THREAT-RELATED ATTENTIONAL BIAS IN ADOLESCENTS
WITH SOCIAL PHOBIA

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By
Anthony C. Puliafico, M.A.
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ABSTRACT

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Candidate's Name: Anthony Clifford Puliafico
Degree: Doctor of Philosophy
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Doctoral Advisory Committee Chair: Philip C. Kendall, Ph.D., ABPP

The present study compared attentional disengagement from threat-related stimuli in socially phobic (SP) and non-anxiety-disordered (NAD) adolescents. The associations between trait anxiety and state anxiety and attentional bias in SP adolescents were assessed. Furthermore, the present study compared the attentional control abilities of SP and NAD adolescents. Twenty-eight SP participants aged 12-17 and 27 NAD controls, matched on age and IQ, were administered a computer task to measure attentional disengagement from threat-related words. Participants completed the State-Trait Anxiety Inventory and subtests of the Test of Everyday Attention for Children (TEA-ch). Mixed ANOVA analyses indicated that SP and NAD adolescents did not differ in their disengagement from threat-related stimuli. Correlational analyses indicated that state anxiety was associated with disengagement from threat, but only when SP participants with comorbid ADHD were excluded from analyses. Trait anxiety was not significantly associated with attentional disengagement from threat. Finally, SP participants performed more poorly than NAD participants on the TEA-ch subtests, indicating poorer attentional control in SP participants. These results suggest that SP adolescents experience a deficit in executive attentional skills. The clinical implications of these findings are discussed.

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CHAPTER 1

INTRODUCTION

Although social anxiety and self-consciousness are normative during adolescence, a minority of adolescents suffer from persistent, excessive social anxiety and meet diagnostic criteria for social phobia. Whereas several studies have found 12-month and six-year prevalence rates for social phobia in adolescence to be approximately 1% (Bittner et al., 2007, Essau, Conradt, & Petermann, 2000), others have reported six-month prevalence rates as high as 9% (Verhulst, van der Ende, Ferdinand, & Kasius, 1997). Social concerns are often present during childhood, but these concerns can lead to increased impairment in adolescence (Sweeney & Rapee, 2001), during which time peer relationships act as important resources of social support and intimacy (Furman & Buhrmester, 1992). In fact, social phobia most frequently begins during early- to mid-adolescence (Leibowitz, Gorman, Fyer, & Klein, 1985; Strauss & Last, 1993).

Social phobia is associated with a number of negative outcomes for adolescents, including lower companionship and intimacy in friendships (Vernberg, Abwender, Ewell, & Beery, 1992), as well as lower perceived acceptance and support from peers (LaGreca & Lopez, 1998). It is also associated with poor academic functioning and early withdrawal from school (Stein & Kean, 2000; VanAmeringen, Mancini, & Farvolden, 2003) and is frequently comorbid with depressive disorders (Stein et al., 2001) and substance abuse (DeWit, McDonald, & Offort, 1999).

Given the prevalence rates of social phobia in adolescence and the impairment associated with the disorder, it is clear that social phobia represents a serious mental health concern for adolescents. Cognitive-behavioral therapy (CBT) has been shown to

successfully treat social phobia in adolescents (Albano, 2000; Albano & Hayward, 2004; Hayward et al., 2000, Masia Warner, Fisher, Shrout, Rathor, & Klein, 2007). However, further research is needed to better understand (a) the efficacious components of these therapies in treating symptoms of social phobia, and (b) if these treatments can be modified to improve efficacy. To potentially enhance the treatment of social phobia, the study of factors that maintain the disorder's symptoms is necessary.

A growing literature has targeted selective attention toward threat-related information, or threat-related attentional bias, as one potential factor that contributes to maintenance of anxiety. Beck and colleagues (Beck, Emery, & Greenberg, 1985) initially postulated that anxious individuals selectively attend to threat-related information to protect themselves from danger. Since then, a number of studies have found that socially phobic (SP) adults selectively attend to social threat-related words and pictures compared to neutral stimuli whereas non-SP adults do not (Amir, Elias, Klumpp, & Przeworski, 2003; Asmundson & Stein, 1994; Hope, Rapee, Heimberg, & Dombeck, 1990; Mattia, Heimberg, & Hope, 1993; Musa, Lepine, Clark, Mansell, & Ehlers, 2003; Rinck & Becker, 2005).

Based on these findings, cognitive theories of anxiety have posited that threat-related attentional bias contributes to the onset and/or maintenance of anxiety disorders (Eysenck, 1992, 1997; Lonigan, Vasey, Phillips, & Hazen, 2004; Williams, Watts, MacLeod, & Mathews, 1987, 1998). Whereas a causal link between threat-related attentional bias and the presence of an anxiety disorder has not been empirically supported, several studies have suggested that threat-related attentional bias may contribute to increased anxiety states. MacLeod, Rutherford, Campbell, Elsworthy, and

Holker (2002) found that individuals trained to selectively attend to threat-related stimuli became more anxious when faced with stressful tasks than did control groups. Similarly, Mathews and Mackintosh (2000) and Wilson, MacLeod, Mathews, and Rutherford (2006) both reported that individuals trained to interpret ambiguous stimuli as threat-related also experienced increases in anxiety when confronted with a stressful task. These studies suggest that, rather than being symptoms of anxiety, threat-related cognitive biases may serve to cause and maintain anxious states.

Over the past fifteen years, researchers have begun to examine threat-related attentional biases in anxiety-disordered (AD) youth. Many studies have reported that AD youth selectively attend to threat-related stimuli compared to neutral stimuli, whereas NAD youth do not (Dalgleish et al., 2003; Martin, Horder, & Jones, 1992; Moradi, Taghavi, Neshat Doost, Yule, & Dalgleish, 1999; Taghavi, Neshat-Doost, Moradi, Yule, & Dalgleish, 1999; Vasey, Daleiden, Williams, & Brown, 1995; see Puliafico & Kendall, 2006, for a review). Indeed, a recent meta-analysis by Bar-Haim et al. (2007) suggests that the presence of threat-related attentional bias in AD youth should be considered a robust finding.

However, the presence of this bias in AD youth is not unequivocal, as a number of studies have found that AD youth do not exhibit a threat-related attentional bias compared to NAD youth (Kindt, Bogels, & Morren, 2003; Taghavi, Dalgleish, Moradi, Neshat Doost, & Yule, 2003; Waters, Lipp, & Spence, 2004). Neither Kindt et al. (2003) nor Waters et al. (2004) found a threat-related attentional bias that was exclusive to AD youth, whereas Taghavi et al. (2003) reported that youth with generalized anxiety disorder (GAD) displayed an attentional bias to negative emotion words, but not to

threat-related words specifically. Additionally, several studies involving high trait-anxious youth (Kindt et al., 1997a), youth with high self-reported anxiety (Ehrenreich & Gross, 2002) and spider-fearing youth (Kindt et al., 1997b, Morren, Kindt, van den Hout, & van Kasteren, 2003) failed to find differences in the attentional responses of anxious youth and non-anxious controls to threat-related stimuli. These results suggest that, either this finding is unreliable, or other factors may impact upon threat-related attentional bias in anxious youth. Two potential factors that may influence this bias - cognitive development and both trait anxiety and state anxiety – will now be discussed more thoroughly.

Consideration of Developmental Factors

When assessing threat-related attentional bias in youth, the consideration of cognitive development is necessary (Kendall, Lerner, & Craighead, 1984). Children are more distractible than adolescents (Brodeur, 2004), and this heightened distractibility likely affects a child's ability to perform an attentional task in the face of mild or moderate threat. However, many attentional bias studies conducted thus far have not adequately controlled for cognitive development. In fact, several studies have used samples with wide age ranges, including both children and adolescents (Moradi et al., 1999; Taghavi et al., 2003; Taghavi, et al., 1999; Vasey et al., 1996). Whereas it is common to study children and adolescents together in clinical research, grouping them together may mask differences in attentional bias across age. A number of studies have found that pre-adolescent children without anxiety disorders or low in trait anxiety selectively attend to threat-related information (Kindt, Bierman, & Brosschot, 1997; Kindt, Brosschot, & Everaerd, 1997; Waters, Lipp, & Spence, 2004). These findings differ from studies in

adults, which have generally found that low-anxious individuals show no bias toward threat-related stimuli (e.g., Asmundson & Stein, 1994) or display a bias *away* from threat-related stimuli (e.g., MacLeod, Mathews, & Tata, 1986).

The discrepancies between attentional bias studies in adults and youth may be caused by immature executive functioning abilities in childhood. Executive functioning abilities, which are responsible for higher attentional processes, continue to mature during childhood and adolescence (e.g., Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001; Luna, Garver, Urban, Lazar, & Sweeney, 2004; Pearson & Lane, 1990) because the neurological processes that improve these abilities, such as synaptic pruning (the destruction of unused neuronal connections) and myelinization (insulation of myelin sheaths) occur throughout this period. Luna et al. (2004) reported that processing speed (reaction time to initiate behaviors, including eye movement) matures at approximately age 15, voluntary response suppression (the ability to filter out distracting stimuli to retain behavioral goals) matures at approximately age 14, and efficiency of response suppression continues to improve until approximately age 19.

These results suggest that individuals generally develop mature attentional processing skills during adolescence. It may be, then, that differences in threat-related attentional bias between AD and NAD individuals are not distinct until this time, because up until this point, NAD individuals may be more generally distractible and their attention may therefore be drawn to novel stimuli, including threat-related objects or information.

Consideration of State Anxiety and Trait Anxiety

Also important to the study of threat-related attentional bias in youth are its relationships with state anxiety and trait anxiety. As defined by Spielberger et al. (1983),

state anxiety refers to the varying level of anxiety experienced at a given moment. In contrast, trait anxiety is defined as a more enduring tendency to experience anxiety. Whereas trait anxiety can be considered a reasonably stable personality characteristic, state anxiety frequently fluctuates based on an individual's given situation. Several theories posit that attentional bias to threat is a function of trait anxiety (Eysenck, 1992; Mogg & Bradley, 1998; Williams, Watts, MacLeod & Mathews, 1988, 1997). Whereas studies have reported that high-trait anxious (HTA) individuals display a threat-related attentional bias (e.g., Broadbent & Broadbent, 1988; Mogg & Bradley, 1999), other studies have found no such association (e.g., Brosschot, di Ruiter, & Kindt, 1999; van Honk, Tuiten, de Haan, van den Hout, & Stam, 2001).

Studies by Egloff and Hock (2001) and Rutherford, MacLeod, and Campbell (2001) suggest that elevations in both trait anxiety and state anxiety are necessary to activate a threat-related attentional bias. As Fox, Russo, Bowles, and Dutton (2001) contended, state anxiety is the direct result of activation of the brain's fear-detection system, and therefore contributes to threat-related attentional bias. According to their argument, anxious individuals may only display an attentional bias when their state anxiety is elevated.

The few studies that have assessed trait anxiety and state anxiety in attentional bias studies with youth have reported mixed results. Schippell, Vasey, Cravens-Brown, and Bretveld (2003) found that both trait anxiety and state anxiety positively correlated with threat-related attentional bias, whereas Kindt, Brosschot, and Everaerd (1997) reported that both HTA and low trait-anxious (LTA) youth displayed an attentional bias toward threat. Heim-Dreger, Kohlmann, Eschenbeck, and Burkhardt (2006) found that

state anxiety, but not trait anxiety, was related to threat-related attentional bias. However, Heim-Dreger et al.'s measure of trait anxiety (composite of state anxiety scores at three different time points) was questionable. Finally, Vasey, El-Hag, and Daleiden (1996) found that state anxiety, measured by a one-item questionnaire, was not associated with attentional bias in a sample of youth high and low in test anxiety. Given these mixed results, research examining the relationships between threat-related attentional bias and both trait anxiety and state anxiety is needed.

The Role of Attentional Control in Threat-Related Attentional Bias

Just as it is important to consider factors that may impact upon a threat-related attentional bias in AD youth, it is equally important to better understand the mechanisms underlying this bias. Recent research suggests that deficits in attentional control may contribute to the presence of an attentional bias to threat-related stimuli in anxious individuals (Amir et al., 2003; Derryberry & Reed, 2002; Fox, Russo, & Dutton, 2002). Attentional control is defined as the ability to suppress a dominant attentional response to maintain goal-directed activities. Researchers have proposed that anxiety disorders, including social phobia, may be associated with general deficiencies in attentional control (see Muris and Ollendick, 2005), which is described as both an executive functioning skill (Manly et al., 2001) and a temperamental factor (Muris & Ollendick, 2005).

Attentional control is often considered a component of effortful control (Lonigan et al., 2004), which is generally defined as the ability to select goal-based behavioral responses and inhibit reactive behavior (Rothbart & Bates, 1998). A number of studies have found low effortful control to be associated with anxiety and other psychopathological symptoms. Effortful control correlates positively with emotional

resiliency (Eisenberg et al., 1997) and negatively with internalizing psychopathology (Eisenberg et al., 2001; John, Caspi, Robins, Moffitt, & Stouthamer-Loeber, 1994) in youth. Furthermore, Muris, Meesters, and Rompelberg (2007) reported a negative correlation specifically between attentional control and symptoms of anxiety, depression, and attention-deficit/hyperactivity disorder (ADHD). To this point, however, the attentional control abilities of AD and NAD youth have not been experimentally tested.

Based on research examining threat-related attentional biases, Lonigan and colleagues (2004) proposed that threat-related attentional bias partially mediates the relationship between negative affect and onset of an anxiety disorder. They further posited that effortful control, comprising attentional control and behavioral control, moderates both the relationship between negative affect and anxiety and the relationship between threat-related attentional bias and anxiety. Specifically, Lonigan et al. argued that effortful control helps override the reactive process of attending to threat-related stimuli. Therefore, an individual's level of effortful control predicts the extent to which one attends to threat-related stimuli. Lonigan and colleagues additionally proposed that effortful control moderates the relationship between negative affect and anxiety in that higher levels of effortful control would allow an individual to suppress reactive responses to negative affect in favor of voluntary strategies that help the individual to more effectively cope. Muris and Ollendick (2005) also suggested that effortful control may moderate the relationship between emotionality/neuroticism and psychopathology, including anxiety disorders.

Similarly, Derryberry and Reed (2002) proposed that threat-related attentional bias is partially a function of effortful control, in that low effortful control may facilitate

focused attention to threat-related information. They argued that threat-related attentional bias consists of both automatic and voluntary attentional processes, and that the ability to disengage attention from threat-related information is important in constraining this bias.

