a modified Stroop task in a sample of 19 children (9 girls and 10 boys; mean age of 13.47 years) with GAD (diagnosis was determined by a team of mental health professionals; with no co-morbid diagnosis of MDD) and a control group of 19 children (11 girls and 8 boys; mean age of 14.50 years) with no diagnosis. The results indicated the GAD group had longer latencies for threat-related information than did the control group. However, Kindt et al. (1997) found no differences in attention bias towards threat information in a group of high anxious vs. low anxious children. Similarly, Dalgleish et al. (2003) found no evidence supporting an

attention bias related to depression, GAD, or PTSD utilizing a modified Stroop task. Given the inconsistent findings using the modified Stroop task, the validity of the task as a measure of selective attention is questionable (e.g., Kahneman & Chajczyk, 1983; MacLeod & Mathews, 1991; see Vasey & MacLeod, 2001).

As a more sophisticated method of measuring of selective attention, MacLeod, Matthews, and Tata (1986) developed the Dot Probe Detection task. The Dot Probe Detection task has yielded more consistent results in assessing selective attention in children (see Vasey et al., 1996) but was developed only recently and has been utilized less often in research (e.g., Vasey, El-Hag, & Daleiden, 1996 and Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 2000). The task involves the simultaneous presentation of, for example, two words (or other threat-related stimuli) on a screen (e.g., one at the top of the screen and one at the bottom). Immediately following the removal of the words from the screen, a probe (e.g. dot) is presented in the same location as one of the preceding words (e.g., in the top space where the word had just appeared). The participant is asked to indicate the presence of the probe by pressing a button (e.g. spacebar). The length of time it takes for the participant to correctly identify the presence of the probe is measured. The theory behind this assessment technique is that the faster the probe is detected the more likely it was that the participant was attending to the stimulus that was located in the same position preceding the appearance of the probe. Therefore, shorter probe detection latencies for one category of stimuli (e.g. threat) over another should indicate a selective attention bias towards the category with the shorter probe detection latency.

A number of studies have found a link between childhood anxiety problems and selective attention utilizing the Dot Probe Detection task (Dalgleish, Taghavi, Neshat-Doost, Moradi, Canterbury, & Yule; 2003; Vasey, Daleiden, Williams, & Brown, 1995; Vasey et al. 1996). For

example, Vasey et al. (1995) used the Dot Probe Detection task to examine biased attention in childhood anxiety disorders with a sample of children, aged 9 to 17, meeting diagnostic criteria for an anxiety disorders (n=12) and control subjects matched on age, gender, and intellectual ability who did not meet diagnostic criteria for any psychological disorder (n=12). Results indicated that children with anxiety disorders demonstrated biased attention directed toward threatening stimuli (i.e., threat words).

Vasey et al. (1996) also examined the relation between anxiety and attention biases in a sample of 40 6th and 8th graders. Participants were assigned to one of two groups [high test-anxious (10 boys and 10 girls) and low test-anxious (10 boys and 10 girls)] based on their scores on the Test Anxiety Scale for children (Sarason, Davidson, Lighthall, Waite, & Ruebush, 1960). The cutoff scores for girls were below 10 for the low-test-anxious group and above 16 or higher for the low-test-anxious group; the cutoff scores for boys were 7 or lower for the low-test-anxious group and 12 or higher for the high-test-anxious group. Results indicated that there was an attention bias for threatening information in high-test-anxious children as well as an attention bias away from threatening information in low-test-anxious boys (the girls in the study did not display this bias). These findings provide further support for a link between childhood anxiety and selective attention.

As part of a study discussed earlier investigating the relation of cognitive biases (e.g. memory and selective attention) and various disorders [e.g. Major Depressive Disorder (MDD), GAD, and PTSD], Dalgleish et al. (2003) examined the association between different categories of the emotional valence of information and attention biases in relation to Depression, GAD, and PTSD using a Dot Probe Detection task that employed 48 negative words matched in length and frequency with 48 neutral words to create 48 “critical” word pairs. Each participant, based on a

clinical interview, was assigned to one of four diagnostic categories: 1) the depressed group (n = 19; 10 girls and 9 boys; met DSM-IV criteria for a primary diagnosis of MDD); 2) the PTSD group (n = 24; 12 girls and 12 boys; met DSM-IV criteria for a primary diagnosis of PTSD with no co-morbid MDD diagnosis); 3) the GAD group (n = 24; 11 girls and 13 boys; met DSM-IV criteria for a primary diagnosis of GAD with no co-morbid diagnosis of MDD); and 4) control group (n = 26; 16 girls and 10 boys; did not meet DSM-IV criteria for the diagnosis of any disorder nor had any history of psychiatric disorder). Results indicated a different pattern of processing across the different disorders. Specifically, the results indicated an attention bias towards threat-related words in only the GAD group; the PTSD and MDD groups did not show an attention bias towards threat-related information.

Thus far, research exploring the link between selective attention and childhood anxiety has focused on comparing groups in the extremes of psychopathology (i.e., those with diagnosed disorders compared to groups with no history of psychiatric diagnosis). For example, Vasey et al. (1995) examined biased attention in childhood anxiety disorders with a sample of children meeting diagnostic criteria for anxiety disorders and control subjects. The extant research has not examined whether a linear relationship exists between selective attention and childhood anxiety problems or if these differences only exist in the extremes of psychopathology. Similarly, there has been little research on the linkages between selective attention and other forms of cognitive biases such as, memory and interpretive biases. Consequently, further research is needed to better understand the nature of the relation between selective attention and anxiety levels in children as well as the relations between selective attention, memory bias, and interpretive bias.

Memory Biases and Interpretive Biases

In addition to selective attention, several cognitive theorists have suggested that a bias towards the recall of threatening information, or a memory bias, is also associated with anxiety (e.g., Beck & Emery, 1985; Weems & Watts, 2005). Empirical evidence supporting a link between memory bias and childhood anxiety problems has been found. For example, Daleiden (1998) found support for an association between anxiety, memory bias, and stimuli valence in a sample of 80 6^{th} - 8^{th} graders. The results of this study suggest that high anxious children are biased towards the recall of negative information over neutral information. In addition, research has found an association between memory bias and PTSD in children aged 9-17 years (Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish; 2000). Moradi et al. (2000) compared a group of children who met DSM-IV criteria for PTSD (n = 24) and a group with those with no history of trauma or psychiatric diagnosis (n = 25). The results indicated no difference between the groups on the amount of negative information recalled but the PTSD group recalled less positive information. These results of these studies suggest the presence of a link between childhood anxiety problems and memory biases.

Although little research has been conducted on the linkages between memory biases and childhood anxiety problems, one of the ways that emotional memory biases have been assessed in relation to anxiety problems in children is through the recall of a list of words with different levels of emotional valence. For example, Moradi et al. (2000) conducted a study in which participants were asked to recall words from a list of 36 negative words (12 depression-related; 12 threat-related; 12 trauma-related), 12 positive words, and 12 neutral words presented individually on a computer screen. After a minute and a half, the children were asked to write down all the words that they remembered for five minutes. Immediately following this free recall

task, the children were asked to indicate which words had been previously presented from a list of 120 words (60 from the original list and 60 filler words matched in length, readability, and emotional content). This method was designed to assess the recall of negative words in relation to positive and neutral words and allow for a measure of assessing memory in terms of a bias towards emotional words.

Biases in interpretation, which involve having a disproportionate amount of emotionally valenced (e.g. threatening) interpretations of neutral, ambiguous, or potentially threatening stimuli or situations in relation to other categories of interpretations (e.g. non-threatening) are thought to be a core factors in anxious and depressive disorders (Beck, 1976, 1985; Ellis, 1962). In recent years, several studies have suggested that anxious children may display biases for negative interpretation of stimuli. Hadwin, Frost, French and Richards (1997), using a pictorial-homophone task with children (aged 7-9 years), found that trait anxiety scores were positively correlated with the number of threatening interpretations chosen. Similarly, research has shown that a similar types of biases in clinically anxious children when asked to interpret the content of ambiguous vignettes (Barrett, Rapee, Dadds, & Ryan, 1996; Chorpita, Albano, & Barlow, 1996).

Beck, Rush, Shaw, & Emery (1979) described a number of ways that information can be negatively biased during interpretation. Four types of interpretive biases, or negative cognitive errors, include catastrophizing (i.e., expecting the worst possible outcome of an event or situation, such as "I got a bad grade on my homework, therefore I will fail the class."), overgeneralizing (i.e., believing that a single negative outcome is representative of or will occur in all similar future events, such as "my team lost this game; we will probably lose the next one too."), personalizing (i.e., attributing control over the outcome of negative events to internal causes, such as "my mother lost her job because of me.") and selective abstraction (i.e., focusing

on only the negative aspects of an event, such as "I did awful on my history test. I may have made an A, but I missed an easy question.").

One of the best-validated measures for assessing general interpretive biases is the Leitenberg, Leonard, and Carroll-Wilson (1986) Children's Negative Cognitive Error Questionnaire (CNCEQ). The measure assesses each of the four types of cognitive biases. Weems, Berman, Silverman, and Saavedra (2001) examined the association between negative cognitive errors assessed with the CNCEQ and anxiety symptoms as well as anxiety sensitivity assessed with the CASI in a sample of children and adolescents who were clinic referred for anxiety disorders (N = 251, ages 6 to16 years). Results indicated that each of the types of errors, except selective abstraction, were significantly positively related to self-reported anxiety [e.g., the trait version of the State Trait Anxiety Index for Children (STAIC; Spielberger, 1973) and the Revised Children's Manifest Anxiety Scale, (RCMAS; Reynolds & Richmond, 1978)] and anxiety sensitivity even when controlling for levels of depression (correlations ranged from .39 to .43).

Integrative Summary

Collectively, the research suggests that childhood anxiety problems may be related to a variety of cognitive biases including attention, memory bias, and interpretive bias. Memory and interpretive biases may be influenced by the limitation selective attention places on the type of information obtained from the environment (Hill, Lewicki, Czyzewaka, & Boss, 1989). Such a view suggests that threat-related selective attention, memory bias, and interpretive bias are not only individually related to anxiety, but also linked to one another. It has been proposed, that selective attention towards threatening stimuli may foster a bias towards the recall of threatening information. This memory bias may, in turn, foster the threatening interpretation of ambiguous

stimuli (Weems & Watts, 2005). Theses biases may work together to predict childhood anxiety symptoms. Specifically, selective attention, memory bias, and interpretive bias may each incrementally predict childhood anxiety problems. Although there is evidence to indicate that childhood anxiety problems are related to selective attention, memory bias, and interpretive bias, the associations among these biases in youths and their combined associations with anxiety has yet to be examined.

As noted, very little research has been conducted examining how the various biases are related to each other. However, Dalgleish et al. (2003), in a study discussed above, did measure both attention and memory bias in a sample of children. Using the same words from Stroop Color-Naming task, Dalgleish et al. (2003) assessed memory bias by asking children to recall the words that are presented to them in the Stroop Color-Naming task. The words were divided into four groups based on emotional valence. Of the 60 words, 24 were threat-related (related to threat and trauma situations), 12 were depression-related words, 12 were happy words and 12 were neutral words. The participants were presented each word individually on a computer screen and asked to repeat each word three times. After the completion of the word presentation, the children were asked to count for 1.5 minutes and then asked to write down all the words they remembered from the list for five minutes. The results indicated no difference between groups on the types of words recalled and the association between memory biases and selective attention was not presented. This failure to find a memory bias may be due, in part, to the use of the words from the Stroop Color-Naming task and the structure of the memory task. The memory task utilized in this study required the participants to allocate attention equally towards both threat and neutral words by reading each word aloud three times. Weems and Watts (2005) theorized that cognitive biases, such memory biases, may be highly influenced by the process of

selectively attending to one category of information over another. The structure of the memory task may not have allowed for the influences of selective attention on memory bias; therefore, the methodology of the memory task may have resulted in a failure to detect a memory bias associated with childhood anxiety problems.

The use of the words from the Dot Probe Detection task may have been more appropriate for this task because of the structure of the Dot Probe Detection task. The Dot Probe Detection task positions two words with varying emotional valence (e.g., a threat and a neutral word) simultaneously on the screen and, in the case of selective attention, the participants will focus on one word (e.g., threat word) over another (e.g., neutral word). The positioning of the two words on the same screen at the same time may create completion for attention. This competition for attention may allow for the selective encoding into memory of one word over another. Therefore, the structure of the Dot Probe Detection task may be a more effective in assessing a memory bias towards the recall of emotional words.

Another limiting factor for the examination of selective attention has been the almost exclusive use of single-word stimuli. The validity of single word based Dot Probe Detection tasks utilized in the majority of research on selective attention in children with anxiety problems has been called into question (see Vasey et al., 2003). Although some developmental differences have been taken into account (e.g., longer presentation times on the Dot Probe Detection task; Vasey et al., 1995), it is unclear whether these allowances for age related differences in reading ability effect the processes of selective attention. Specifically, does allowing children more time to process the stimuli confound the results of the experiment? Furthermore, another limiting factor to the Dot Probe Detection task is a child's the susceptibility to fatigue. This Detection task utilizes a large number of word pairs (e.g., 196 word pairs; Dalgleish et al., 2003; Moradi et

al., 2000). There are a number of suggested alterations made to the original Dot Probe Detection task to accommodate a child's susceptibility to fatigue. For example, frequent and longer rest intervals (see Vasey et. al., 2003). Another way to limit the effects of fatigue is to modify the task to lessen the number of trials involved in the task. This can be accomplished through the use of a Dot Probe Discrimination task. The Discrimination task uses fewer stimulus trials (e.g., 32 word pairs). The Detection task necessitates fewer stimulus trials because each of the trails is probed. In the Detection task the trails more trials are necessary because only a specific number of trials are probed (e.g., 48 out of 196 word pairs; Dalgleish et al., 2003; Moradi et al., 2000). By using fewer trials, the child may be less likely to become fatigued during the task.

In addition, developmental differences in the content of children's worries across childhood may also affect the results of single-word based Dot Probe Detection tasks. Older children (aged 6 to 11 years) have been found to worry more about performance and appearance than do younger children (aged 12 to 16 years; Weems et al., 2000). The use of threat words that are related to social situations may be less salient for younger children than for older children and therefore would fail to indicate the presence of an attention bias in younger children. Pictorial stimuli of angry faces have been used to examine whether there is an association between anxiety problems in adults and selective attention. For example, Bradley, Mogg, and Millar (2000) found that trait anxiety in adults was related to an attention bias towards threat faces. Further research is needed to explore whether there is a similar bias among children with anxiety problems. In general, research is needed to explore the ability to establish whether or not selective attention is present in young children. Being able to establish the existence of such a bias in younger children will help to investigate the possible role of selective attention in the development of anxiety problems in youth.