Supporting their argument, studies using adult samples have reported that AD and HTA individuals experience difficulty disengaging from threat-related stimuli after they have already attended to them (Amir, Elias, Klumpp, & Przeworski, 2003; Derryberry & Reed, 2002; Fox, Russo, & Dutton, 2002; Yiend & Mathews, 2001). The aforementioned studies also reported that difficulty disengaging *from* threat-related information, and not initial orienting *toward* threat-related information, is primarily responsible for the attentional bias found in anxious individuals. These findings suggest that attentional bias, originally thought to be an automatic process (e.g. Williams, Watts, MacLeod, & Mathews, 1988), may instead be caused by difficulty disengaging attention from threat-related information. That is, these difficulties with disengagement represent a more conscious inhibitive process related to effortful control. More recent research (Bar-Haim et al., 2007; Koster, Crombez, Verschuere, Van Damme, & Weisema, 2006) indicated that threat-related attentional bias is the result of both speeded orienting to threat stimuli and difficulty disengaging from these stimuli. Unfortunately, the role of disengagement in threat-related attentional bias has not yet been empirically studied in children and adolescents. However, the aforementioned research indicates that assessment of attentional control, and its role in disengagement from threat-related stimuli, in SP and NAD youth is a much needed topic of research.

Study Goals and Hypotheses

Based on the research needs outlined above, the present study compared threat-related attentional bias in SP adolescents and NAD adolescents. Adolescents with social phobia were targeted because of the high prevalence of and impairment caused by social phobia in adolescence. The study targeted social phobia exclusively based on research suggesting that threat-related attentional bias is content-specific with regard to the stimuli presented (Asmundson & Stein, 1994; Hope, Rapee, Heimberg, & Dombeck, 1990). That is, individuals with an anxiety disorder selectively attend to information related to their disorder or fear, but not to information related to other disorders or fears. Given research suggesting that threat-related attentional bias results from delayed disengagement from threat-related stimuli, the study used attentional disengagement from threat as an indicator of attentional bias.

The sample was limited to adolescents aged 12-17 to help control for the ongoing cognitive developments during childhood and adolescence discussed earlier. Limiting the age range of the current sample to adolescents only partially controls for ongoing developments in cognitive processing, as a number of these skills (e.g., processing voluntary response suppression) continue to mature during adolescence. Nevertheless, it was decided that the current age range would help minimize executive functioning differences that exist between children and adolescents while also allowing for a sufficiently powered sample.

The study's hypotheses were: (1) SP adolescents would take longer than NAD adolescents to disengage from threat-related information, (2) Both trait anxiety and state anxiety would be significantly correlated with this threat-related attentional bias, (3) SP

adolescents would exhibit poorer attentional control abilities compared to NAD adolescents, and (4) threat-related attentional bias would partially mediate the relationship between negative affect and presence of an anxiety disorder (exploratory).

The study represented the first examination of threat-related attentional bias exclusively in adolescents, as well as the first study to measure attentional disengagement in AD youth. As previous studies have supported the association between threat-related attentional bias and both trait anxiety and state anxiety (Broadbent & Broadbent, 1988; Brosschot, di Ruiter, & Kindt, 1999; Egloff & Hock, 2001; Mogg & Bradley, 1999; Rutherford et al., 2001), the present study tested these associations. Additionally, the study planned to test Lonigan et al.'s (2004) model of the development of anxiety disorders in youth, specifically that threat-related attentional bias partially mediates the relationship between negative affect and development of disorder. This hypothesis was exploratory, as Lonigan et al.'s model has not yet been empirically tested, and contingent on the presence of threat-related attentional bias in SP adolescents.

CHAPTER 2

METHOD

Participants

The sample consisted of 55 English-speaking male and female adolescents ages 12 years, 0 months – 17 years, 11 months. The sample included two groups: adolescents diagnosed with social phobia (SP group, $n = 28$), and adolescents who did not meet criteria for an anxiety disorder (NAD group, $n = 27$). SP participants met DSM-IV criteria for a social phobia diagnosis based on the Anxiety Disorders Interview Schedule for Children and Parents (ADIS-C/P; Silverman & Albano, 1996).

Adolescents and their parents/guardians in the SP group were informed of the proposed study at the beginning of a larger assessment battery. Those adolescents who consented to participate and who met diagnostic criteria for SP were included in the study unless they met one or more of the following exclusion criteria: (a) diagnosis of a mood disorder, including major depressive disorder, dysthymic disorder, or bipolar disorder, (b) diagnosis of attention-deficit/hyperactivity disorder (ADHD), or (c) a full-scale IQ below 80. Individuals diagnosed with mood disorders were excluded based on previous findings that individuals with comorbid anxiety and mood disorders do not display a threat-related attentional bias (e.g., Musa, Lepine, Clark**,** Mansell, & Ehlers, 2003). Individuals diagnosed with ADHD were excluded because deficits in attentional processing may influence performance on the study's experimental task. However, SP adolescents with comorbid ADHD or a comorbid mood disorder were included if they were on medication for the disorder for six months or longer. Because of the high prevalence of ADHD in

adolescence (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003), and the high comorbidity of social phobia and depression in adolescence (Stein et al., 2001), this decision was made to ensure a sufficiently powered sample. Inclusion of participants with ADHD and depression that were managed by medication also increased the external validity of the findings. Diagnosis of a comorbid anxiety disorder in addition to social phobia was not an exclusion criterion.

Participants in the NAD group were recruited from the community and were financially compensated for their participation. Interested participants were included in the study unless they met one of the following exclusion criteria: (a) diagnosis of an anxiety disorder, (b) diagnosis of a mood disorder, including major depressive disorder, dysthymic disorder or bipolar disorder, (c) diagnosis of ADHD, or (d) a full-scale IQ below 80. NAD adolescents diagnosed with ADHD or a mood disorder were included if they were on medication for the disorder for at least six months.

In the SP group, 67.86% of participants met criteria for a comorbid disorder. The highest comorbidity rate was with generalized anxiety disorder (53.57%), followed by specific phobia (32.14%). Of participants with comorbid diagnoses, social phobia was the principal or co-principal diagnosis for 63.16%. Because diagnostic interviews were not administered to NAD participants, comorbidity rates could not be calculated.

To minimize error variance across the samples, NAD participants were matched with SP participants on age and IQ. Age was a necessary matching criterion because it is associated with executive functioning development, and IQ was a necessary criterion because certain components of the experimental task (e.g. vocabulary recognition, visual processing speed) are associated with IQ. Age was matched within 18 months. IQ was

measured using the Shipley Institute of Living Scale (SILS) and was matched within one standard deviation based on the SILS norms.

To ensure comparable gender rates, a maximum of twenty members of either gender were recruited for each group. There were twelve males and sixteen females in the SP group and ten males and eighteen females in the NAD group. Likewise, a maximum of twenty younger adolescents (12 years, 0 months – 14 years, 11 months) and twenty older adolescents (15 years, 0 months – 17 years, 11 months) were recruited for each group. There were sixteen younger adolescents and twelve older adolescents in the SP group and thirteen younger adolescents and fifteen older adolescents in the NAD group.

Power Analysis

A power analysis was conducted to determine the number of participants needed to detect effects for the study's primary hypotheses. Power analyses were conducted using guidelines suggested by Cohen (1988). Studies assessing the role of disengagement of attention to threat-related stimuli in adults have generally used ANOVA analyses to assess for group differences. As the primary analyses of interest were ANOVA analyses, *f* statistics were determined as estimates of effect size. The *f* statistic is analogous to the *d* statistic used to determine effect sizes from regression analyses. A small effect is denoted by $f = .1$, a medium effect is denoted by $f = .24$, and a large effect is denoted by $f = .4$.

No existing studies have examined the role of disengagement in threat-related attentional bias in youth, so studies of attentional disengagement in anxious adults and attentional bias in anxious youth were used to determine an appropriate predicted effect size. Large effects have been found in AD adults ($f = .40$; Amir et al., 2003) and high trait anxious adults ($f = .35$, Yiend & Mathews, 2001). Studies assessing threat-related

attentional bias in AD youth using a dot-probe detection task have reported moderate to large effects (f = .41, Vasey et al., 1995; f = .22, Dalgleish et al., 2003). Based on the results of these studies, an estimated effect size of .35 was considered appropriate for the proposed study. To achieve this effect size with a power of .80, 40 total participants (20 per group) were necessary. To ensure sufficient power, 28 SP participants and 27 NAD participants were recruited.

Measures

Clinician-Administered Measures

Anxiety Disorders Interview Schedule for Children (ADIS-C/P; Silverman & Albano, 1996). The ADIS-C/P is a diagnostic instrument that assesses child and adolescent psychopathology according to DSM-IV criteria, with particular coverage of the internalizing disorders. It is used to collect parent report and child report of symptomatology. Diagnosticians assign diagnoses and clinician severity ratings (CSRs) for each diagnosis based on information rendered from the ADIS-C/P. CSRs range from 0-8; a CSR $\geq$ 4 denotes that the child's symptom presentation meets full criteria for diagnosis (see Silverman & Albano, 1996).

The ADIS-C/P possesses strong psychometric properties. Diagnosticians at Temple University have achieved high interrater reliability, Cohen's κ = .85. The ADIS-C/P has demonstrated high concurrent validity (Wood et al., 2002), high retest reliability (k > .70 for both interviews; Silverman & Eisen, 1992; Silverman et al., 2001) and is sensitive to treatment-related changes (e.g., Kendall et al., 1997; Silverman et al., 1999).

Test of Everyday Attention for Children (TEA-ch; Manly et al., 2001). The TEA-ch is a clinician-administered measure of sustained attention, selective attention, divided

attention, and attentional switching abilities in children and adolescents. Two subtests of the TEA-ch, *Creature Counting* and *Opposite Worlds,* comprise the attentional control subscale of the TEA-ch. These subtests were administered in the present study. The *Creatures Counting* subtest measures attentional switching; the task is completed by counting creatures on pages of a stimulus booklet and following arrows to guide counting. Two scores are obtained; the Accuracy score reflects ability to accurately count the creatures, and the Timing score reflects the time spent doing so. The Timing score is only calculated if participants accurately count the creatures in three or more of the eight trials.

The *Opposite Worlds* subtest assesses inhibition of dominant responses. The task presents four pages displaying an s-shaped row of squares with the number "1" or "2" written in each one. Participants are asked to read the numbers from the beginning of the row to the end. On Same World trials, participants are instructed to state aloud the numbers as they appear ("1" when "1" is presented). On Opposite World trials, participants are instructed to state aloud the opposite number being presented ("1" when "2" is presented). Practice trials are presented first, followed by a Same World trial, two Opposite World trials, and a Same World trial. Again, two scores are obtained: a timing score for Same World trials, and a timing score for Opposite World trials. The order of the practice trial and experimental trials creates a situation in which both Same World and Opposite World trials test inhibition of a competing response.

Both subtests possess high retest reliability (r = .69 for *Creature Counting*, r = .92 for *Opposite Worlds;* Manly et al., 2001). They also possess adequate convergent validity, as evidenced by significant correlations with other measures of attention (Manly

et al., 2001). The TEA-ch is normed for adolescents up to the age of 15 years, 11 months.[1]

Adolescent Self-Report Measures

Beck Depression Inventory – II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a self-report measure completed by individuals ages 13 and older to assess depressive symptomatology. It was used to screen for depressive symptomatology in participants. It consists of 21 items that are scored on a 3-point Likert-type scale. The BDI-II possesses high internal consistency (Osman, Barrios, Gutierrez, Williams, & Bailey, 2008), and adequate convergent and discriminant validity in both adults and adolescents (Beck et al., 1996; Osman, Kopper, Barrios, Gutierrez, & Bagge, 2004). Furthermore, the BDI-II has been useful in differentiating individuals diagnosed with major depressive disorder (MDD) from non-depressed individuals (Arnau, Meagher, Norris, & Bramson, 2001) and clinical outpatient adolescents from a sample of high school students (Osman et al., 2008). The BDI exhibited high internal consistency in the current sample, $\alpha = .79$.

The Positive and Negative Affect Schedule (PANAS; Clark, Watson, & Tellegen, 1988). The PANAS was administered to assess negative affect in participants. The PANAS is a 20 item self-report measure that assesses the temperamental dimensions of positive and negative affect. Each item consists of a self-describing term (i.e., interested, distressed). Responders are asked to rate each item based on the extent to which the term describes them. The PANAS provides a total score for both positive affect (PA) and negative affect (NA). It possesses high internal consistency and retest reliability (Clark, Watson, & Tellegen, 1988; Crawford & Henry, 2004). Additionally, the scales of the

PANAS correlate adequately with other measures of positive and negative affect (Clark, Watson, & Tellegen, 1988). Huebner and Dew (1995) found the PANAS to have adequate internal consistency and convergent validity when administered to adolescents. In the current sample, both the PANAS PA scale ($\alpha = .89$) and NA scale ($\alpha = .90$) exhibited high internal consistency.

Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997). The MASC was administered to assess anxious symptomatology in SP and NAD adolescents. Its specific purpose was to screen NAD participants for anxious symptomatology. The MASC is a self-report measure completed by children and adolescents about their anxious symptomatology. It consists of 39 items that are answered on a 4-point Likert-type scale (0 = "Never true about me", 3 = "Often true about me"). The MASC provides a total score as well as scores on four scales – physical symptoms, social anxiety, separation anxiety, and harm avoidance – and factor analyses have supported this four factor model (Baldwin & Dadds, 2007). It possesses high three-week retest reliability in both clinical ($r = .79$; March et al., 1997) and school ($r = .88$; March & Sullivan, 1999) samples. The MASC total score has an internal consistency of .90, and subscale scores range in internal consistency from .74 to .85 (March, et al., 1997). Good convergent validity has also been demonstrated (Baldwin & Dadds, 2007). Furthermore, the MASC has been shown to accurately discriminate between AD and NAD adolescents (Dierker et al., 2001). High internal consistency was reported for the MASC in the current sample, $\alpha = .92$.

Shipley Institute of Living Scale (SILS; Zachary, 1991). The SILS was used as a screen for IQ. It is a self-report measure of intellectual ability that consists of 40

vocabulary items and 20 inductive reasoning items. The SILS and the Wechsler Adult Intelligence Scale correlate highly with one another (Weiss & Schell, 1991).

State Trait Anxiety Inventory – State and Trait Versions (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI is a self-report measure that independently assesses an individual's current state anxiety and trait anxiety levels. The measure consists of 20 items related to state anxiety (A-State) as well as 20 items related to trait anxiety (A-Trait). Each set of items is scored separately to provide a trait anxiety score and a state anxiety score. All items are answered on a 4-point Likert-type scale (1 = almost never, 4 = almost always). The STAI possesses adequate 30-day retest reliability for high school students (A-Trait: $r = .71$ for males, $r = .75$ for females, A-State: $r = .62$ for males, $r = .34$ for females, Spielberger et al., 1983) as well as adequate construct validity (Spielberger et al., 1983). The internal consistency for the A-State in the current sample was adequate, $\alpha = .63$, whereas the internal consistency for the A-Trait was low, $\alpha = .31$.