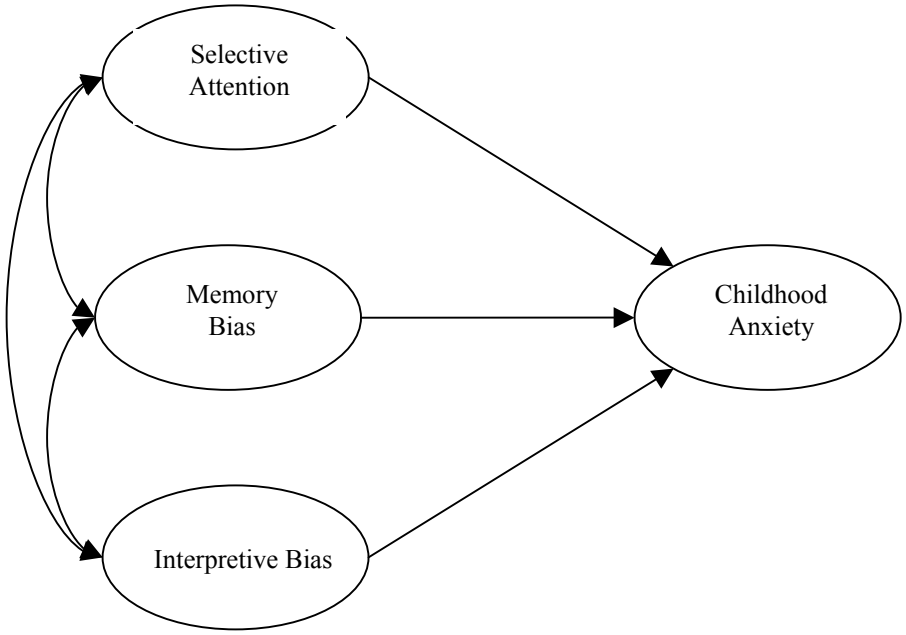
The Proposed Study

The purpose of this study is to add empirical support for theories posed by researchers such as Vasey et al. (1996) and Weems and Watts (2005). Specifically, this study attempts to replicate and extend the findings that selective attention towards threatening stimuli is associated with anxiety in youth by examining its association in a community sample and testing the linear association between selective attention and anxiety levels. It is important to study this in community samples because it allows for an examination into whether these associations exist in only the extremes of psychopathology or whether there is an association in various levels of symptomology. Additionally, this study will examine the interrelations among selective attention, memory bias, and interpretive bias and test their combined prediction of anxiety.

Hypotheses of the Proposed Investigation

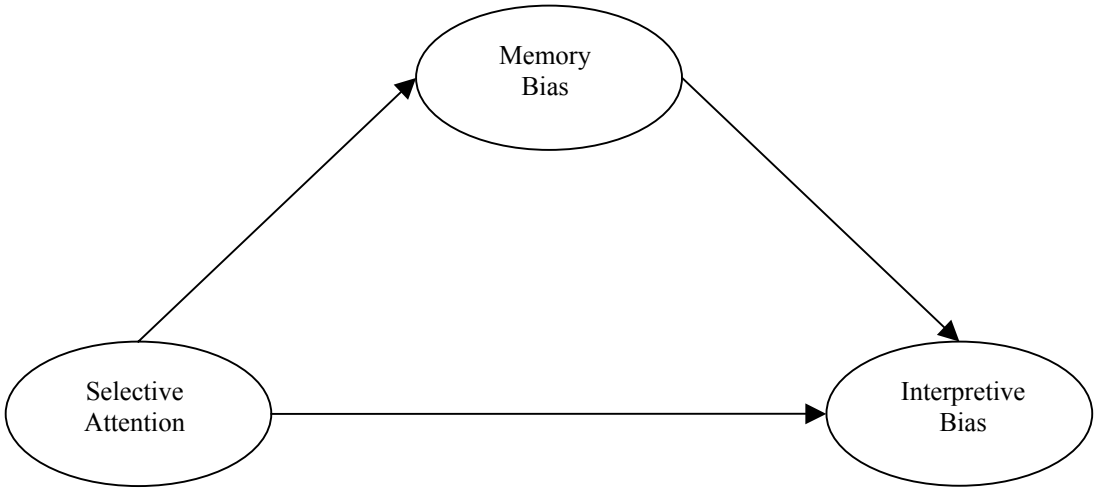
1. Children with high levels of anxiety will differ from children with low levels of anxiety on levels of attention bias towards threatening stimuli. Specifically, children with high levels of anxiety will show a greater bias (i.e., longer detection latencies) in attending towards threat stimuli than children with low levels of anxiety.
2. Attention, memory, and interpretative biases will each be associated linearly with each other and with levels of childhood anxiety problems (see Figure 1).

Figure 1. Hypothesized Model of Selective Attention, Memory Bias, and Interpretive Bias Predicting Childhood Anxiety.



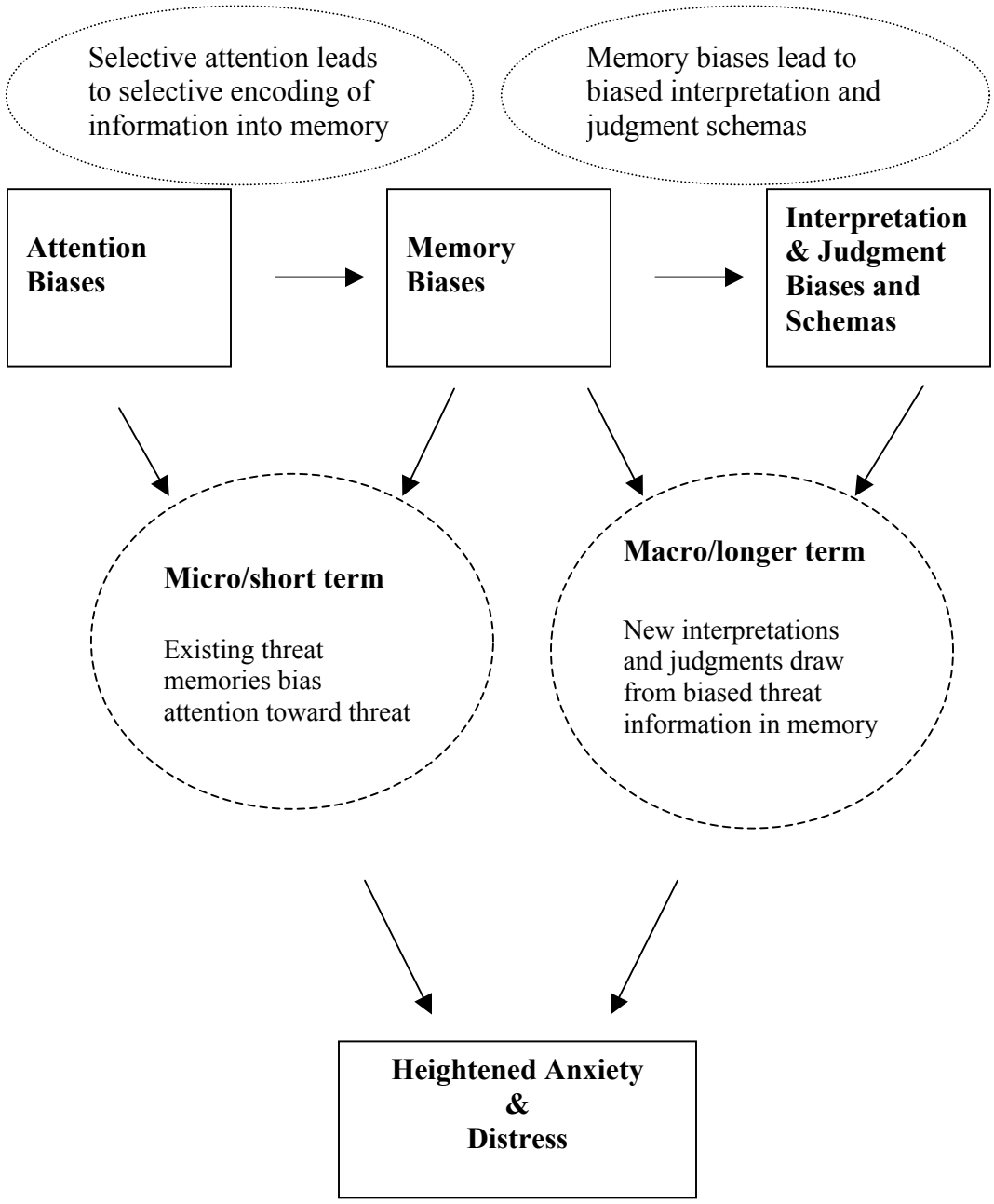
3. Memory bias towards the recall of threatening information will mediate the association between selective attention towards threatening stimuli and interpretative bias (see Figure 2).

Figure 2. Hypothesized Model for the Mediation of Selective Attention and Interpretive Bias by Memory Bias.



4. In the event that memory biases were not found to be a mediator between selective attention and interpretive biases and if all three cognitive biases are found to be individually and significantly related to childhood anxiety problems, an alternative test of how the three cognitive biases may be related to anxiety was tested. From the model depicted in Figure 3 (Weems and Watts, 2005), interpretive bias may be more directly related to the process of childhood anxiety problems than selective attention or memory bias (i.e., interpretative biases are more potentially proximally related to anxiety in the model). This would suggest that interpretive bias will predict childhood anxiety problems beyond what is predicted by selective attention to threatening stimuli and memory bias towards the recall of threatening information.

Figure 3. A Schematic Model of Hypothetical Relations among the Cognitive Biases and their Role in the Exacerbation of Anxiety



Method

Participants

Data were collected from 81 participants (38 females and 43 males) and their primary care givers (mothers 87.7%, fathers 7.4%, and grandparents 4.9%). The participants, aged 9 to 17 years (mean age = 12.83, SD = 2.5), were Caucasian (56.8%), African-American (33.3%), Hispanic (4.9%), Asian (2.5%), and other ethnic backgrounds (2.5%). The median family income was between $40,000 and $50,000.

Participants were recruited through written advertisements posted on college campuses. Adult students enrolled in courses at the University of New Orleans were recruited through sign-up sheets with details regarding the study and financial incentive to participate. In addition, the participants were recruited through local area elementary, middle, and high schools. With the school's permission, a letter was sent home with the children addressed to the parent. Assessments were conducted between 9am and 6pm, Mondays through Saturdays to accommodate for school and work schedules. Participants received a small monetary reward as compensation for participating in the research study.

Children were excluded if parents indicated that the child had a history of one or more of the following diagnoses--all pervasive developmental disorders, mental retardation, selective mutism, organic mental disorders, schizophrenia, and other psychotic disorders, or were are at risk for harm to self or others.

Measures

Demographics. Demographic information was collected from each parent including age, gender, race, child's education level, parental marital status, and family income.

The following section describes two groups of measures that were used in this study: 1) the first group was used to assess anxiety levels, 2) the second group of measures were used to assess the various cognitive mechanisms.

1. Measures of Anxiety

Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978) was used to assess anxiety. The 37-item measure is designed to assess general anxiety in children. It generates four sub-scales (Worry-Oversensitivity, Physiological, Concentration, and social desirability or "lie" sub-scale) and has been widely used in researching childhood anxiety. The RCMAS has an adequate internal consistency, test-retest reliability, and construct validity (e.g., Reynolds & Richmond, 1978). Parents also completed the parent version of the RCMAS. The RCMAS-P asks parents to rate their child's anxiety with similar items as the RCMAS (i.e., wording is changed from "I" to "My child") and twenty-eight items are summed from 'yes' or 'no' responses to yield a Total Anxiety score. Each item is scored with a zero or one. The RCMAS-P has similar validity estimates to the RCMAS (Pina, Silverman, Saavedra, & Weems, 2001). Internal consistency (coefficient alpha) for the RCMAS total anxiety scores for both the parent and child versions were computed in this study's sample. Internal consistencies for the parent and child versions were .83 and .85, respectively, in the full sample. In youth aged 9 to 12 years the internal consistencies for the parent and child versions were .82 and .81, respectively and for youth aged 13 to 17 years internal consistencies for the parent and child versions were .83 and .87, respectively.

The Revised Child Anxiety and Depression scales (RCADS; Chorpita, Yim, Moffitt, Umemoto, and Francis, 2000; Spence, 1997). The RCADS is a 47-item adaptation of the Spence Children's Anxiety Scale that assesses symptoms of each anxiety disorder (except PTSD) and

depression based on DSM-IV criteria (APA, 1994). The scale is scored 1 “Never”, 2 “Sometimes”, 3 “Often”, 4 “Always” and contains a total anxiety score (i.e., the sum of all anxiety symptoms) as well as scales for generalized anxiety disorder (GAD), panic disorder and agoraphobia (PDA), separation anxiety disorder (SAD), social anxiety disorder (SOC), obsessive compulsive disorder (OCD) and specific phobia (SP). The RCADS is an adaptation of the Spence Anxiety Scales (Spence, 1997). Moreover, the RCADS demonstrated concurrent validity with existing measures of childhood anxiety and anxiety disorders (Chorpita et al., 2000). In addition, Parents also completed a parent version of the RCADS (RCADS-P) designed identical to the RCADS with modification similar to those of the RCMAS-P (i.e., wording was changed from “I” to “My child”). Internal consistency (coefficient alpha) for the RCADS total anxiety scores for both the parent and child versions were computed in this study’s sample. Internal consistencies for the parent and child versions were .93 and .94, respectively, in the full sample. In youth aged 9 to 12 years the internal consistencies for the parent and child versions were .92 and .93, respectively and for youth aged 13 to 17 years internal consistencies for the parent and child versions were both .94.

A Composite Anxiety score was formed by computing the unit-weighted scores. Z-scores from the averaged sum of individual items measuring a construct (i.e., the RCMAS parent and child versions and the RCADS parent and child versions) were combined to create the Composite Anxiety score. Unit-weighted scores have been found to be preferable to differentially weighted scores. Due to the aggregation of multiple items, unit-weighted factors provide a high degree of reliability. Unit-weighted factors have been shown to correlate .95 with differentially-weighted factors, but show lower standard errors and increased stability of estimates across studies and samples than differentially-weighted factors (see Dawes, 1971;

Dawes & Corrigan, 1974; Kaiser, 1970; Wainer, 1976). Unit-weighted factors are desirable for use in this study because it allows for the integration of multiple sources (e.g., parent and child) and multiple measures (e.g., RCMAS & RCADS). This integration into one composite score reduces the probability of Type 1 error by reducing the number of statistical tests needed to test the main hypotheses**.** The composite anxiety score has as its indicators: 1) the deviation score of parent-rated anxiety items from the RCMAS & RCADS and 2) the deviation score of youth-rated anxiety items on the RCMAS and RCADS.

Parent and child reports often demonstrate low correlations between the two reporters (Achenbach, McConaughy, & Howell; 1987, Weems, Silverman, Saavedra, Pina, & Lumpkin, 1999). Because, the Composite Anxiety score gives equal weight to both parent and child report, a RCADS High score was also computed using the RCADS parent and child versions of the RCADS. The score was computed by comparing the rating of the parent and child and selecting the highest score from each for use in the analyses. The method of utilizing the highest rating between two reporters has been recommended for use in integrating multiple source information in the reporting of anxiety disorders (Reich & Earls, 1987).

2. Cognitive Mechanisms

Attention. Two modified versions of the Dot Probe Detection task (MacLeod Matthews & Tata, 1986) were used for this study. The two variants are Dot Probe Discrimination tasks. The fundamental difference between the Detection and Discrimination task is the manner in which the trials are probed. The underlying methodologies of the two tasks are similar. A fixation point was presented in the center of a computer screen, followed by the simultaneous presentation of two stimuli, one on the top half of the screen, one on the bottom. The stimuli were equal distances from the center of the screen. For the Detection task, only a specific number

of trials (e.g., 48 out of 196 trials) are followed by a probe (e.g., an 'X'). Each participant is asked to strike a key (e.g. spacebar) when a trial is followed by a probe. Following the presentation of the two stimuli for the Discrimination task, a probe appeared in the place of either the top or the bottom stimulus. The participant was asked to strike the up arrow key if the probe appeared in place of the top stimulus and the down arrow key if the probe appeared in pace of the bottom stimulus.