Materials

A computer task designed by the investigator was used to measure disengagement from threat-related stimuli. The task was an adaptation of a task developed by Posner and colleagues (Posner, Cohen, & Rafal, 1982) commonly used to assess attentional disengagement. Adaptations of the Posner task have been used in previous studies to examine attentional disengagement from threat-related stimuli in anxious individuals (Amir et al., 2003; Fox et al., 2001; Yiend & Mathews, 2001). The computer task was designed using E-Prime software and was conducted on a Dell laptop computer with a 19" monitor.

The computer task presented threat-related, positive, and emotionally neutral words to participants via a computer screen. Threat-related words were limited to words suggesting social threat (e.g. failure, rejected) because SP adolescents comprised the target sample. All words needed to be at or below a 7th grade reading level. In choosing threat-related words to be used in this study, the investigator attempted to select words that were used in previous attentional bias studies. Because no previous study had examined attentional bias to social threat-related words in SP youth, there existed no list of social threat-related words at an appropriate reading level that had been used in attentional tasks before. Although the word banks from Vasey et al. (1995) and Asmundson and Stein (1994) each provided many appropriate words, neither study's entire word bank was appropriate for the current study. Fifteen of the 16 threat-related words used in the study were selected from those word banks. One additional word was generated by the investigator based on emotional valence and reading level. The list of words presented in the computer task is presented in Table 1.

Each threat-related word was matched with a positive and neutral word for length and frequency of usage. In addition, all words were rated by a PhD level psychologist and two graduate students who specialized in child anxiety. Words were rated for threat valence level and positive valence level ("How threatening or disturbing is this word?", "How positive or pleasant is this word?"). Ratings were made on a 5-point Likert-type scale in which 0 denoted "not at all" and 5 denoted "extremely." A threat-related word was selected for the computer task if it achieved an average "threat" score higher than 3.0 and an average "positive" score lower than 1.5. Likewise, a positive word was selected for the computer task if it achieved an average "positive"

score higher than 3.0 and an average "threat" score lower than 1.5. Finally, a neutral word was selected for the task if its average "threat" and "positive" scores were both below 1.5. In all, sixteen social threat-related words, sixteen positive emotional words, and sixteen neutral words were selected for the task.

The task consisted of 288 experimental trials and 30 practice trials. Each trial began with the appearance of a cross in the center of the computer screen, and participants were instructed to focus their attention on the cross. On *cued* trials, a word then appeared on either the left or right side of the screen for 750ms before disappearing. Words appeared 3.5 inches from the center of the screen on either the left or right side. Immediately after the word disappeared, a dot .5 inches in diameter appeared 3.5 inches from the center of the screen on either the left or right side. On *validly cued* trials, a dot-probe appeared in the location of the word after it disappeared. On *invalidly cued* trials, the dot-probe appeared in the opposite location of the word after the word disappeared. Finally, on *uncued* trials, no word appeared before the appearance of the dot-probe.

Participants were instructed to press the "z" key if the dot-probe appeared on the left side of the screen, and the "m" key if the dot-probe appeared on the right side. These keys were not labeled "l" and "r" to avoid confusion with the actual "l" and "r" keys on the keyboard, but participants were thoroughly instructed to use the "m" and "z" buttons for responding. The dot remained on the screen until the participant responded, or for five seconds if the participant did not respond. After an intertrial period of 1000ms, the fixation cross reappeared to signal the start of the next trial. The E-Prime program recorded and stored the response times, in milliseconds, of every trial for each participant.

Table 1.

Words Presented in Computer Task

Threat Word	Matched Positive Word	Matched Neutral Word
Coward	Dazzling	Teapot
Ashamed	Amazed	Plastic
Dull	Calm	Ray
Embarrassed	Impressive	Occupy
Terrified	Confident	Concentrate
Failure	Genius	Wander
Nervous	Laughter	Border
Ignored	Dessert	Rattle
Hated	Merry	Nickel
Teased	Pal	Twig
Foolish	Finest	Tissue
Dumb	Cute	Slot
Stupid	Hobby	Shipping
Disliked	Award	Census
Lonely	Gentle	Differ
Worthless	Giggle	Slipper

Consistent with Posner's task, two-thirds (192) of the experimental trials in the computer task were validly cued trials, one-sixth (48) were invalidly cued trials, and one-sixth (48) were uncued. These percentages were designed to train the participant to expect the dot-probe in the location in which the cue stimulus appeared. The invalidly cued trials were then used to measure attentional disengagement from the presented stimuli.

Each word appeared in two validly cued trials, one invalidly cued trial, and one uncued trial. Furthermore, each word appeared twice on the left side of the screen and twice on the right; the trials were balanced so that the words in each category appeared equally often on the left and right sides of the screen during invalid and uncued trials. The order that words appeared in the task was randomly selected for each participant. This randomization was conducted using E-Prime software before data collection began.

Procedure

Recruitment. Participants in the SP group were recruited from adolescents seeking treatment at three sites: the Temple University Child and Adolescent Anxiety Disorders Clinic (CAADC), the New York University Child Study Center (NYCSC) and the New York State Psychiatric Institute (NYSPI). All adolescents seeking treatment completed a pre-treatment assessment battery including the ADIS-C/P. The study's tasks were included in this pre-treatment battery. Participants in the SP group and their parents consented to participation in the study as part of a larger consent to assessment and treatment for anxiety.

NAD adolescents were recruited from a public high school in Manhasset, New York. Before participating, NAD adolescents interested in participating were given a

consent form to take home for their parent/guardian(s) to read and sign if they permitted their child to participate, as well as a demographic questionnaire for their parent/guardian to complete. The consent form described the purpose of the study and the nature of the adolescent's participation. The questionnaire inquired about demographic information and assessed potential participants for presence of ADHD or a mood disorder. Adolescents participated in the study after they returned signed consent forms to the investigator. Those endorsing presence of ADHD (on the demographic questionnaire) or a mood disorder (on the BDI-II) were excluded from the study unless they were taking a stable dose of prescribed medication for a minimum duration of six months to manage. However, the parents of many participants refused to answer questions related to ADHD, and due to limited recruitment opportunities, these participants were included in the study. Participating adolescents completed the study's tasks during a 45 minute period of the school day when they did not have class or after school. All NAD participants received $15 compensation for their participation.

Experimental Procedure. Participants in the SP group were administered the ADIS-C/P as part of the larger pre-treatment assessment. They then completed the SILS, MASC, A-Trait and PANAS before completing the TEA-ch and the computer task. Upon arriving for the study, NAD participants completed self-report forms after assenting to participate. A multiple gate procedure was used to ensure that NAD participants did not meet diagnostic criteria for an anxiety disorder. All NAD participants completed the MASC before completing the study's tasks to screen for presence of excessive anxiety. Participants who received a total MASC score that fell one standard deviation above the mean (51 or higher for males, 59 or higher for females) were administered the anxiety

disorders sections of the ADIS-C to assess for presence of anxiety disorder. NAD participants who met criteria for an anxiety disorder according to the ADIS-C completed the study's tasks but their data were not included. After completing the self-report forms and the ADIS-C (if necessary), participants completed the computer task.

To increase state anxiety in participants, the investigator remained in the room and frequently looked over the shoulder of participants as they completed the computer task. To capture an increase in state anxiety caused by the investigator monitoring the task, participants completed the A-State after completing the computer task.

Upon completion of the study, all participants were given a brief overview of the study's primary purposes and had the opportunity to ask questions about the study. NAD volunteers were financially compensated after completion of all study tasks.

CHAPTER 3

RESULTS

Preliminary Analyses

Before testing the study's hypotheses, the normality of each study variable's distribution was examined. All variables displayed normal skewness and kurtosis except for response time to trials of invalidly cued threat-related words and invalidly cued neutral words. To correct for non-normality, log-transformations were conducted for all response time variables.

Preliminary analyses compared the demographic variables of the SP and NAD groups (see Table 2). An independent-samples *t* test revealed no significant difference between the participant groups on age, $t(53) = .30$, p = ns, or IQ, $t(53) = 1.30$, p = ns. Chi Square tests revealed no group differences on participant sex, χ^2 (1, N = 55) = .53, p = ns, or participant race, χ^2 (1, N = 55) = .18, p = ns.[2]

Additional analyses examined associations between demographic variables and dependent variables. Pearson correlation coefficient tests revealed that neither age nor IQ were significantly correlated with response times regardless of cue type or word type (all p's = ns). Similarly, independent samples *t* tests revealed that response times to all trials did not differ by sex (all p's = ns).

The means and standard deviations of independent variable self-report forms are presented in Table 3. Independent samples *t* tests assessed the differences between SP and NAD participants on these variables. As expected, SP adolescents reported higher levels of trait anxiety, $t(53) = 4.04$, $p < .001$, state anxiety, $t(53) = 3.43$, $p = .001$, and

Table 2.

Participant Demographic Characteristics

Variable	SP Group		NAD Group	
	n	Mean (SD)	n	Mean (SD)
Age (years)	28	14.25 (1.82)	27	14.74 (1.68)
IQ	28	104.00 (10.57)	27	108.11(8.02)
Sex				
Female	16	-	18	-
Male	12	-	9	-
Race				
Caucasian	24	-	22	-
African-American	3	-	1	-
Asian-American	0	-	4	-
Latin-American	1	-	0	-

Note. SP = social phobia; NAD = non-anxiety disordered.

Table 3.

Means and Standard Deviations for Independent Variables

Measure	SP Group	NAD Group	*t*
	Mean (SD)	Mean (SD)	
A-State	42.56 (8.55)	35.58 (6.48)	*t(53)* = 3.43***
A-Trait	48.29 (10.89)	37.50 (8.71)	*t(53)* = 4.04***
PANAS-PA	28.61 (9.78)	32.93 (6.76)	*t(53)* = 1.86
PANAS-NA	21.22 (8.16)	16.30 (7.77)	*t(53)* = 2.23*

Note. SP = social phobia; NAD = non-anxiety disordered; A-State = State Trait Anxiety Inventory – State Version; A-Trait = State Trait Anxiety Inventory – Trait Version; PANAS-PA = Positive and Negative Affect Schedule – Positive Affect Score; PANAS-NA = Positive and Negative Affect Schedule – Negative Affect Score. *$p < .05$; ***$p < .001$.

negative affect, $t(53) = 2.23$, $p = .03$, than NAD participants. SP and NAD participants did not differ on positive affect, $t(53) = 1.86$, $p = ns$.

The correlations between each of the self-report independent variables and each of the dependent variables were separately examined (see Tables 4 and 5). As expected, self-report measures assessing anxiety – the MASC, the A-State, and the A-Trait - were all positively correlated at either the $p = .05$ or $p = .01$ level. In addition, each of these measures was significantly correlated with the PANAS Negative Affect scale. The PANAS Positive Affect scale was either negatively correlated or uncorrelated with the other independent variables.

Table 4.

Correlations Between Independent Variables

	MASC	PANAS PA	PANAS NA	A-State	A-Trait
MASC	-	-.48**	.45**	.39*	.63**
PANAS PA		-	-.09	-.39**	-.49**
PANAS NA			-	.51**	.55**
A-State				-	.64**
A-Trait					-

Note. MASC = Multidimensional Anxiety Scale for Children; PANAS PA = Positive and Negative Affect Schedule – Positive Affect Scale; PANAS NA = Positive and Negative Affect Schedule – Negative Affect Scale. $^{**}p < .01$; $^{***}p < .001$.

With regard to the correlations between dependent variables, the response times to all attentional disengagement trials were positively correlated with each other at the $p = .01$ level. Three of the TEA-ch scores – the Creature Counting Timing score, the Same World score, and the Opposite World score – were also all positively correlated with each other. The Creature Counting Accuracy score was positively correlated with the Opposite World score, but was not significantly correlated with the other TEA-ch scores. None of the attentional disengagement trials were significantly correlated with the Creature Counting Accuracy score or the Same World score. However, several of the attentional disengagement task trial types – invalidly cued threat related, validly cued positive, validly cued neutral, and invalidly cued neutral – were negatively correlated with the Creature Counting timing score. In addition, all attentional disengagement trials were

Table 5.

Correlations of Dependent Variables.

	ThrVal	ThrInVal	PosVal	PosInVal	NeuVal	NeuInVal	UnCued	CCAcc	CCTim	SameW	OppW
Thr Val	-	.80**	.95**	.81**	.91**	.78**	.70**	.09	-.34	-.30	-.47**
Thr InVal		-	.78**	.84**	.83**	.85**	.70**	.13	-.38*	-.17	-.43**
Pos Val			-	.77**	.93**	.73**	.71**	.03	-.37*	-.26	-.53**
Pos InVal				-	.88**	.92**	.83**	.03	-.27	-.09	-.39*
Neu Val					-	.82**	.79**	-.01	-.35*	-.21	-.56**
Neu InVal						-	.81**	.05	-.36*	-.18	-.47**

Table 5. (continued)

	ThrVal	ThrInVal	PosVal	PosInVal	NeuVal	NeuInVal	UnCued	CCAcc	CCTim	SameW	OppW
UnCued							-	-.07	-.32	-.12	-.52**
CC Acc								-	.30	.29	.39*
CC Tim									-	.81**	.75**
SameW										-	.74**
OppW											-

Note. ThrVal = validly cued threat-related trial mean response time; ThrInVal = invalidly cued threat-related trial mean response time; PosVal = validly cued positive trial mean response time; PosInVal = invalidly cued positive trial mean response time; NeuVal = validly cued neutral trial mean response time; NeuInVal = invalidly cued neutral trial mean response time; UnCued = uncued trial mean response time; CCAcc = TEA-ch Creature Counting Accuracy subtest; CCTim = TEA-ch Creature Counting Accuracy score; SameW = TEA-ch Same World score; OppW = TEA-ch Opposite World score; *$p < .05$; **$p < .01$.

negatively correlated with the Opposite World score at the $p = .01$ level.

Given the high comorbidity in the SP group, mean clinician severity ratings were calculated for social phobia and all comorbid diagnoses. For SP participants, the mean clinical severity rating was 5.75 (SD = .93). The mean clinical severity ratings for all disorders are listed in Table 6.

Table 6.

Mean clinical severity ratings for diagnoses in SP group

	SP (n=28)	GAD (n=15)	SAD (n=1)	SpP (n=9)	OCD (n=2)	MDD (n=1)	Dysth (n=4)	ADHD (n=3)	PD (n=1)	ODD (n=1)
Mean CSR (SD)	5.75 (.93)	5.67 (1.18)	6.00 (-)	4.56 (1.13)	5.50 (2.12)	4.00 (-)	5.00 (1.15)	4.33 (.58)	4.00 (-)	4.00 (-)

Note. SP = social phobia; GAD = generalized anxiety disorder; SAD = separation anxiety disorder; SpP = specific phobia; OCD = obsessive compulsive disorder; MDD = major depressive disorder; Dysth = dysthymia; ADHD = attention-deficit/hyperactivity disorder; PD = panic disorder; ODD = oppositional defiant disorder; CSR = clinician severity rating.

Finally, one way ANOVAs were conducted for each of the dependent variables with site of data collection (CAADC, NYUCSC, and NYSPI) as the independent variable. No site differences were found for response times to the attentional disengagement task or for TEA-ch scores (all p's = ns, see Table 7).