For both tasks, the time between the appearance of the probe and the key strike, or the probe detection latency, was recorded. Versions of the Dot Probe Detection task have been used widely in research for both children and adults (see Vasey et al, 1996). The two variants of the Dot Probe Detection task utilized in this study were presented using a Latitude C800 Pentium III Processor 850MHz with a 15 inch SXGA plus Display. The programs for the tasks were designed and implemented using E-Prime Version 1.0 (Schneider, Eschman, & Zuccolotto, 2001). Using E-prime, probe detection latencies were measured to 1msec. accuracy.

Word Dot Probe Discrimination task. The task consisted of a list of 32 threat-neutral word pairs (see Table 1) utilized in a previous study (Neshat-Doost et al., 2000) with children ages 9-17. The threat and neutral words were generated by a group of 221 children in 6 primary and secondary schools in London (Neshat-Doost, et al., 1999). The 32 threat words were matched on both length and frequency with 32 neutral words. Participants were asked to read aloud the fixation point, which was either the number '1' or '2', instead of the upper word. The fixation point appeared for 1000msec and be followed by the presentation of a word pair for 1,500msec, the presentation time used in previous research for children as young as age 9 (e.g., Vasey, 1995), to allow adequate time for the words to be read. The 32 threat-neutral word pairs were followed by a probe, the letter 'X'. The probe appeared in the same location as one of the

words. Each child was asked to strike the up-arrow or down-arrow key to indicate the location of the probe (top or bottom, respectively). The probe remained on the screen until the participant struck the either arrow key and the probe detection latency was recorded. If no key was struck, then the probe remained on the screen for 5 seconds. Half of the threat-neutral word pairs were presented with the threat word in the top location the other half were presented with the threat word in the bottom location. The probe that follows was alternated so that 50% of the probes appeared in the bottom location and 50% appeared in the top. In all, the set of 16 threat-neutral word pairs with threat words in the upper location and the set of 16 threat-neutral word pairs with threat words in the lower location were each flowed with 8 upper probes and 8 lower probes.

Table 1. Threat-Neutral Word Pairs Presented in the Word Dot Probe Discrimination Task.

Threat Words	Neutral Words
dark	ball
gun	hill
dog	ago
murder	morocco
fire	town
cold	book
attacked	moonlight
explosion	northwest
accident	explore
noise	farmer
killed	visit
bomb	fare
kidnapped	alphabet
spider	orange
shark	hall
worried	printing
failed	degree
silly	pride
annoyed	essay
people	than
useless	testing
embarrassed	association
confused	partners
shameful	Sheffield
teacher	covered
rejected	memorial
unpleasant	libraries
foolish	drivers
careless	desirable
school	together
dull	hats

Picture Dot Probe Discrimination task. Similar to the word dot probe detection task, the picture Dot Probe Discrimination task is also a modified version of the Dot Probe Detection task (MacLeod et al., 1986) created for this study. The pictures utilized in this task were three drawings of facial expressions depicting the emotion anger (see Table 2). To create the task, four faces were created using Microsoft Paint and were rated by a group of 20 individuals aged 7 to

36 years. Each face was rated for threat value on a scale of 0 to 3: 0- None, 1- Some, 2- A Little, 3- A lot. The face with the lowest rating was given a mean rating of .2 and is considered to have a neutral rating. In addition, two faces received mean rating of 1.95 and 1.90. These two faces differed only on eye size and the face with the lower rating and that more closely resembling the neutral (same size eyes as the neutral face) was selected for this task. This face was considered to have a mildly-threatening rating. The face with the highest rating was given a mean rating of 2.9 and was considered to have a highly-threatening rating. During the administration of the picture Dot Probe Discrimination task, the mildly-threatening face and the highly-threatening face were each paired with a neutral face.

Table 2. Faces in Picture Dot Probe Detection Task

Face	Rating
	Neutral
	Mild
	High

Similar to the word Dot Probe Discrimination task, the picture Dot Probe Discrimination task consisted of the presentation of a fixation point, followed by the presentation of a face pair (e.g., highly-threatening face paired with a neutral face) The face pair was presented with one face above the center of the screen and one face below, both equal distances from the center. The participants were asked to read aloud the fixation point, the number '1' or '2'. The fixation point appeared for 1000msec and was followed by the presentation of a face pair for 500msec. There were a total of 48 trails equally divided into three sets: 16 mild threat-neutral face pairs, 16 high threat-neutral face pairs and 16 neutral-neutral face pairs. Each mild and high threat-neural face pairs was presented with eight threat faces in the top location and 8 threat faces in the bottom location. The probes appeared in a similar manner to the word Dot Probe Detection task. In the set of mild and high threat-neutral face pairs with threat faces that appear in the top location, 4 of

the probes appeared in the bottom location and 4 appeared in the top. Likewise, in the sets of mild and high threat face pairs with the threat face in the bottom location, 4 of the probes appeared in the bottom location and 4 appeared in the top. Upon the detection of the probe's location, the participants were asked to press the up arrow key if the probe appeared in the top location or the down arrow key if the probe appeared in the bottom location. The probe remained on the screen until one of the two keys is pressed (with a maximum detection time of 5 seconds). The probe detection latency was recorded along with the log of which key was pressed.

Probe discrimination latencies for both the word Dot Probe Discrimination task and the picture Dot Probe Discrimination task were calculated using a formula given by MacLeod and Mathews (1988) for the calculation of an Attention Bias score:

$$\text{Attention Bias} = \frac{(\text{UP/LE} - \text{UP/UE}) + (\text{LP/UE} - \text{LP/LE})}{2}$$

For this study, the UP and LP indicate the presence of the probe in the upper and lower positions, respectively. Similarly, UE and LE indicate the presence of the threat word in the upper and lower positions. Thus, UP/LE designates the mean discrimination latency for trials with the probe in the upper position and threat words in the lower positions. The equation calculates a mean attention bias score by subtracting the mean scores for probe discrimination in the same location from those in the opposing location for both probe locations. Then, the differences are added together and the mean is taken to obtain the mean attention bias score. Both versions of the Dot Probe Discrimination tasks exhibited good internal consistency (see Table 3).

Table 3. Internal Consistency for the Word Dot Probe Discrimination Task and the Picture Dot Probe Discrimination Task.

	UP/UE Chronbach's Alpha	UP/LE Chronbach's Alpha	LP/UE Chronbach's Alpha	LP/LE Chronbach's Alpha
Word Bias	.87	.88	.93	.80
Picture Bias	.88	.88	.88	.86

Note: Word Bias = Attentional Bias Score for the Word Dot Probe Discrimination Task, Picture Bias = Attentional Bias score for the Picture Dot Probe Discrimination Task, UP/UE = Probe in upper location, threat word in upper location, UP/LE = Probe in upper location, threat word in lower location, LP/UE = Probe in lower location, threat word in upper location, and LP/LE = Probe in lower location, threat word in lower location

Memory. The word memory task was designed for this study to measure memory bias associated with threat related words. The task consisted of 64 words: 16 threat, 16 neutral, 16 threat-distracter, and 16 neutral-distracter words. The 32 threat and neutral words from each group were randomly selected for inclusion from the list utilized in the word Dot Probe Discrimination task. A different set 32 threat- and neutral-distracter words were obtained from a Dot Probe Detection task for use with adults (Cognition and Emotion Laboratory at the University of Western Australia, 2003) and were matched on readability, as measured by Flesch-Kincaid Grade Level, to the previously used threat and neutral words. The participants were handed a form with the list of words presented in random order. The participants were asked to indicate which words they remember from the attentional task by checking the box next to the word.

Memory Bias scores were computed using a formula that incorporates both number of threat words and number of neutral words recalled and the number of distracter-threat words and distracter-neutral words inaccurately reported.

$$\text{Memory Bias} = \frac{\text{Neutral} + 1}{\text{Distracter Neutral} + 1} - \frac{\text{Threat} + 1}{\text{Distracter Threat} + 1}$$

The equation calculates the bias towards threat words by dividing the total number threat words recalled by the number of distracter-threat words falsely recalled. That number is then subtracted from the number of neutral words recalled divided by the number of distracter-neutral words recalled. The number 1 is added to each variable to ensure that neither denominator is equal to zero while maintaining the value of the ratios.

Reading Check. Following the administration of the Memory task, the participants were given a list of words identical to the list utilized in the Memory task described above. The list given to the participant was unmarked. Each participant was asked to read the words aloud and the laboratory assistant marked the words that were read incorrectly on a separate sheet of paper. The number of words misread was summed to calculate a Reading score. The Reading score was used as a measure of reading ability.

Interpretation. The **Children's Negative Cognitive Error Questionnaire** was used to assess cognitive distortions. (CNCEQ; Leitenberg, Yost, & Carroll-Wilson, 1986). This measure is designed to assess four major forms of cognitive distortions (catastrophizing, overgeneralization, personalizing, and selective abstraction) through 24 items making up four six-item subscales. Each item on the CNCEQ consists of a situation of a possible interpretation of an event. The child is asked to respond to each item by indicating how closely the thought pattern resembles their thought patterns in that situation (e.g., 1- “not at all like I would think” 5- “almost exactly like I would think”). The CNCEQ has been found to have acceptable internal consistency, test-retest reliability and construct validity estimates (Leitenberg et al., 1986; Thurber, Crow, Thurber, & Woffington, 1990 Weems et al., 2001). Internal consistency (coefficient alpha) for the CNCEQ total was computed in this study’s sample. Internal

consistencies for the Total CNCEQ score was .89, in the full sample. In youth aged 9 to 12 years and youth aged 13 to 17 years internal consistencies for both age groups were .89.

Procedure

Informed consent was obtained from the parent and informed assent was obtained from the child. The completion of measures took place at the Youth and Family Anxiety, Stress, and Phobia Lab on the University of New Orleans campus. Each child completed the measures in a separate room from the parent. The assessment took approximately three hours to complete. Standard instructions were given to the parent and child separately. During the assessment, the child completed a questionnaire battery. Trained research assistants assisted youth in the completion of the questionnaires as necessary. Following the completion of the questionnaires, the participants were administered the word Dot Probe Discrimination task. Immediately following, the participant were asked to complete the Memory task. Upon completion of the Memory task, the participants were asked to complete the Reading Check and the picture Dot Probe Discrimination task. At the conclusion of the study, all participants were debriefed and given a small monetary reward.

Results

Preliminary Analyses

Prior to analysis, demographic data, measures of anxiety, measures of depression, and measures of the cognitive mechanisms were examined through the SPSS program for accuracy of data entry, missing values, and acceptable score range and skew planned parametric analysis. Data were screened for outliers through procedures recommended by Tabachnick and Fidell (2001). Two participants who misread more than 30% of the words on the Reading Check were excluded from the following analyses. No other outliers were removed. Missing data was

handled through analysis wise deletion. Cases with missing data were not correlated with any of the measures used in this study. Means and standard deviations for each of the measures for the total sample and by age and gender are presented in Table 4. The frequencies of the Reading score indicated that 79% of the sample misread at least one word from the Reading Check. The correlations among measures are presented in Table 5. The correlation matrix indicated that the Composite Anxiety score and the RCADS High score were significantly correlated with one another. All of the subscales of the CNCEQ were correlated with one another and the total CNCEQ score.

Gender, Age, Ethnicity

Results of 2 (gender) by 2 [age group (9-12 years and 13-17 years)] ANOVAs are summarized in Table 4 and indicated that boys and girls did not differ on either measure of anxiety nor on any of the measures of cognitive biases. The results indicated a significant difference between age groups for the Composite Anxiety scores, RCADS High scores, scores on the Catastrophizing subscale of the CNCEQ, and the Reading score. Because the sample sizes for the other ethnicities were small, the role of ethnicity was considered separately and only the African-American and Caucasian participants were used for the ethnic comparisons. Results of *t*-tests indicated that African-American and Caucasian participants significantly differed on CNCEQ Catastrophizing [African-American $M = 13.08$ ($SD = 5.2$); Caucasian $M = 11.01$($SD = 4.0$); $t(120) = 2.46$, $p < .05$].

Table 4. Means and Standard Deviations for Cognitive and Symptom Measures by Age and Gender

	Full Sample		9-12 years		13-17 Years		Boys		Girls	
Measure	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Composite[a]	.00	(3.13)	.92	(3.36)	-.86	(2.65)	-.19	(3.08)	.22	(3.21)
RCADS High[a]	64.29	(15.46)	68.01	(15.78)	60.83	(14.46)	63.56	(14.40)	65.11	(16.74)
Word Bias	.80	(41.45)	-1.06	(43.11)	2.66	(40.23)	-1.86	(42.16)	3.91	(41.01)
Picture Bias	3.07	(50.10)	1.76	(51.36)	4.28	(49.54)	1.97	(47.01)	4.33	(54.06)
Memory Bias	.57	(1.54)	.41	(1.54)	.73	(1.54)	.46	(1.55)	.71	(1.52)
CNCEQ-Total	48.35	(15.10)	51.48	(15.96)	45.37	(13.76)	47.93	(13.20)	48.81	(17.12)
CNCEQ-CT[a]	12.17	(4.59)	13.53	(5.04)	10.88	(3.74)	12.74	(4.05)	11.54	(5.11)
CNCEQ-OG	11.82	(4.63)	11.94	(5.01)	11.71	(4.30)	11.07	(3.56)	12.65	(5.51)
CNCEQ-PS	12.12	(4.97)	13.05	(5.41)	11.24	(4.40)	11.62	(4.62)	12.68	(5.34)
CNCEQ-SL	12.23	(3.94)	12.96	(3.92)	11.54	(3.87)	12.50	(3.90)	11.94	(4.01)
Reading Score[a]	2.85	(3.80)	4.05	(4.81)	1.74	(2.00)	2.95	(4.01)	2.76	(3.64)

Note: Superscript a = significant age group difference, Composite = Composite Anxiety Score, Word Bias = Attentional Bias Score for the Word Dot Probe Discrimination Task, Picture Bias = Attentional Bias score for the Picture Dot Probe Discrimination Task, CNCEQ = Children's Negative Cognitive Error Questionnaire, CT = Catastrophizing, OG = Overgeneralizing, PS = Personalizing, SA = Selective abstraction.

Table 5. Correlations Among Measures of Anxiety, Attentional Bias Scores, Memory Bias Scores, and Interpretive Bias Scores.

		1	2	3	4	5	6	7	8	9	10
1.	Composite		.877**	.020	.062	.257*	.504**	.462**	.448**	.458**	.288**
2.	RCADS High			-.045	.224*	.242*	.511**	.489**	.399**	.477**	.320**
3.	Word Bias				-.131	.142	-.037	-.024	-.026	-.015	-.064
4.	Picture Bias					.068	.207	.188	.162	.116	.240*
5.	Memory Bias						-.055	-.094	-.029	-.082	.036
6.	CNCEQ Total							.850**	.815**	.870**	.786**
7.	CNCEQ-CT								.576**	.657**	.587**
8.	CNCEQ-OG									.614**	.503**
9.	CNCEQ-PS										.584**
10.	CNCEQ-SA										

Note: * = p < .05, ** = p < .01 Two Tailed. Composite = Composite Anxiety Score, Word Bias = Attentional Bias Score for the Word Dot Probe Discrimination Task, Picture Bias = Attentional Bias score for the Picture Dot Probe Discrimination Task, CNCEQ = Children's Negative Cognitive Error Questionnaire, CT = Catastrophizing, OG = Overgeneralizing, PS = Personalizing, SA = Selective abstraction.