Errors

All trials in which participants made response errors (e.g. pressing the right "m" button when the target dot appears on the left side of the screen) were excluded from data analyses. Additionally, all response times longer than 2500 milliseconds were excluded. Response errors and response times greater than 2500 milliseconds often indicate random responding, and the majority of previous studies have deleted these data from analyses (e.g., Amir et al., 2003; Yiend & Mathews, 2001). Of all trials, 1.69% were excluded because they were incorrect or they exceeded the 2500 millisecond limit. An independent samples *t* test found that SP and NAD participants did not differ in number of trials excluded, $t(53) = 1.38$, p = ns.

Hypotheses and Main Statistical Analyses

Hypothesis 1

The first hypothesis was that the SP group would take longer than the NAD group to disengage from threat-related information. Specifically, it was hypothesized that the SP group would display longer response times on invalidly cued trials when visually exposed to threat-related words than when exposed to neutral or pleasant words, whereas, for the NAD group, response times on invalidly cued trials would not differ based on word type (threat-related, pleasant, neutral). Invalidly cued trials were targeted because, on these trials, participants were forced to disengage from the presented word on one side of the screen to attend to the dot-probe presented on the opposite side of the screen. It was additionally hypothesized that the SP and NAD groups would not differ in their response times on validly cued trials involving threat-related words. To test this

Table 7.

Means and Standard Deviations of Dependent Variables According to Site

Measure	CAADC		NYUCSC		NYSPI		F	*f*
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)		
Attentional Disengagement Task								
Threat-Related Valid	17	506.11 (94.98)	4	449.39 (159.80)	7	459.00 (151.19)	.92	.27
Threat-Related Invalid	17	593.51 (176.74)	4	577.96 (22.52)	7	537.96 (190.55)	.41	.18
Positive Valid	17	498.33 (86.18)	4	491.77 (166.55)	7	465.34 (172.93)	.43	.19
Positive Invalid	17	589.10 (157.31)	4	501.98 (79.38)	7	550.57 (177.93)	.52	.21
Neutral Valid	17	517.85 (110.07)	4	466.33 (97.60)	7	471.77 (167.21)	.52	.24
Neutral Invalid	17	590.77 (170.16)	4	557.77 (110.44)	7	520.75 (159.37)	.56	.22

Table 7. (continued)

Measure	CAADC		NYUCSC		NYSPI			
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	F	*f*
TEA-ch								
CC Accuracy	14	9.07 (3.25)	3	10.68 (3.21)	3	10.00 (1.00)	.05	.06
CC Timing	12	8.83 (2.37)	3	9.33 (2.08)	3	8.68 (3.21)	.67	.25
Same World	14	6.57 (3.37)	3	8.68 (.58)	3	6.00 (2.65)	.16	.11
Opposite World	14	7.07 (3.25)	3	7.33 (2.31)	3	8.00 (1.00)	1.51	.35

Note. CAADC = Temple University Child and Adolescent Anxiety Disorders Clinic; NYUCSC = New York University Child Study Center; NYSPI = New York State Psychiatric Institute; TEA-ch = Test of Everyday Attention for Children; CC = Creature Counting.

hypothesis, a 2 (group: SP, NAD) x 3 (word type: threat-related, positive, neutral) x 2 (cue type: validly cued, invalidly cued) mixed ANOVA was conducted. The means and standard deviations of all trials are presented in Table 8.

There was a significant main effect of participant group, $F(1, 52) = 6.64$, $p = .01$, $f = .35$, indicating that SP participants responded more slowly to attentional disengagement task trials compared to NAD participants, regardless of word or cue type. In addition, there was a significant main effect of cue type, $F(1, 52) = 73.17$, $p < .001$, $f = 1.20$, indicating that participants responded more quickly to validly cued trials than invalidly cued trials, regardless of word type or participant group. The main effect of word type was not significant, $F(1, 52) = 2.09$, $p =$ ns, $f = .20$, indicating that, overall, participants did not respond differently to different types of words. In addition, the three-way interaction effect between participant group, cue type, and word type was not significant, $F(1, 104) = .18$, $p =$ ns, $f = .05$, indicating that the interaction between word type and cue type did not differ by participant group. Because this interaction effect was non-significant, follow-up analyses and exploratory analyses assessing threat-related attentional bias as a partial mediator between negative affect and presence of an anxiety disorder were not conducted.

To ensure that these findings were not associated with comorbid ADHD in the SP group, the analyses were conducted excluding the three SP participants who were diagnosed with ADHD. The results were not significant for the interaction effect between participant group, word type, cue type, and portion of task, $F(1, 49) = .34$, $p = ns$, $f = .007$. The means and standard deviations for first-half and second-half response times are presented in Table 9.

Table 8.

Mean response time by cue type and word type

Word and cue type	SP Mean (SD)	NAD Mean (SD)
Threat-related	531.15 (21.16)	445.23 (21.16)
Valid	485.49 (18.91)	417.95 (18.91)
Invalid	576.81 (25.93)	472.51 (25.93)
Positive	527.50 (20.93)	463.18 (20.93)
Valid	488.81 (19.30)	434.23 (19.30)
Invalid	566.20 (25.36)	492.13 (25.36)
Neutral	533.00 (21.13)	445.15 (21.13)
Valid	498.27 (19.86)	424.41 (19.86)
Invalid	567.73 (24.69)	465.88 (24.69)
Total	530.55 (20.60)	451.19 (20.60)

Note. SP = social phobia; NAD = non-anxiety disordered

Table 9.

Mean response time by cue type and word type in analyses excluding SP participants with comorbid ADHD

Word and cue type	SP Mean (SD)	NAD Mean (SD)
Threat-related	517.16 (22.28)	445.23 (21.40)
Valid	474.68 (20.12)	417.95 (18.97)
Invalid	559.65 (27.26)	472.51 (25.71)
Positive	511.24 (21.41)	463.18 (20.19)
Valid	478.06 (20.58)	434.23 (19.40)
Invalid	544.43 (24.72)	492.13 (23.30)
Neutral	511.73 (20.43)	445.15 (19.26)
Valid	477.25 (19.62)	424.41 (18.50)
Invalid	546.21 (23.50)	465.88 (22.15)
Total	513.38 (20.95)	451.19 (19.75)

Note. SP = social phobia; NAD = non-anxiety disordered

Participants in the current study completed the computer task in one sitting, whereas other studies occasionally administer similar tasks in multiple sittings to prevent fatigue (e.g. Dalgleish et al., 2001, Vasey et al., 1995). It was hypothesized *post hoc* that the length of the task (approximately 12 minutes) may have led participants to lose focus on the task as it progressed. To test this hypothesis, a 2 (group) x 3 (word type) x 2 (cue type) x 2 (portion of task: first half, second half) mixed ANOVA was conducted. Non-significant results were rendered for the interaction effect between participant group, word type, cue type , and portion of task, $F(1, 52) = .11$, $p = ns$, $f = .10$. The means and standard deviations for first-half and second-half response times are presented in Table 10.

Hypothesis 2

The second hypothesis was that trait anxiety and state anxiety, as measured by the STAI, would each correlate positively with response time to threat-related words on invalidly cued trials, but would not be significantly correlated with response time to positive or neutral words. Pearson correlation coefficients were conducted to measure correlations between A-Trait and A-State scores and mean response times on invalidly cued trials. There were no significant associations
between trait anxiety and response time to invalidly cued threat-related words, positive words, or neutral words (all p's = ns; See Table 10). Similarly, there were no significant associations between state anxiety and response time to invalidly cued threat-related words, positive words, or neutral words (all p's = ns; See Table 11).

To ensure that these findings were not associated with comorbid ADHD in the SP group, the analyses were conducted excluding the three SP participants with ADHD. A

Table 10.

Post hoc analysis mean response times by cue type and word type

Word and cue type	SP Mean (SD)	NAD Mean (SD)
First Half		
Threat-related	521.75 (21.37)	443.79 (21.37)
Valid	470.24 (19.40)	423.04 (19.40)
Invalid	573.25 (26.47)	464.54 (26.47)
Positive	521.95 (23.24)	464.34 (23.24)
Valid	491. 47 (21.39)	436.76 (21.39)
Invalid	552.43 (29.46)	491.92 (29.46)
Neutral	525.78 (22.08)	452.70 (22.08)
Valid	504.65 (22.87)	433.78 (22.87)
Invalid	546.91 (23.74)	471.62 (23.74)
Total	523.16 (21.23)	453.61 (21.23)
Second Half		
Threat-related	531.15 (22.66)	449.91 (22.24)
Valid	496.20 (23.02)	420.48 (22.59)
Invalid	566.11 (27.47)	479.35 (26.96)
Positive	530.31 (21.87)	459.24 (21.46)
Valid	488.99 (21.17)	438.12 (20.78)
Invalid	571.63 (26.13)	480.37 (25.64)

Table 10. (continued)

Word and cue type	SP Mean (SD)	NAD Mean (SD)
Neutral	529.76 (22.02)	438.87 (21.61)
Valid	481.61 (19.77)	419.44 (19.40)
Invalid	577.92 (28.28)	458.30 (27.75)
Total	530.41 (21.13)	449.34 (20.73)

Note. SP = social phobia; NAD = non-anxiety disordered

Table 11.

Correlations between A-State, A-Trait and attentional disengagement task response times

	A-State	A-Trait	Threat-Related Invalidly Cued	Positive Invalidly Cued	Neutral Invalidly Cued
A-State	-	.64**	.21	.02	.04
A-Trait		-	.12	.02	.09
Threat-Related Invalidly Cued			-	.78**	.85**
Positive Invalidly Cued				-	.92**
Neutral Invalidly Cued					-

Note. A-State = State Trait Anxiety Inventory – State Version; A-Trait = State Trait Anxiety Inventory – Trait Version

**$p < .01$

significant association was found between state anxiety and response time to invalidly cued threat-word trials (r = .30, p = .04; See Table 12). All other correlations were non-significant (all p's = ns).

Hypothesis 3

The final hypothesis was that the SP group would exhibit poorer attentional control than the NAD group, as measured by subtests of the TEA-Ch. As a preliminary analysis, a MANOVA was conducted in which only SP participants were included to examine if presence of ADHD predicted lower scores on the TEA-ch. Three of the 28 SP adolescents were diagnosed with ADHD, whereas 25 were not. Presence of ADHD was entered as the predictor variable and the subtests of the TEA-ch were entered as dependent variables. There was no main effect of ADHD presence, Λ = .62, F (4, 24) = 1.74, p = ns, η^2 = .59. Whereas the F test indicated no difference between SP participants with and without ADHD, the effect size suggested a large effect.

To ensure that results of tests examining the TEA-ch were not due to ADHD, the three SP participants with ADHD were excluded from these analyses. To test this hypothesis, a multivariate analysis of variance (MANOVA) was conducted with participant group entered as the predictor variable and the four subtests of the TEA-ch - Creature Counting accuracy score, Creature Counting timing score, Same World score, and Opposite World score – entered as dependent variables. If participants scored a 3 or below on the TEA-ch *Creature Counting* Accuracy task, then a Timing score could not be calculated. Because the MANOVA analysis required that scores existed for each participant, participants for whom a timing score could not be calculated (2 SP participants and one NAD participant) were not included in the TEA-ch analyses.

Table 12.

Correlations between A-State, A-Trait and attentional disengagement task response times excluding SP participants with comorbid ADHD

	A-State	A-Trait	Threat-Related Invalidly Cued	Positive Invalidly Cued	Neutral Invalidly Cued
A-State	-	.65**	.30*	.14	.19
A-Trait		-	.16	.07	.16
Threat-Related Invalidly Cued			-	.84**	.86**
Positive Invalidly Cued				-	.89**
Neutral Invalidly Cued					-

Note. A-State = State Trait Anxiety Inventory – State Version; A-Trait = State Trait Anxiety Inventory – Trait Version

*$p < .05$; **$p < .01$

There was a main effect of group, $\Lambda = .56$, $F\ (4, 29) = 3.79$, $p = .01$, $\eta^2 = .36$. According to follow-up ANOVA analyses, there were significant effects of group on the Creature Counting timing score, $F\ (1, 32) = 6.03$, $p = .02$, $f = .45$, the Same World score, $F\ (1, 32) = 5.73$, $p = .02$, $f = .43$, and the Opposite World score, $F\ (1, 32) = 9.04$, $p < .01$, $f = .55$. There was no significant group effect on the Creature Counting accuracy score, $F\ (1, 32) = 1.04$, $p =$ ns, $f = .19$. The means and standard deviations for all of the TEA-ch scores are presented in Table 13.

Table 13.

Means and Standard Deviations for TEA-ch Scores

Measure	SP Group (n = 16)	NAD Group (n = 16)
	Mean (SD)	Mean (SD)
Creature Counting Accuracy Score	10.25 (2.52)	9.31 (2.68)
Creature Counting Timing Score	9.00 (2.42)	11.13 (2.47)
Opposite World Same World Score	6.94 (3.04)	9.69 (3.44)
Opposite World Opposite World Score	7.81 (2.20)	10.31 (2.50)

Note. SP = social phobia; NAD = non-anxiety disordered.

CHAPTER 4

DISCUSSION

The role of attention in anxiety disorders, including social phobia, has received considerable attention in psychological research. Previous work suggests that AD children and adolescents exhibit a threat-related attentional bias, although studies have not examined the presence of a threat-related attentional bias exclusively in an adolescent sample. The present study did not find that SP adolescents selectively attended to threat on an attentional disengagement task. There was a significant association between state anxiety and attentional disengagement from threat, but only when SP participants with ADHD were excluded. Trait anxiety was not significantly associated with attentional disengagement from threat. Finally, SP adolescents did perform more poorly than NAD adolescents on the *Creature Counting* and *Opposite World* subtests of the TEA-ch, which suggests that SP adolescents exhibit lower attentional control than NAD adolescents.

That SP adolescents exhibit relatively poor attentional control is consistent with literature indicating that attentional control (considered a component of effortful control; Lonigan et al., 2004; Ollendick & Muris, 2005) is related to anxiety. More specifically, it suggests that SP adolescents may find it more difficult than NAD adolescents to control their attention when it is challenged by other environmental stimuli. Compared to NAD participants, SP participants exhibited lower timing scores on the *Creature Counting* subtest, and lower timing scores on both the Same World and Opposite World components of the *Opposite World* subtests. Slowed performance on these subtests suggests that SP participants, compared to NAD participants, took longer to switch their

attention to goal-directed stimuli (as measured by the *Creature Counting* subtest) and found it more difficult to suppress a dominant attentional response (as measured by the *Opposite World* subtest).