Hypotheses 1

A series of independent samples *t*-tests were conducted to examine whether there were differences between the high and low anxious participants. Results are presented in Table 6. Using the Composite Anxiety score, the participants were grouped into 2 groups: high-anxiety group (participants with Composite Anxiety scores 1 *SD* above the mean) and low-anxiety group (participants with Composite Anxiety scores 1 *SD* below the mean). The two groups were compared on the mean scores for both the word Dot Probe Discrimination task and the picture Dot Probe Discrimination task. The two groups did not differ significantly on either version of the Dot Probe Discrimination tasks. Subsequently, using the RCADS High score, the participants were grouped into a high-anxious group (participants with RCADS High scores falling 1 *SD*

above the sample mean) and a low-anxious group (participants with RCADS High scores falling 1 *SD* below the sample mean). The high- and low-anxious groups did not differ significantly on the mean scores for the word Dot Probe Discrimination task. However, the two groups did differ significantly on their scores for the picture Dot Probe Discrimination task.

Table 6. Independent Samples t-Tests for Measures of Selective Attention and Measures Anxiety

		Word Bias						Picture Bias					
		N	M	SD	t	df	sig.	N	M	SD	t	df	sig.
Composite	High	12	2.42	45.06	.18	23	.852	12	2.96	45.16	-.30	23	.770
	Low	13	5.99	49.12				13	-1.82	35.28			
RCADS High	High	13	-14.73	45.92	1.12	20	.277	14	23.57	47.77	-2.32	22	.030
	Low	9	7.08	43.63				10	-15.51	27.50			

Note: Composite = Composite Anxiety Score, Word Bias = Attentional Bias Score for the Word Dot Probe Discrimination Task, Picture Bias = Attentional Bias score for the Picture Dot Probe Discrimination Task.

A series of correlations were calculated and indicated that the Attention Bias scores on the picture Dot Probe Discrimination task were significantly correlated with the RCADS High scores. However, the Composite Anxiety score was not significantly correlated with the Attention Bias score on the picture Dot Probe Discrimination task. Furthermore, the Composite Anxiety score was not significantly correlated with Attention Bias scores from either variation of the Dot Probe Discrimination task (see Table 5).

Hypothesis 2

To test whether Attention Bias scores for the word Dot Probe Discrimination task, Attention Bias scores for the picture Dot Probe Discrimination task, Memory Bias scores, total CNCEQ scores, and the subscales of the CNCEQ will each be related one another and to Composite Anxiety scores or RCADS High scores a series of Pearson correlations were

conducted. Results are presented in Table 5. The results indicated that the Attention Bias scores for the word Dot Probe Discrimination task were not correlated with any of the other measure of cognitive biases or with either measure of anxiety. However, the Attention Bias scores for the picture Dot Probe Discrimination task were found to significantly correlate with scores on the CNCEQ subscale for Selective Abstraction. Memory Bias scores were not significantly related to any of the other measures of cognitive biases. Total CNCEQ scores did not correlate with any measure of cognitive biases. However, the results indicated that Composite Anxiety scores were significantly and positively correlated with the total CNCEQ scores, each of the scores for the CNCEQ subscales, and the memory bias towards threat words. Consequently, as Composite Anxiety scores increase, the total CNCEQ scores, the scores on the subscales of the CNCEQ, and the Memory Bias scores also increase. Similarly, the results indicated that RCADS High scores were significantly and positively correlated with the total CNCEQ scores, each of the scores for the CNCEQ subscales, Memory Bias scores, and the Attention Bias scores for the picture Dot Probe Discrimination task. Thus, as RCADS High scores increase, the scores for the total CNCEQ, the scores on the subscales of the CNCEQ, the Memory Bias, and the Attention Bias score for the picture Dot Probe Discrimination task also increase.

Hypothesis 3

Hypothesis 3 was that memory biases towards the recall of threatening information would mediate the relation between selective attention and interpretive bias. However, results indicated that Attention Bias scores from the word Dot Probe Discrimination task did not significantly predict Memory Bias scores ($\beta = -.142$, not significant). Because the first condition for mediation was not met, the subsequent analyses for mediation were not conducted. Results using the Attention Bias scores from the picture Dot Probe Detection task as a predictor of

Memory Bias scores indicated that Attention Bias scores did not significantly predict Memory Bias scores (β = -.068, not significant). Likewise, due to a failure to meet the first condition of mediation, the subsequent analyses for mediation were not conducted.

Hypothesis 4

Due to the insufficient evidence to support the mediation of the relation between selective attention and interpretive biases by memory biases, a series of hierarchical linear regressions were conducted to test whether the three cognitive biases were predictive of anxiety problems in children. The results are presented in Table 7. The first analysis used the Composite Anxiety score as the criterion variable, age and gender were entered into the first step, Attention Bias scores from the word Dot Probe Discrimination task and Memory Bias scores were entered into the second step, and the total CNCEQ scores were entered into the third step. The results indicated that Attention Bias scores from the word Dot Probe Discrimination task and Memory Bias scores were not significantly predictive of Composite Anxiety scores. Similar results were found when using age and gender in the first step, Attention Bias scores from the picture Dot Probe Discrimination task and Memory Bias scores in the second step, total CNCEQ scores in the third step, and Composite Anxiety scores as the criterion variable. For the third analysis, age and gender were entered into the first step, Attention Bias scores from the word Dot Probe Discrimination task and Memory Bias scores were entered into the second step, total CNCEQ scores were entered into the third step, and RCADS High scores were entered as the criterion variable. The results of the third analysis indicated that the Attention Bias scores from the word Dot Probe Discrimination task and Memory Bias scores were not predictive of RCADS High scores.

Table 7. Summary of Regression Analyses Predicting Composite Anxiety Scores and RCADS High Scores

Step	Measure	R^2	Change in R^2	*t*	*p*	β	VIF
Predicting Composite Anxiety Scores							
1	Age	.07	.07	-2.2	.030	-.26	1.1
	Gender			-1.2	.252	-.14	1.1
2	Word Bias	.14	.07	0.3	.799	.03	1.0
	Memory Bias			2.4	.022	.27	1.0
3	CNCEQ	.33	.19	4.5	.000	.45	1.0
1	Age	.07	.07	-2.1	.038	-.25	1.0
	Gender			-1.3	.204	-.15	1.0
2	Picture Bias	.08	.01	0.7	.487	.08	1.0
	Memory Bias			0.0	.972	.00	1.0
3	CNCEQ	.26	.18	4.0	.000	.44	1.0
Predicting RCADS High Scores							
1	Age	.04	.04	-1.7	.091	-.20	1.1
	Gender			-0.6	.549	-.07	1.1
2	Word Bias	.10	.06	-0.3	.748	-.04	1.0
	Memory Bias			2.1	.038	.24	1.0
3	CNCEQ	.32	.22	4.7	.000	.48	1.0
1	Age	.04	.04	-1.7	.094	-.20	1.0
	Gender			-1.0	.315	-.12	1.0
2	Picture Bias	.18	.14	2.4	.017	.27	1.0
	Memory Bias			2.6	.013	.28	1.0
3	CNCEQ	.36	.18	4.4	.000	.44	1.0

Note: Word Bias = Attentional Bias Score for the Word Dot Probe Discrimination Task, Picture Bias = Attentional Bias score for the Picture Dot Probe Discrimination Task, CNCEQ = Children's Negative Cognitive Error Questionnaire.

In the final analysis, RCADS High scores used as the criterion variable, age and gender were entered into the first step, Attention Bias scores from the picture Dot Probe Discrimination task and Memory Bias scores were entered in the second step, and the total CNCEQ scores were entered in the third step. The results indicated that Attention Bias scores from the picture Dot

Probe Discrimination task and Memory Bias scores were predictive of RCADS High scores when controlling for both age and gender. Attention Bias scores from the picture Dot Probe Discrimination task and Memory Bias scores accounted for an additional of 14% of the variance in RCADS High scores. Moreover, the total CNCEQ score was a significant predictor, accounting for an additional 18% of the variance in the RCADS High scores beyond age, gender, Attention Bias scores from the picture Dot Probe Discrimination task, and Memory Bias scores[i].