Notably, SP and NAD adolescents did not differ on their *Creature Counting* Accuracy scores. Manly and colleagues found that this score was significantly correlated with Full Scale IQ score on the Wechsler Intelligence Scale for Children (Manly et al., 2001). To the contrary, the other TEA-ch subtests were not significantly correlated with IQ and consequently may be truer measures of executive attentional abilities. The *Creature Counting* Accuracy score was not correlated with IQ in the current study, but the measure used to screen for IQ (the SILS) is a brief assessment of vocabulary and abstract reasoning. Although the SILS is a useful screen of general intellectual functioning, it does not assess intellectual functioning as fully and accurately as other, more thorough measures of intelligence.

Scores obtained by the NAD group were generally consistent with scores obtained from the sample used to develop norms for the TEA-ch by Manly et al. (2001). According to the TEA-ch norms, a scaled score of 10 is considered average. The mean scores for *Creature Counting* timing (11.13), *Same World* (9.61), and *Opposite World* (10.31) were close to the average TEA-ch scaled score. The mean scores of SP participants (9.00 on *Creature Counting* timing, 6.94 on *Same World*, and 7.81 on *Opposite World*) are all below the average scaled score. That the mean scores of SP participants are close to the normed sample scores suggests that poorer than average performance by SP participants, and not greater than average performance by NAD participants, accounted for the differences between the groups.

As described earlier, attentional control has been negatively correlated with anxiety symptoms (Muris, Meesters, & Rompelberg, 2007). However, this study represents the first indication that SP adolescents may demonstrate lower attentional control relative to NAD adolescents. This relative deficit may help to explain the cognitive bias often empirically observed in anxious samples. Difficulty suppressing dominant attentional responses may lead anxious individuals to selectively attend to threat-related stimuli in the environment, which would serve to maintain and perhaps exacerbate their anxiety. Furthermore, due to difficulties with attentional switching, anxious individuals may disengage their attention from threat-related stimuli more slowly than non-anxious individuals. Indeed, recent research suggests that threat-related attentional bias is the result of both (a) attentional hypervigilance toward threat-related stimuli, and (b) difficulty disengaging attention from threat-related stimuli (Bar-Haim et al., 2007, Koster, Crombez, Verschuere, Van Damme, & Weisema, 2006).

The fact that NAD adolescents performed more quickly than SP adolescents on Same World trials may not seem to support the claim that SP adolescents exhibit relatively poor attentional control because the Same World task merely requires the individual to read the numbers exactly as they are presented. One may argue that differences on this task are due to differences in processing speed or reading speed between SP and NAD adolescents. However, the order of trials presented on the *Opposite Worlds* subtest– Same World (practice), Opposite World (practice), Same World, Opposite World, Opposite World, Same World – created a situation in which participants were required to inhibit a competing response on Same World trials. That is, individuals completed an Opposite World trial before each of the experimental Same World trials, and were thus required to

inhibit that previously learned response. Therefore, the difference observed on Same World trials likely measured a difference in attentional inhibition between SP and NAD adolescents.

It is possible that the relatively poor performance of SP adolescents on tasks of attentional control was due to increased anxiety experienced by SP adolescents when completing the tasks. That is, SP adolescents may have felt more anxious than NAD controls when engaging in the tasks of attentional control. However, A-State scores indicated no significant difference in state anxiety between SP and NAD participants. Consequently, it is improbable that the difference in attentional control found between SP and NAD adolescents was primarily a result of increased state anxiety.

Interestingly, analyses involving the attentional disengagement task indicated a main effect of participant group, indicating that SP participants responded more slowly than NAD participants, regardless of cue type or word type. This is consistent with the finding that SP participants exhibit poor attentional control relative to NAD participants, in that the task requires attentional switching and inhibition of dominant responses. Indeed, Amir and colleagues (2003) also found that SP adults took longer than NAD participants to respond in general on an attentional disengagement task. These results further suggest that SP adolescents may demonstrate poor attentional control that contributes to the threat-related bias reported in many studies.

Although SP participants responded more slowly than NAD participants to trials of the computer task in general, they did not exhibit the threat-related attentional bias hypothesized in this study. There are several possible explanations for these findings. First, contrary to hypothesis, SP adolescents may not exhibit slowed attentional

disengagement from threat-related stimuli. Studies demonstrating slowed attentional disengagement from threat in anxious participants have been conducted exclusively with adult samples (Amir et al., 2003; Derryberry & Reed, 2002; Fox et al., 2002; Yiend & Mathews, 2001). The present study is the first to test this phenomenon in adolescents. It may be that the threat-related attentional bias often reported in youth is not the result of delayed attentional disengagement, but is caused by other biases in cognitive processing. Alternatively, threat-related attentional bias may not be a robust phenomenon in adolescents with social phobia. Many studies have found that AD youth exhibit a threat-related attentional bias, but the presence of this bias exclusively in SP adolescents has not been reported. The probability that SP adolescents do not exhibit a threat-related attentional bias is unlikely, given that youth with other anxiety disorders and SP adults have been found to selectively attend to threat. Nevertheless, future research is needed to assess this phenomenon in SP adolescents.

It has also been suggested that elevated state anxiety may be necessary to activate an attentional bias to threat-related stimuli (Fox et al., 2001). We attempted to elevate state anxiety in the present study by having the investigator stand behind participants and watch their responses as they completed the computer task. However, A-State scores were not elevated for SP or NAD participants, indicating that this process was not successful. Failure to elevate participants' state anxiety as they completed the computer task may have contributed to the failure to detect a threat-related attentional bias.

Another factor that may have influenced the current findings is the type of stimuli used in the computer task. Printed words were selected instead of pictures as the stimuli to be used in the task because the majority of similar previous studies used words as the

stimuli in attentional tasks. It has been argued that threat-related words may not elicit a sufficient emotional reaction from anxious individuals and that pictures serve as more emotionally salient stimuli (e.g., Lang, 1985). Although the words used in the attentional disengagement task were mostly selected from previous studies and were rated as highly threatening by independent raters, they may not have elicited sufficient anxiety in SP participants. However, it is unlikely that the use of words as opposed to pictures of faces is fully responsible for the failure to detect a threat-related attentional bias in SP adolescents, given that a number of studies have found that AD individuals exhibit an attentional bias to threat-related words (e.g., Asmundsen & Stein, 1994; Vasey et al., 1995).

Although SP participants did not exhibit slowed disengagement from threat in the study, attentional disengagement from threat was significantly associated with state anxiety in analyses excluding participants with comorbid ADHD. The fact that state anxiety was not significantly correlated with other response times indicates that elevated state anxiety did not slow task responses in general, but specifically slowed responses in which participants were required to disengage their attention from a threat-related word. This finding suggests that attentional disengagement from threat may be more a function of elevated state anxiety than trait anxiety. The association between state anxiety and attentional disengagement from threat should be interpreted with caution given that it only emerged when SP participants with ADHD were excluded. However, it could be argued that the presence of ADHD led to increased distractibility and/or impulsive responding during the attentional disengagement task. Based on these findings, future

studies should further examine the role of state anxiety in attentional disengagement from threat.

Several methodological strengths support the validity of reported findings in this study. First, the study employed adolescents diagnosed with social phobia. The results of the present study can consequently be generalized to other SP adolescents and can inform our understanding of social phobia in youth. However, because the study specifically studied attentional bias in SP adolescents, these results cannot be generalized to other anxiety disorders or SP individuals of other ages.

Second, the data collection plan was stringent in that SP and NAD adolescents were matched on age and IQ. Furthermore, the investigator ensured that gender rates were comparable and that a relatively equal number of younger and older adolescents participated in the study. These strategies minimized error variance and the likelihood of Type I errors.

Finally, the study's computer task was modeled as closely as possible after attentional bias computer tasks used in previous published studies. Specifically, most of the words used in the study were taken from word banks used by Vasey et al. (1995) and Asmundson and Stein (1994). Additionally, the frame of the task was modeled directly after the attentional disengagement task used by Amir et al. (2003). One of the limitations of studies assessing cognitive biases in psychopathology is that cognitive tasks used to measure these biases are often novel tasks that are developed specifically for the study and whose psychometric properties are unknown (Vasey, Dalgleish, & Silverman, 2003). As a result, when such studies do not find hypothesized results, it is unclear whether the null findings are due to a true lack of differences between groups or the use of an

assessment measure with low validity. The actions taken to model this study's task after tasks from published studies were done to minimize the novelty of the task.

Despite the positive qualities of the computer task, one of the major limitations of the current study is the lack of information regarding the task's psychometric properties. Future studies should assess the validity and reliability of the cognitive tasks that they develop, or should use previously developed cognitive tasks that have demonstrated adequate reliability and validity, before using these tasks to measure cognitive differences.

The study was also limited by the inability to appropriately assess for the presence of ADHD in many NAD participants. The parents of these participants were unwilling to disclose whether their children had been diagnosed with ADHD. Because of limited recruitment opportunities, the investigator decided to include these participants in the study. Their inclusion limits the validity of the study's findings. Specifically, the lack of differences found between groups on the attentional disengagement task may have been caused by a high rate of attentional difficulties in the NAD group. Although the possibility that a large percentage of the NAD group suffered from ADHD and did not take medication to manage these symptoms is unlikely, the fact that ADHD was not assessed in many of these participants was a limitation of the current study.

A third limitation was the failure to include adolescents with other anxiety disorders in the present study. Because there was no additional comparison group composed of adolescents with another anxiety disorder (e.g. generalized anxiety disorder, panic disorder), it was impossible to determine if the present findings are specific to social phobia or if they generalize to other disorders. Similarly, adolescents in the SP group also

met criteria for other anxiety disorders. Whereas the inclusion of comorbid anxiety disorders increased generalizability of the findings, their presence again calls into question the specificity of the findings to social phobia. To determine whether the present findings are specific to social phobia or generalize to other disorders, future studies should employ a "pure" social phobia group (i.e. individuals with social phobia and no other diagnoses) and should also include comparison groups comprised of individuals with other anxiety disorders.

Another limitation of the current study was that data from SP adolescents were collected at three different sites. This was necessary to complete data collection within a reasonable time, given that only adolescents diagnosed with social phobia were eligible. It is possible that differences may exist between participants collected at each site. However, analyses revealed no site differences for any of the study's variables, except for a difference in state anxiety. Furthermore, all three data collection sites were in Northeastern urban treatment settings, which likely reduced variance across the samples from each site.

Additionally, the age range of the current sample ranged from early to late adolescence and likely included adolescents with varied executive functioning abilities. As discussed earlier, the sample was limited to adolescents to help control for executive functioning differences. Given that executive functioning skills continue to mature during adolescence, though, an age range from 12-17 may have been too wide, which may have confounded results on the attentional disengagement task. Future studies assessing threat-related attentional bias in youth should target narrower age ranges (no more than 2-3

years) both in childhood and adolescence to more effectively control for the ongoing development of executive functioning skills.

Because words for the attentional disengagement task needed to be matched with two other words on frequency and length, the inclusion of words up to a 7th grade reading level was decided to provide the largest number of possible words for the attentional disengagement task. However, it is possible that participants may not have comprehended all of the words in the attentional disengagement task, given that words with a 7th grade reading level or lower were included. Future studies examining adolescents may do well to set a lower reading level limit to maximize the chances that all words are correctly comprehended by participants.

Finally, the study was limited by the use of the STAI A-Trait as a measure of trait anxiety. Bieling, Antony, and Swinson (1998) reported that the A-Trait assesses symptoms of depression as well as anxiety. They determined that a number of items loaded onto a factor assessing depression, whereas other items loaded onto a factor measuring anxiety. Therefore, the A-Trait likely assessed symptoms of both depression and anxiety, which may have confounded the reported results.

Evidence that SP adolescents exhibit relatively poor attentional control compared to NAD adolescents can potentially help to explain the mechanisms by which cognitive-behavioral therapy treats social phobia in adolescents. Research suggests that an associated feature of social phobia is hyperfocus on anxiety-related stimuli, whether they are external stimuli or internal physiological sensations (Clark & Wells, 1995, Rapee & Heimberg, 1997). It has been further suggested that this hyperfocus maintains and increases anxiety (Bogels & Mansell, 2004). CBT may train SP adolescents to inhibit

their tendency to hyperfocus on anxiety-related stimuli through cognitive restructuring exercises and behavioral exposures in which alternate coping options are presented to the adolescent. Although current CBT treatments for social phobia do not directly address attentional training, the skills taught in CBT may indirectly help SP adolescents to retrain their attention.

The current findings regarding attentional control suggest that a greater emphasis on attentional training may increase the efficacy of treatment for social phobia. Specifically, the findings imply that SP adolescents may benefit from strategies, such as mindfulness, that refocus their attention from threat-related stimuli to goal-directed stimuli. Mindfulness strategies encourage individuals to focus on their present sensations and perceptions, and to return to these sensations when they are distracted by external stimuli or their own worries or ruminations. It can be argued that mindfulness training teaches individuals to inhibit dominant attentional stimuli, whether the stimuli are internal or external, and to essentially better control their attention. Consistent with this idea, Bogels and Mansell (2004) noted that mindfulness strategies may help SP individuals to "become aware of their automatic tendency to self-focus or ruminate, and to regain control over attention processes" (Bogels & Mansell, 2004, p. 849).

Strategies aimed directly toward increasing attentional control may also prove efficacious if used in conjunction with cognitive-behavioral interventions to treat social phobia in adolescents. As a result of research strongly indicating that AD individuals selectively attend to threat-related stimuli, new therapeutic interventions have been developed that directly train individuals to attend away from internal or external threat-related stimuli. Research has recently begun to test the efficacy of this treatment, known

as task concentration training (TCT) or applied attention retraining (ATT). Bogels (2006) reported that SP adults who received eight sessions of TCT reported greater reductions in dysfunctional beliefs and fear of bodily symptoms than SP adults who received applied relaxation training (AR). At one year follow-up, after all participants received eight sessions of cognitive therapy to supplement TCT or AR, participants who received TCT continued to show greater reductions in self-consciousness and fear of bodily symptoms than participants who received AR. Similarly, Amir (2006) reported that SP individuals who underwent ATT reported reductions in social anxiety and in a social performance task.

These studies suggest that attentional retraining may help train SP individuals to inhibit the dominant response to attend to threat-related stimuli. However, there are caveats to this line of research. First, no large studies have examined TCT or ATTs long-term efficacy. Although Bogels (2006) found that individuals who received TCT maintained gains at 1-year follow-up, these gains cannot be attributed solely to TCT because participants also received cognitive therapy. Amir (2006) did not conduct any follow-up assessments with regard to his findings. Additionally, TCT/ATT studies have not been completed with SP adolescents. Finally, the fact that TCT/ATT essentially trains attentional avoidance of threat-related stimuli is inconsistent with the theory that exposure to feared stimuli leads to habituation and reduction of fear. TCT or ATT alone may have short-term anxiety-reducing effects (just as behavioral avoidance does), but may not teach the individual coping skills to effectively handle feared situations. However, a treatment involving CBT in conjunction with TCT or ATT may provide

anxious individuals with coping skills to reduce anxiety while also training the individual to better control their attention when faced with anxiety-provoking stimuli.