Discussion

This investigation added to the literature by examining the linkages among three cognitive biases and childhood anxiety problems. In general the results indicate that there were links between selective attention and childhood anxiety problems. The results indicated that there was a link between childhood anxiety problems and Attention Bias scores on the picture Dot Probe Discrimination task. The findings were consistent with previous research that has shown a link between selective attention and childhood anxiety problems (e.g., Dalgleish et al., 2003; Vasey et al., 1995; Vasey et al. 1996). Specifically, the results indicated highly anxious children (participants with scores falling 1 *SD* above the sample mean) have a significantly greater bias towards attending to threat pictures as compared to low anxious children (participants with scores falling 1 *SD* above the sample mean). Moreover, the results indicated that there was a significant correlation between RCADS High scores and Attention Bias scores on the picture Dot Probe Discrimination task. Taken together, the results suggest that selective attention towards threat related information may be displayed not only in high and low anxious children but also across a community sample.

[i] Ethnicity was not found to moderate the relations between RCADS High scores and Attention Bias scores from the picture Dot Probe Discrimination task or the relations between RCADS High scores and Memory Bias scores.

In addition, the results of this study indicate that selective attention, memory bias, and interpretive bias work together to predict childhood anxiety problems. These results support a cognitive model of anxiety which suggests that various cognitive biases (e.g., selective abstraction, memory bias, and interpretive bias) may work in concert to predict childhood anxiety problems. Results also lend support to the supposition that interpretive bias may be more proximally related to anxiety problems in youth than are selective attention and memory bias (Weems & Watts, 2005). Such results point to the potential importance of these three biases in understanding childhood anxiety problems. Given the results of the study, possible improvements could be made to the model proposed by Weems and Watts (2005) by taking into account the manner in which the three biases are related to anxiety. For instance, the model might include a possible mediational role of interpretive bias in the relation between memory bias and childhood anxiety problems. Further research is needed to explore the possible mediational role that interpretive biases may play in the prediction of childhood anxiety problems by other cognitive biases.

Moreover, the results of this study extend the literature by exploring the relations between selective attention, memory bias, and interpretive bias. The results lend partial support for the model proposed by Weems and Watts (2005) that selective attention, memory bias, and interpretive bias are linked to one another. The results indicate that there is only a small but significant correlation between interpretive bias and selective attention. In particular, selective abstraction was the interpretive bias linked to selective attention. This finding is consistent with the definition of the two constructs. Specifically, selective attention and selective abstraction involve focusing on the negative or threatening aspects of an event. Thus, by definition the two constructs should be closely linked. The remaining links between the three biases did not yield

significant correlations. These results are consistent with results found by Dalgleish et al. (2003), which failed to support a link between selective attention and memory bias. Therefore, the results do not support the mediation of the relation between selective attention and interpretive bias by memory bias.

The results did not indicate a link between Composite Anxiety scores and the Attention Bias scores on the picture Dot Probe Discrimination task. The results were inconsistent with the findings of the present studies comparison of RCADS High scores and the Attention Bias scores on the picture Dot Probe Discrimination task discussed above. The discrepancy in the findings between the two anxiety scores and the results of the picture Dot Probe Discrimination task may be due to the nature of the two measures used to compute the two scores. The RCMAS assesses general levels of trait anxiety in children (Reynolds & Richmond, 1978) and the RCADS is used to assess DSM-IV symptoms of childhood anxiety disorders (Chorpita et al., 2000 and Spence, 1997). The majority of the research examining the relations between childhood anxiety problems and selective attention has focused children with clinical diagnoses of an anxiety disorders (see Vasey et al., 1996). The inconsistent results between the two measures of anxiety may be reflective of differences in the way selective attention is associated with different types of childhood anxiety problems. Specifically, selective attention may be more closely liked with symptom levels of specific anxiety disorders than with general levels of trait anxiety in children.

The results of the analyses utilizing the word Dot Probe Discrimination task were inconsistent with the findings of previous research that found a connection between childhood anxiety problems and Attention Bias scores on the word Dot Probe Detection tasks (e.g., Vasey et al., 1996 and Neshat-Doost et al., 2000). The failure to find a link between the selective attention and childhood anxiety problems using the Attention Bias scores on the word Dot Probe

Discrimination task may be reflective of the developmental requirements needed for the word Dot Probe Discrimination task. Specifically, the reading ability required to perform the word Dot Probe Discrimination task. In order for the word Dot Probe Discrimination task to be a valid measure of selective attention, the child should be able to read and correctly interpret the meaning of the words used in the task in a relatively short period of time (i.e., 1,500ms per word pair). Although, the words used for the task had been used in previous research for children ages 9 to 17 years (see Neshat-Doost et al., 2000), the results of the Reading Check indicated that only 23.5% of the participants were able to read all the words in the task correctly. These results might indicate the word Dot Probe Discrimination task may not be sensitive to the development of reading skills in children.

In addition, cultural differences may have had an effect on the emotional valence of the words utilized in this study. The threat and neutral words were generated by a group of 221 children in 6 primary and secondary schools in London (Neshat-Doost, et al., 1999). The results of this study may have been confounded by the effects cultural differences may have on the emotional valence words utilized in this study. Specifically, differences between the two samples on the emotional valence of the words may have made the word Dot Probe Discrimination task less sensitive in detecting biases towards emotional words. The use of word pairs developed by a sample of children with more similar cultural backgrounds may allow for the word Dot Probe Discrimination task to more accurately the presence or absence of biases towards threat words.

Similarly, the discrepancy in the findings may be due to the use of a word Dot Probe Discrimination task instead of a word Dot Probe Detection task. As discussed above, a Discrimination task has fewer trials and each trial is followed by a probe. In contrast, the Detection task has more trials and only a certain number of trials are probed (e.g., Neshat-Doost,

et al., 2000). The use of fewer trials may make the word Detection task more sensitive to the effects of differences in reading ability.

Previous literature has compared two types of measures, a modified version of the Stroop Color-Naming task and a modified version of the dot probe detection task, and has found almost no correlation between the two measures (Dalgleish, 1995). Dalgleish (1995) suggested that the reason for the discrepancy was that the methodology of the two tasks tapped into different constructs involved in the attentional process. The current study adds to the literature by supplying an estimate of the convergent validity between two variants of the Dot Probe Discrimination task that differed on only the type of type of stimuli used (words and pictures) and the presentation time of the stimuli (1,500ms and 500ms, respectively). Similar to the findings of Dalgleish (1995) when comparing the Dot Probe Detection task and a modified version of the Stroop Color-Naming task, there was almost no correlation between the Attention Bias scores for the word Dot Probe Discrimination task and the picture Dot Probe Discrimination task.

The lack of convergent validity between the two variants of the Dot Probe Discrimination tasks may be reflective of the different developmental constraints required of the participant to perform each task. Therefore, the word Dot Probe Discrimination task may be confounded by the reading ability of the children; whereas, the picture Dot Probe Discrimination task does not necessitate any specific level of reading ability. This would suggest that the picture Dot Probe Discrimination task might be a more effective measure in assessing selective attention in younger age groups.

Although this study contributes to the existing literature on the relation between cognitive biases and childhood anxiety problems, the study does have limitations. First, the study is limited

by its cross-sectional design. Because the study does not inform us regarding whether cognitive biases are predictive or just associated with anxiety problems in children, further research is needed to explore whether cognitive biases precede the development of anxiety problems in children. In addition, the study is limited by its reliance on self-report measures. Specifically, the associations between RCADS high scores and CNCEQ scores may appear stronger than the associations between RCADS high scores and the Attention Bias scores from the picture Dot Probe Discrimination task due to the method variance between the measures. Moreover, our recruitment strategy may limit the generalizability of the study's findings and thus replication in additional samples of youth is also needed. In addition, future research would benefit from the exploration of the role of judgment bias, which involve negative and or lowered estimates of the individual's coping ability or style, in childhood anxiety problems and its relation to the other cognitive biases examined in this study.

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