REFERENCES

Albano, A.M. (2000). Treatment of adolescents in social phobia: Cognitive behavioral programs focused on intervention and prevention. *Journal of Cognitive Psychotherapy, 14*, 67-76.

Albano, A.M., & Hayward, C. (2004). Social anxiety disorder. In Ollendick, T.H. (Ed.), *Phobic and Anxiety Disorders in Children and Adolescents: A Clinician's Guide to Effective Psychosocial and Pharmacological Interventions* (pp. 198-235). London: Oxford University Press.

Amir, N. (2006). Modifications of attention bias: A novel treatment for anxiety disorders. Paper presented at the European Association for Behavioral and Cognitive Therapies. Paris, France.

Amir, N., Elias, J., Klumpp, H., & Przeworski, A. (2003). Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat? *Behaviour Research and Therapy, 41*, 1325-1335.

Anderson, V.A., Anderson, P., Northam, E., Jacobs, R., & Catroppa, C. (2001). Development of executive functions through late childhood and adolescence in an Australian sample. *Developmental Neuropsychology, 20*, 385-406.

Arnau, R.C., Meagher, M.W., Norris, N.P., & Bramson, R. (2001). Psychometric evaluation of the Beck Depression Inventory – II with primary care medical patients. *Health Psychology, 20*, 112-119.

Asmundson, G.J.G., & Stein, M.B. (1994). Selective processing of social threat in patients with generalized social phobia: Evaluation using a dot-probe paradigm. *Journal of Anxiety Disorders, 8*, 107-117.

Balwin, J.S., & Dadds, M.R. (2007). Reliability and validity of parent and child versions of the Multidimensional Anxiety Scale for Children in community samples. *Journal of the American Academy of Child and Adolescent Psychiatry*, *46*, 252-260.

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M.J., & van Ijzendoorn, M.H. (2007). Threat-related attentional bias in anxious and non-anxious individuals: A meta-analytic study. *Psychological Bulletin, 133*, 1-24.

Beck, A.T., Emery, G., & Greenberg, R. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York: Basic Books.

Beck, A. T., Steer, R. A. & Brown, G. K. (1996). *Manual for the Beck Depression Inventory—II.* San Antonio, TX: Psychological Corporation.

Bieling, P.J., Antony, M.M., & Swinton, R.P. (1998). The State-Trait Anxiety Inventory, Trait Version: Structure and content re-examined. *Behaviour Research and Therapy, 36*, 777-788.

Bittner, A., Egger, H.L., Erkanli, A., Costello, E.J., Foley, D.L., & Angold, A. (2007). What do childhood anxiety disorders predict? *Journal of Child Psychology and Psychiatry, 48*, 1174-1183.

Bogels, S.M. (2006). Task concentration training versus applied relaxation, in combination with cognitive therapy, for social phobia patients with fear of blushing, trembling, and sweating. *Behaviour Research and Therapy, 44*, 1199-1210.

Bogels, S.M., & Mansell, W. (2004). Attention processes in the maintenance and treatment of social phobia: hypervigilance, avoidance, and self-focused attention. *Clinical Psychology Review, 24*, 827-856.

Broadbent, D.E., & Broadbent, M. (1988). Anxiety and attentional bias: State and trait. *Cognition and Emotion, 2*, 165-183.

Brodeur, D.A. (2004). Age changes in attention control: Assessing the role of stimulus contingencies. *Cognitive Development, 19*, 241-252.

Brosschot, J.F., de Ruiter, C., Kindt, M. (1999). Processing bias in anxious subjects and repressors, measured by emotional Stroop interference and attentional allocation. *Personality and Individual Differences, 26*, 777-793.

Clark, D., Watson, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54,* 1063-1070.

Clark, D.M., & Wells, A. (1995). A cognitive model of social phobia. In Heimberg, R.G., Leibowitz, M.R., Hope, D.A., & Schneier, F.R. (Eds.), *Social Phobia: Diagnosis, Assessment, and Treatment* (pp. 69-93). New York: Guilford Press.

Costello, E.J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry, 60*, 837-844.

Crawford, J.R., & Henry, J.D. (2004). The Positive and Negative Affect Scale (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*, 245-265.

Dalgleish, T., Taghavi, R., Neshat-Doost, H., Moradi, A., Canterbury, R., & Yule, W. (2003). Patterns of processing bias for emotional information across clinical disorders: A comparison of attention, memory, and prospective cognition in children and adolescents with depression, generalized anxiety, and posttraumatic stress disorder. *Journal of Clinical Child and Adolescent Psychology*, *32*, 10-21.

Derryberry, D., & Reed, M.A. (2002) Anxiety-related biases and their regulation by attentional control. *Journal of Abnormal Psychology, 111*, 225-236.

DeWit, D.J., McDonald, K., & Offord, D.R. (1999). Childhood stress and symptoms of drug dependence in adolescence and early adulthood: Social phobia as a mediator. *American Journal of Orthopsychiatry, 69*, 61-72.

Dierker, L.C., Albano, A.M., Clarke, G.N., Heimberg, R.G., Kendall, P.C., Merikangas, K.R., et al. (2001). Screening for anxiety and depression in early adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 929-936.

Egloff, B., & Hock, M. (2001). Interactive effects of state anxiety and trait anxiety on emotional Stroop interference. *Personality and Individual Differences, 31*, 875-882.

Ehrenreich, J.T., & Gross, A.M. (2002). Biased attentional behavior in childhood anxiety: A review of theory and current empirical investigation. *Clinical PsychologyReview, 22*, 991-1008.

Eisenberg, N., Cumberland, A., Spinrad, T.L., Fabes, R.A., Shepard, S.A., Reiser, M., Murphy, B.C., Losoya, S.H., & Guthrie, I.K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*, 1112-1134.

Eisenberg, N., Guthrie, I.K., Fabes, R.A., Reiser, M., Murphy, B.C., Holgren, R., Maszk, P., & Losoya, S. (1997). The relations of regulation and emotionality to resiliency and competent social functioning in elementary school children. *Child Development, 68*, 295-311.

Essau, C.A., Conradt, J., & Petermann, F. (2000). Frequency, comorbidity, and psychosocial impairment of anxiety disorder in German adolescents. *Journal of Anxiety Disorders, 14,* 263-279

Eysenck, M.W. (1992). *Anxiety: The cognitive perspective.* London: Lawrence Erlbaum Associates Ltd.

Eysenck, M.W. (1997). *Anxiety and cognition: A unified theory.* Hove: Psychology Press.

Fox, E., Russo, R., Bowles, R., & Dutton, K.(2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety? *Journal of Experimental Psychology: General, 130*, 681-700.

Fox, E. Russo, R., & Dutton, K. (2002). Attention bias for threat: Evidence for delayed disengagement from emotional faces. *Cognition and Emotion, 16*, 355-379.

Furman, W., & Buhrmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development, 63*, 103-115.

Hayward, C., Varady, S., Albano, A.M., Thienneman, M., Henderson, L., & Schatzberg, A.F. (2000). Cognitive-behavioral group therapy for social phobia in female adolescents: Results of a pilot study. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 721-726.

Hope, D.A., Rapee, R.M., Heimberg, R.G., & Dombeck, M.J. (1990). Representations of the self in social phobia: Vulnerability to social threat. *Cognitive Therapy and Research, 14*, 177-189.

Huebner, E.S., & Dew, T. (1996). The interrelationships of positive affect, negative affect, and life satisfaction in an adolescent sample. *Social Indicators Research, 38*, 129-137.

John, O.P., Caspi, A., Robins, R.W., Moffitt, T.E., & Stouthamer-Loeber, M. (1994). The "little five": Exploring the nomological network of the five-factor model of personality in adolescent boys. *Child Development, 65*, 160-178.

Kendall, P.C., Flannery-Schroeder, E., Panichelli-Mindel, S., Southam-Gerow, M., Henin, A., & Warman, M.J. (1997). Therapy for youths with anxiety disorders: A second randomized clinical trial. *Journal of Consulting and Clinical Psychology, 65,* 366-380.

Kendall, P.C., Lerner, R., & Craighead, W.E. (1984). Human development and intervention in childhood psychopathology. *Child Development, 55*, 71-82.

Kindt, M., Bogels, S., & Morren, M. (2003). Processing bias in children with separation anxiety disorder, social phobia, and generalized anxiety disorder. *Behaviour Change, 20*, 143-150.

Kindt, M., Bierman, D., Brosschot, J.F. (1997a). Cognitive bias in spider fear and control children: Assessment of emotional interference by a card format and a single-trial format of the Stroop task. *Journal of Experimental Child Psychology, 66*, 163-179.

Kindt, M., Brosschot, J.F., & Everaerd, W. (1997b). Cognitive processing of children in a real life stress situation and a neutral situation. *Journal of Experimental Child Psychology, 64*, 79-97.

Koster, E.H.W., Crombez, G., Verschuere, B., Van Damme, S., & Wiersema, J.R. (2006). Components of attentional bias to threat in high trait anxiety: Facilitated engagement, impaired disengagement, and attentional avoidance. *Behaviour Research and Therapy, 44*, 1757-1771.

La Greca, A.M., & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*, 83-94.

Lang, P.J. (1985). The cognitive psychophysiology of emotion: fear and anxiety. In A.H. Tuma, & J.D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 101-128). Hillsdale, NJ: Erlbaum.

Leibowitz, M.R., Gorman, J.M., Fyer, A.J., & Klein, D.F. (1985). Social phobia: Review of a neglected anxiety disorder. *Archives of General Psychiatry, 42*, 669-677.

Lonigan, C.L., Vasey, M.W., Phillips, B.M., & Hazen, R.A. (2004). Temperament, anxiety, and the processing of threat-relevant stimuli. *Journal of Clinical Child and Adolescent Psychology, 33*, 8-20.

Luna, B., Garver, K.E., Urban, T.A., Lazar, N.A., & Sweeney, J.A. (2004). Maturation of cognitive processes from late childhood to adulthood. *Child Development, 75*, 1357-1372.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15-20.

MacLeod, C., Rutherford, E., Campbell, L., Elsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology, 111*, 107-123.

Manly, T., Anderson, V., Nimmo-Smith, I., Turner, A., Watson, P., & Robertson, I.H. (2001). The differential assessment of children's attention: The Test of Everyday Attention for Children (TEA-ch), normative sample, and ADHD performance. *Journal of Child Psychology and Psychiatry, 42*, 1065-1081.

Mathews, A., & Mackintosh, B. (2000). Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology, 109*, 602-615.

Mathews, A., & MacLeod, C. (1994). Cognitive approaches to emotion and emotional disorders. *Annual Review of Psychology, 45*, 25-50.

March, J.S., Parker, J.D.A., Sullivan, K., Stallings, P., & Conners, C. (1997). The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. *Journal of the American Academy of Child and Adolescent Psychiatry, 33*, 975-983.

Masia Warner, C., Fisher, P.H. Shrout, P.E., Rathor, S., & Klein, R.G. (2007). Treating adolescents with social anxiety disorder in school: An attention control trial. *Journal of Child Psychology and Psychiatry, 48*, 686-696.

Mattia, J.I., Heimberg, R.G., & Hope, D.A. (1993). The revised Stroop color-naming task in social phobics. *Behaviour Research and Therapy, 31*, 305-313.

Mogg, K., & Bradley, B.P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36,* 809-848.

Mogg, K., & Bradley, B.P. (1999). Some methodological issues in assessing attentional biases for threatening faces in anxiety: A replication study using a modified version of the dot-probe detection task. *Behaviour Research and Therapy, 37*, 595-604.

Moradi, A.R., Taghavi, M.R., Neshat Doost, H.T., Yule, W., and Dalgleish, T. (1999). Performance of children and adolescents with PTSD on the Stroop colour-naming task. *Psychological Medicine, 29*, 415-419.

Morren, M., Kindt, M. van den Hout, M., van Kasteren, H. (2003). Anxiety and the processing of threat in children: Further examinination of the cognitive inhibition hypothesis. *Behaviour Change, 20*, 131-142.

Muris, P., Meesters, C., & Rompelberg, L. (2007). Attention control in middle childhood: Relations to psychopathological symptoms and threat perception distortions. *Behaviour Research and Therapy, 45*, 997-1010.

Muris, P., & Ollendick, T.H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8*, 271-289.

Musa, C., Lepine, C.P., Clark, D.M., Mansell, W., & Ehlers, A. (2003). Selective attention in social phobia and the moderating effect of a concurrent depressive disorder. *Behaviour Research and Therapy, 41*, 1043-1054.

Pearson, D.A., & Lane, D.M. (1990). Visual attention movements: A developmental study. *Child Development, 61*, 1779-1795.

Pine, D.S., Klein, R.G., Mannuzza, S., Moulton, J.L., Lissek, S., Guardino, M., & Woldehawariat, G. (2005). Face-emotion processing in offspring at risk for panic disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 44*, 664-672.

Osman, A., Barrios, F.X., Gutierrez, P.M., Williams, J., & Bailey, J. (2008). Psychometric properties of the Beck Depression Inventory-II in non-clinical adolescent samples. *Journal of Clinical Psychology, 64*, 83-102.

Osman, A., Kopper, B.A., Barrios, F.X., Gutierrez, P.M., & Bagge, C.L. (2004). Reliability and validity of the Beck Depression Inventory-II with adolescent psychiatric inpatients. *Psychological Assessment, 16*, 120-132.

Posner, M.I., Cohen, Y., & Rafal, R.D. (1982). Neural systems control over spatial orienting. *Philosophical Transactions of the Royal Society of London. Series B, 2908*, 187-198.

Puliafico, A.C., & Kendall, P.C. (2006). Threat-related attentional bias in anxious youth: A review. *Clinical Child and Family Psychology Review, 9*, 162-180.

Rapee, R.M., & Heimberg, R.G. (1997) A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35*, 741–756.

Rinck, M., & Becker, E.S. (2005). A comparison of attentional biases and memory biases in women with social phobia and major depression. *Journal of Abnormal Psychology, 114*, 62-74.

Rothbart, M.K., & Bates, J.E. (1998). Temperament. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Volume 3. Social, emotional, and personality development* (5th ed., pp. 105-176). New York: Wiley.

Rutherford, E.M., MacLeod, C.M., & Campbell, L.W. (2004). Negative selectivity effects and emotional selectivity effects in anxiety: Differential attentional correlates of state and trait variables. *Cognition and Emotion, 18*, 711-720.

Silverman, W.K., & Albano, A.M. (1996). The Anxiety Disorders Interview Schedule for Children (*DSM-IV*). San Antonio, TX: Psychological Corporation.

Silverman, W.K., & Eisen, E.R. (1992). Age differences in the reliability of parent and child reports of child anxious symptomatology using a structured interview. *Journal of the American Academy of Child and Adolescent Psychiatry, 31*, 117-124.

Silverman, W.K., Kurtines, W.M., Ginsburg, G.S., Weems, C.F., Lumpkin, P.W., & Carmichael, D.H. (1999). Treating anxiety disorders in children with group cognitive-behavioral therapy: a randomized clinical trial. *Journal of Consulting and Clinical Psychology, 67*, 995-1003.

Silverman, W.K., & Nelles, W.B. (1988). The Anxiety Disorders Interview Schedule for Children. *Journal of the American Academy of Child and Adolescent Psychiatry, 27*, 772-778.

Silverman, W.K., Saavedra, L.M., & Pina, A.A. (2001). Test-retest reliability of anxiety symptoms and diagnoses with the Anxiety Disorders Interview Schedule for *DSM-IV*: Child and parent versions. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 937-944.

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). *Manual for the state-trait anxiety inventory.* Palo Alto, CA: Consulting Psychologists Press.

Stein, M.B., Fuetsch, M., Mueller, N., Hoefler, M., Lieb, R., & Wittchen, H. (2001). Social anxiety disorder and the risk of depression: A prospective community study of adolescents and young adults. *Archives of General Psychiatry, 58,* 251-256.

Stein, M.B., Kean, Y.M. (2000). Disability and quality of life in social phobia: Epidemiologic findings. *American Journal of Psychiatry; 157*, 1606-1613.

Taghavi, M.R., Dalgleish, T., Moradi, A.R., Neshat-Doost, H.T., Yule, W. (2003). Selective processing of negative emotional information in children and adolescents with generalized anxiety disorder. *British Journal of Clinical Psychology, 42*, 221-230.

Taghavi, M.R., Neshat-Doost, H.T., Moradi, A.R., Yule, W., & Dalgleish, T. (1999). Biases in visual attention in children and adolescents with clinical anxiety and mixed anxiety-depression. *Journal of Abnormal Child Psychology, 27*, 215-223.

VanAmeringen, M., Mancini, C., & Farvolden, P. (2003). The impact of anxiety disorders on educational achievement. *Journal of Anxiety Disorders, 17*, 561-571.

van Honk, J., Tuiten, A., de Haan, E., van den Hout, M., & Stam, H. (2001). Attentional bias for angry faces: Relationships to trait anger and anxiety. *Cognition and Emotion, 15*, 279-297.

Vasey, M.W., Daleiden, E.L., Williams, L.L., & Brown, L.M. (1995). Biased attention in childhood anxiety disorders: A preliminary study. *Journal of Abnormal Child Psychology, 23,* 267-279.

Vasey, M.W., Dalgleish, T., & Silverman, W.K. (2003). Research on information-processing factors in child and adolescent psychopathology: A critical commentary. *Journal of Clinical Child and Adolescent Psychology, 32*, 81-93.

Vasey, M.W., El-Hag, N., & Daleiden, E.L. (1996). Anxiety and the processing of emotionally threatening stimuli: Distinctive patterns of selective attention among high- and low-anxious children. *Child Development, 67*, 1173-1185.

Verhulst, F.C., van der Ende, J., Ferdinand, R.F., & Kasius, M.C. (1997). The prevalence of DSM-III-R diagnoses in a national sample of Dutch adolescents. *Archives of General Psychiatry, 54,* 329-336.

Vernberg, E.M., Abwender, D.A., Ewell, K.K., & Beery, S.H. (1992). Social anxiety and peer relationships in adolescence: A prospective analysis. *Journal of Clinical Child Psychology, 21*, 189-196.

Waters, A.M., Lipp, O.V., & Spence, S.H. (2004). Attentional bias toward fear-related stimuli: An investigation with nonselected children and adults and children with anxiety disorders. *Journal of Experimental Psychology: General, 89,* 320-337.

Weiss, J.L., & Schell, R.E. (1991). Predicting WAIS-R IQ from the Shipley Institute of Living Scale: A replication. *Journal of Clinical Psychology,* 47, 558-562.

Williams, J.M.G., Watts, F.N., MacLeod, C., & Mathews, A. (1988). *Cognitive Psychology and Emotional Disorders.* Chichester: Wiley.

Williams, J.M.G., Watts, F.N., MacLeod, C., & Mathews, A. (1997). *Cognitive Psychology and Emotional Disorders* (2nd ed.). Chichester: Wiley.

Wilson, E.J., MacLeod, C., Mathews, A., & Rutherford, E.M., The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103-111.

Wood, J.J., Piacentini, J.C., Bergman, R.L., McCracken, J., & Barrios, V. (2002). Concurrent validity of the anxiety disorders section of the Anxiety Disorders Interview Section for *DSM-IV*: child and parent versions. *Journal of Clinical Child and Adolescent Psychology, 31*, 335-342.

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *The Quarterly Journal of Experimental Psychology, 54A*, 665-681.

Zachary, R. A. (1991). The manual of the Shipley Institute of Living Scale. Los Angeles, CA: Western Psychological Services.

FOOTNOTES

1. Participants ages 16 and older were excluded from these analyses because the TEA-ch is only normed through age 15.

2. Because of the low number of minorities in the sample, African-American, Asian-American, and Latin American participants were collapsed into a minority group for the Chi Square analysis to satisfy the assumption of expected frequencies.

APPENDIX

THREAT-RELATED ATTENTIONAL BIAS IN YOUTH: A REVIEW

Anxiety disorders represent a serious concern for children and adolescents. Approximately 10-20% of youth suffer from anxiety symptoms (Kashani & Orvaschel, 1988) and 2-3% meet diagnostic criteria for an anxiety disorder (Costello et al., 1996). Of all childhood psychiatric disorders, anxiety disorders are among the most prevalent (Albano, Chorpita, & Barlow, 1996). Childhood anxiety is often associated with academic and social impairment (Ialongo, Edelsohn, Werthamer-Larsson, Crockett, & Kellam, 1995; LaGreca & Lopez, 1998; Strauss, Lahey, Frick, Frame, & Hynd, 1988) and, if left untreated, these disorders may persist for years (Keller et al., 1992; Kovacs & Devlin, 1998). Because of the functional interference and distress suffered by anxiety-disordered (AD) youth, research investigating the factors that may contribute to the maintenance of anxiety disorders early in life is essential.

Over the past twenty years, research has targeted the role of cognition in the development and maintenance of anxiety disorders. Beck argued for the importance of cognition in the maintenance of anxiety disorders, proposing that schemata, or overarching representations or beliefs based on knowledge and experience, influence an individual's cognitive processing, including attention, memory, and executive functioning (Beck & Clark, 1988; Beck, Emery, & Greenberg, 1985). Extending Beck's schema theory to children and adolescents, Ingram and Kendall (1987) proposed that AD youth experience distortions in their thinking that lead them to perceive situations as excessively threatening or dangerous. In support of this, studies have found that anxious children view ambiguous situations as more threatening than do non-anxious children

(Barrett, Rapee, Dadds, & Ryan, 1996; Bell-Dolan, 1995; Chorpita, Albano, & Barlow, 1996).

Building upon the Ingram and Kendall distinction (1987), Daleiden and Vasey (1997) offered an extended information-processing perspective of anxiety, proposing that anxious children experience distortions at different stages of cognition. According to Daleiden and Vasey, anxious children selectively attend to threat-related information, interpret ambiguous situations as threatening, make threat-related attributions, expect negative outcomes, and select behavioral options prioritizing personal safety as opposed to goal achievement or success. The interaction of these processes leads anxious youth to overemphasize threat in various situations and to make decisions based on this perceived threat.

Of the processes proposed by Daleiden and Vasey (1997), selective attention to threat-related information has garnered the most attention (Eysenck, 1992, 1997; Mogg & Bradley, 1998; Williams, Watts, MacLeod, & Mathews, 1988, 1997). The majority of studies testing these theories have indeed found that AD adults selectively attend to threat-related stimuli, whereas non-anxiety-disordered (NAD) adults do not (e.g., MacLeod, Mathews, & Tata, 1986; Mogg, Mathews, & Eysenck, 1992). Considerably fewer studies in this area have been conducted with youth, and differences that may exist with regard to attentional biases across childhood and adolescence have not yet been examined. Although researchers have concluded that this bias does indeed exist in anxious youth, additional research is needed to better understand this phenomenon (Ehrenreich & Gross, 2002; Vasey & McLeod, 2001). For example, it is precarious to assume that anxious youth experience an attentional bias in the same manner as anxious

adults, as cognitive development occurs throughout childhood and adolescence, especially with regard to executive functioning (e.g., Brocki & Bohlin, 2004; DeLuca et al., 2003; Levin et al., 1991). It is therefore necessary to consider research examining threat-related attentional bias in children and adolescents within the context of, but independent from, the adult literature. Moreover, the study of threat-related attentional bias in youth can potentially inform the field as to the development of this bias and how it may intersect with the onset of anxiety.

The present review focuses on the relationship between anxiety and threat-related attentional bias in children and adolescents. This review will first briefly discuss the volume of research examining threat-related attentional bias in anxious adults as a context in which to understand the youth literature and will describe models regarding the relationship between threat-related attentional bias and anxiety in youth. Research investigating threat-related attentional bias in AD youth will be integrated and critiqued, followed by a similar review of studies using other samples of anxious youth. Throughout, as well as in a closing summary, current issues in the research of threat-related attentional bias in youth will be raised and future directions for research will be addressed.

Threat-Related Attentional Bias in Anxious Adults

A review of the adult literature offers a suitable context in which to understand the phenomenon of selective attention to threat-related stimuli, especially given the relative dearth of attentional bias studies in children and adolescents. This section briefly describes the theoretical models set forth regarding anxiety and cognition and reviews general findings from studies assessing threat-related attentional bias in anxious adults.

Research examining threat-related attentional bias in AD individuals has been guided by theoretical models attempting to explain the role of cognition and attention in anxiety. Eysenck (1992, 1997), Williams et al. (1988, 1997), and Mogg and Bradley (1998) have theorized about the relationship between anxiety and threat-related attentional bias. All three theories suggest a link between attentional bias and anxiety, although the nature of this relationship differs in each model. Williams et al.'s model proposes that high trait anxiety imposes a consistent influence on an individual's reaction to environmental stimuli, so that anxious individuals selectively attend to threat-related stimuli and non-anxious individuals selectively attend away from threat-related stimuli.

To the contrary, Mogg and Bradley's model suggests that all individuals selectively attend to stimuli perceived as dangerous. The differences in the attentional responses to threat of anxious and non-anxious individuals, then, are primarily due to their subjective appraisal of environmental stimuli. That is, the threshold for perceiving a stimulus as dangerous is lower in anxious individuals than in non-anxious individuals.

Eysenck's theory argues that hypervigilance is an essential feature of trait anxiety and that focused attention to threat-related information is one component of this hypervigilance. According to Eysenck, high trait anxious (HTA) individuals display a greater vigilance toward threat-related stimuli at all levels of cognition, including attention, memory, and interpretation of stimuli. He further proposed that attentional bias involves several components, including (a) greater visual scanning of the environment for threat, (b) greater distractibility by environmental stimuli whether they are threat-related or not, and (c) narrowed attention to other stimuli when exposed to a threat-related stimulus. These components interact to favor threat-related stimuli in the environment.

Despite the differences between these models, they converge on the proposals that threat-related attentional bias is directly related to anxiety and that this bias may contribute to the onset and/or maintenance of anxiety disorders. The majority of research testing these theories has supported an association between anxiety and threat-related attentional bias. Studies have generally found that AD and HTA individuals selectively attend to threat-related words or pictures, whereas non-anxious individuals do not (e.g., Asmundson & Stein, 1994; MacLeod, Mathews, & Tata, 1986; Mathews & MacLeod, 1985; Mattia, Heimberg, & Hope, 1993). Consistent with Mogg and Bradley's theory, research also suggests that all individuals selectively attend to stimuli associated with high threat, but that only HTA individuals selectively attend to stimuli associated with mild to moderate threat (Mogg et al., 2000; Wilson & MacLeod, 2003).

Several other important findings have resulted from studies assessing threat-related attentional bias in anxious adults. Research suggests that threat-related attentional bias is content-specific (Asmundson & Stein, 1994; Hope, Rapee, Heimberg, & Dombeck, 1990). That is, individuals with an anxiety disorder selectively attend to information related to their disorder or fear, but not to information related to other disorders or fears. In addition, several studies have found that anxious individuals with a comorbid depressive disorder do not display an attentional bias toward threat-related stimuli (Musa, Lepine, Clark, Mansell, and Ehlers, 2003; Rinck & Becker, 2005). Indeed, Mogg and Bradley (1998) argued that the decreased motivation associated with depression suppresses the behavioral component of focusing attention on threat-related stimuli. However, these findings are not unequivocal, as others have reported that

depressed individuals do selectively attend to threat-related stimuli (e.g., Mathews, Ridgeway, & Williamson, 1996).

In addition, research has found both trait anxiety and state anxiety to be related to threat-related attentional bias. Whereas several studies have found that state anxiety was only associated with threat-related attentional bias in HTA individuals (Broadbent & Broadbent, 1988; Egloff & Hock, 2001; MacLeod & Mathews, 1988), a recent study by Rutherford, MacLeod, and Campbell (2004) reported that high-trait anxious individuals only displayed a threat-related attentional bias when state anxiety was elevated. These findings suggest that elevations in both trait anxiety and state anxiety may be associated with attentional bias, although the specific extent of this association is currently unclear. Future research needs to determine the manner in which threat-related attentional bias is activated and the emotional state of the individual experiencing an attentional bias.

Research has also examined the components of attentional bias. This work has followed Posner's suggestion that disengagement from visual stimuli serves a basic role in selective attention (e.g., Posner, 1988; Posner & Petersen, 1990). Derryberry and Reed (2002) argued that threat-related attentional bias consists of both automatic and voluntary attentional processes, and that the ability to disengage attention from threat-related information is important in constraining this bias. Indeed, studies have reported that the attentional bias displayed in anxious individuals may be due to a disengagement from threat-related stimuli, as opposed to an initial orienting toward such stimuli (Amir, Elias, Klumpp, & Przeworski, 2003; Derryberry & Reed, 2002; Fox, Russo, & Dutton, 2002; Koster, Crombez, Verschuere, & De Hoewer, 2004; Yiend & Mathews, 2001).

Taken together, the adult literature strongly indicates that anxious individuals display an attentional bias to threat-related information that is not displayed by non-anxious individuals. As this research has been primarily cross-sectional, it is currently impossible to determine whether threat-related attentional bias directly contributes to the onset or exacerbation of anxious symptoms. Future research is necessary to determine whether threat-related attentional bias is a causal factor or a correlate of anxiety symptoms and disorders.

Threat-Related Attentional Bias and Childhood Anxiety

Whereas the theoretical models proposed by Eysenck (1992, 1997), Williams et al. (1988, 1997), and Mogg and Bradley (1998) have garnered empirical support, they do not speak to the relationship between anxiety and threat-related attentional bias in children. Addressing this gap, Lonigan and colleagues (2004) proposed a model that integrates cognition and temperament to explain the development of anxiety in youth. The model argues that attentional bias partially mediates the relationship between negative affect and the development of anxiety disorders. According to Lonigan et al.'s model, the temperamental processes of negative affect and effortful control influence emotion regulation. Negative affect is defined as general distress and upset with one's surroundings and situation (Clark & Watson, 1991), whereas effortful control is defined as the ability to control the executive functions of cognition and to regulate negative reactive processes (Rothbart & Bates, 1998). Effortful control is often divided into two components – attentional control and inhibitory control (Muris & Ollendick, 2005).

According to Lonigan et al. (2004), high negative affect is associated with a pre-attentive bias toward threat-related information. If the individual does not possess

sufficient effortful control to override this pre-attentive bias, then the individual will selectively attend to threat-related information in the environment. This attentional bias then serves as one pathway leading from negative affect to the development of an anxiety disorder.

Lonigan et al.'s (2004) model is based on the postulation that the combination of high negative affect and low effortful control contributes to the development of psychopathology in youth (Lonigan & Phillips, 2001; Muris & Ollendick, 2005; Vasey & MacLeod, 2001). The Lonigan et al. model is further informed by research supporting the role of temperament in the development of anxiety disorders (Caspi, Henry, McGee, Moffitt, & Silva, 1995), the association between attentional biases and anxiety (e.g. Vasey et al., 1995), and the moderation of the relationship between attentional processes and anxiety (Derryberry & Reed, 2002) and general adjustment (Lengua, 2002) by effortful control. Even more promising are research findings from Lonigan and colleagues (2004) that youth high in negative affect and low in effortful control displayed a threat-related attentional bias, whereas youth high in both negative affect and effortful control did not display a bias.

One implication of Lonigan et al.'s (2004) model is that executive attention skills influence threat-related attentional bias, specifically via effortful control. In general, cognitive processes develop throughout late childhood and adolescence based on neurological changes during this time (Hale, 1990; Zald & Iacono, 1998). As Luna, Garver, Urban, Lazar, and Sweeney (2004) noted, two neurological processes are associated with cognitive developments during childhood and adolescence, specifically synaptic pruning and increased myelination. Synaptic pruning involves the elimination of

unnecessary neuronal synapses (Huttenlocher, 1990), which serves to speed neuronal processes. Synaptic pruning begins during late childhood and continues during adolescence. Myelination, or the insulation of axonal connections to speed signals throughout the central nervous system, occurs from early childhood until early adulthood (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999; Yaklolev & Lecours, 1967).

The processes of synaptic pruning and myelination during late childhood and adolescence are synchronous with the development of several executive functioning processes related to attention. Luna and colleagues (2004) found that processing speed (defined as "reaction time to initiate an eye movement" [p. 1367]) continues to mature until age 14, and spatial working memory does not mature until age 19. Finally, voluntary response suppression, or the ability to suppress dominant behavioral responses to environmental stimuli, grows more efficient throughout adolescence. Whereas all of these processes are related to attention, voluntary response suppression is centrally relevant to the present review, as threat-related attentional bias involves an inability to suppress a reaction to threat-related stimuli.

Not surprisingly, research indicates that children do not possess fully mature attentional abilities. Cohen (1972) suggested that environmental stimuli are characterized by both attention-getting and attention-holding properties. An individual processes the attention-getting properties of a stimulus consistently throughout life, but the ability to process attention-holding properties improves with age. In accord with Cohen's proposal, the automatic attention orienting skills of children and adults have been found to be rather similar (Brodeur & Enns, 1997; Pearson & Lane, 1991). However, compared to adults, children display inferior abilities to consciously relocate attention (Pearson & Lane,

1991). Indeed, the ability to control one's attention remains immature until rapid developments during mid-adolescence (Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001). As a result, children are generally more distractible than adults (e.g., Brodeur & Boden, 2001; Enns & Brodeur, 1989; Tipper, Bourque, Anderson, & Brehaut, 1989), which may considerably impair the ability of even non-anxious children to control their attention to threat-related stimuli. Recently, Brodeur (2004) found that children ranging in age from five to nine years old attended to distracting stimuli more so than adults in situations in which their attention was not focused for them. Taken together, these findings indicate that attentional control develops considerably from childhood to adulthood.

Given that children do not possess mature attentional abilities, findings from the adult literature regarding threat-related attentional bias should not be generalized to children and the study of threat-related attentional bias in anxious youth represents a worthwhile area of research. The following review summarizes and provides a critical analysis of the research to date on threat-related attentional bias in anxious youth, and in doing so, identifies conceptual and methodological issues. Attentional bias studies were identified via a PsychInfo search for the keywords "attentional bias" and "selective attention" as well as a manual search through the following journals*: Journal of Anxiety Disorders*, *Journal of Clinical Child and Adolescent Psychology*, *Behaviour Research and Therapy, Cognition and Emotion, Journal of the American Academy of Child and Adolescent Psychiatry, Journal of Abnormal Child Psychology,* and *Journal of Abnormal Psychology*.

Threat-related attentional bias has been assessed in studies comparing AD youth to NAD youth and using several different methodologies. The most commonly used paradigms, the emotional Stroop task and the dot-probe detection task, will be discussed below. In addition, one study that used an eyeblink modification paradigm to test threat-related bias in AD youth (Waters, Lipp, & Cobham, 2000) will be reviewed.

Studies Using the Emotional Stroop Task

The emotional Stroop task is a modification of the original Stroop task (Stroop, 1938), a measure of cognitive interference. The original Stroop task consists of cards with rows of color words (e.g. blue, yellow). Each of these words is printed in colored ink that does not match the color that the word describes. This discrepancy is meant to create cognitive interference for the participant, who is asked to state aloud the color in which each word is printed. The emotional Stroop task was designed to assess interference caused by threat-related words. It includes threat-related words and neutral words on the list of words to be read. As in the original task, all words are printed in different colors and participants are asked to state the color of the word as quickly as possible. It is generally hypothesized that AD individuals, compared to NAD individuals, will take longer to state the color of threat-related words compared to other words.

The majority of studies employing the emotional Stroop task have provided evidence for threat-related attentional bias in AD youth. Martin, Horder, and Jones (1992) administered the emotional Stroop task to 24 children with a specific phobia of spiders (as determined by a diagnostic screener) and 24 children who did not meet criteria for a specific phobia of spiders. Within each group, the children were divided equally into

young (6-7 years old), middle (9-10 years old), and older (12-13 years old) children. The Stroop task consisted of four sets of words: spider-related words, control words, non-words, and color words as well as a set of practice words. The spider-phobic children in all three age groups displayed greater response interference to spider-related words than to non-spider-related words. This bias was not found in non-spider-phobic children at any age.

Importantly, the Martin et al. study provides evidence that threat-related attentional bias is displayed in children as young as six years old. However, it is possible that some children, especially in the young group, could not read some of the words presented to them in the Stroop task. Martin and colleagues did not mention administering a reading or vocabulary test to participants. Because of their fear, spider phobic children may have been more familiar with reading spider-related words compared with other words presented in the task.

Since the Martin et al. (1992) study, other researchers using the Stroop task have reported a threat-related attentional bias in youth with various other anxiety disorders. Moradi, Taghavi, Neshat-Doost, Yule, and Dalgleish (1999) compared the attentional interference of youth with posttraumatic stress disorder (PTSD; n = 23) and NAD controls (n = 23), all ranging in age from 9-17. Sixty words were categorized as either happy, general threat-related, trauma-related, depression-related, or neutral. It was hypothesized that PTSD youth (but not controls) would display an attentional bias to trauma-related words compared to all other words. Moradi et al. found that PTSD youth reacted more slowly to all words than did NAD youth. Moreover, PTSD youth reacted

more slowly to trauma-related words compared to neutral words, whereas their reactions to other emotional words did not significantly differ from their reaction to neutral words.

Similarly, Taghavi, Dalgleish, Moradi, Neshat-Doost, and Yule (2003) reported a threat-related attentional bias in youth diagnosed with GAD. They administered the emotional Stroop task to 19 GAD and 19 NAD youth (mean age = 13.47), using the same set of words employed by Moradi et al. (1999). As hypothesized, they found that GAD youth displayed an attentional bias for threat- and trauma-related words, whereas NAD controls did not.

Not all studies employing the emotional Stroop task have detected a bias specific to AD youth. Kindt, Bogels, and Morren (2003) administered a version of the Stroop task to 40 AD youth and NAD controls. Kindt and colleagues tested whether AD youth display content-specific attentional biases as reported in the adult literature (e.g., Asmundson & Stein, 1994; Hope, Rapee, Heimberg, & Dombeck, 1990), or whether AD children do not yet possess established fear networks and therefore display an attentional bias to all threat-related stimuli. Their AD sample consisted of youth diagnosed with SP, GAD, and separation anxiety disorder (SAD) and the Stroop task included words related to social threat, separation threat, and general threat, as well as neutral words. Contrary to hypothesis, neither AD youth nor NAD youth displayed an attentional bias to threat-related words. Moreover, there was no evidence for content-specific attentional bias in the AD sample.

Taken together, three of the four studies employing the emotional Stroop task to test attentional bias in AD youth found a threat-related attentional bias in AD youth. However, the use of the Stroop task has been criticized by attentional bias researchers,

who have argued that that it is impossible to determine whether interference on the task is due to an attentional bias or a response bias to emotional words. That is, anxious individuals may attend to both threat-related and neutral words similarly, but a negative emotional reaction caused by threat-related words may impair their ability to react to threat-related words. This response bias would most likely only exist in anxious individuals and would thus create differential responses on the emotional Stroop task.

Despite this limitation, the emotional Stroop task remains a common measure of attentional interference. Indeed, studies using the Stroop task have consistently detected a threat-related attentional bias in AD adults. However, because of the Stroop task's questionable validity, it is important to review studies using other paradigms when considering threat-related attentional bias in anxious youth.

Studies Using the Dot-Probe Detection Task

The dot-probe detection task consists of numerous trials in which two words or pictures appear on a computer screen for a short interval of time (usually from 250ms-1500ms). After the stimuli disappear, a dot appears in the location of one of the stimuli. Participants are instructed to press a button indicating the location of the dot. The task measures the time it takes for an individual to respond to the appearance of the dot-probe on trials with threat-related and non-threat-related stimuli. Generally, researchers using the dot-probe task hypothesize that anxious individuals will display shorter response times (compared to non-anxious individuals) when the dot appears in the location where the threat-related stimulus appeared, and longer response times on trials in which the dot-probe appears in the opposite location of a threat-related stimulus. Because participants do not respond directly to threat-related stimuli on the dot-probe detection task, the dot-

probe paradigm minimizes the possibility that a response bias causes interference in response time. Six studies have employed the dot-probe task in studies of threat-related attentional bias in AD youth.

Vasey, Daleiden, Williams, and Brown (1995) first used the dot-probe detection task to compare attentional reactions to threat-related stimuli in AD (n = 12) and NAD children (n = 12), ages 9-14. The dot-probe task used by Vasey et al. displayed pairs of words, either threat-related or neutral in valence. In all trials, the words appeared, one above the other, for 1250 ms before disappearing. Participants were instructed to read aloud the word on the top portion of the screen as soon as it appeared. They were further instructed to press a button as soon as they saw the dot-probe appear. Results revealed that AD children displayed an attentional bias toward threat-related words, whereas NAD children showed no such bias. However, the bias displayed by AD children only existed in trials in which threat-related words appeared in the lower half of the computer monitor.

Taghavi, Neshat-Doost, Moradi, Yule, and Dalgleish (1999) replicated and extended Vasey et al.'s (1995) findings in a study comparing attention to threat-related stimuli of youth with GAD (n = 24), youth with mixed anxiety-depression (n = 19), and NAD controls (n = 24), ages 9-18. The words used in the dot-probe task were related to social threat, physical threat, or sadness, or were neutral in valence.

Taghavi and colleagues (1999) found that AD participants displayed an attentional bias toward threat-related words, but not depression-related words. Neither the anxious-depressed group nor the NAD group displayed an attentional bias toward any emotion-related words. These findings replicated the results of Vasey et al. (1995). Moreover, they provide support in the youth literature that depression is not associated

with attentional bias toward threat-related stimuli (Williams, et al., 1997) and that, in individuals diagnosed with anxiety and depression, depression may suppress selective attention to threat-related stimuli (Mogg & Bradley, 1998). Subsequent studies by these researchers have reported that depressed youth do not display an attentional bias toward threat- or depression-related words (Dalgleish et al., 2003; Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 1999a).

Whereas studies with adults have reported a content-specific attentional bias in AD participants (e.g. Asmundson & Stein, 1994: Mattia et al., 1990), these findings have not been replicated in AD youth. Kindt and colleagues (2003) tested the content-specificity hypothesis using the Stroop test, but found no evidence for any threat-related attentional bias in AD youth. Using the dot-probe task, Dalgleish, Moradi, Taghavi, Neshat-Doost, and Yule (2001) tested whether PTSD youth displayed a specific bias to words related to physical threat. They administered a dot-probe detection task to 24 PTSD youth and 24 NAD controls with no history of psychiatric disorder. The task consisted of words categorized as related to physical threat, social threat, or depression. These words were selected from the word bank generated by Neshat-Doost, Moradi, Taghavi, Yule, and Dalgleish (1999b).

Interestingly, the PTSD youth displayed an attentional bias to social-threat related words, although they did not display an attentional bias to physical-threat related words. Furthermore, the PTSD youth also displayed a bias away from depression-related words compared to controls. It should be noted that the responses to emotional words in the Dalgleish et al. (2001) study were not compared to neutral word responses. That is, the

PTSD youth displayed a threat-related attentional bias compared to the control group, but not compared to neutral words.

One limitation of the attentional bias literature is the lack of multi-method validation of attentional bias measures (Vasey, Dalgleish, & Silverman, 2003). Although both the dot-probe task and the Stroop task have been used to measure threat-related attentional bias, reliability across these tasks has not been established. In an attempt to compare these tasks, Dalgleish and colleagues (2003) combined and analyzed data from previous studies assessing attentional bias and memory bias in AD and NAD youth (Dalgleish et al., 1997, 2000, 2001; Moradi et al., 1999, 2000; Neshat-Doost et al., 1997, 1999a; Taghavi et al., 1999, 2003). Their sample included 7-18 year old youth suffering from GAD (n = 24), PTSD (n = 24), or major depressive disorder or dysthymia (n = 19), as well as controls with no history of psychiatric disorder (n = 26). Participants were administered the same dot-probe paradigm used by Taghavi et al. (1999) as well as an emotional Stroop task and a word memory task. These final two tasks included threat-related words, depression-related words, and neutral words. As hypothesized, AD youth displayed a bias toward threat-related words, whereas neither the depressed youth nor the controls displayed attentional biases on either the dot-probe task or the Stroop task. Also of note, AD youth did not display an attentional bias to threat-related words on the emotional Stroop task. Finally, depressed youth displayed a memory bias toward depression-related words, but AD youth did not display a memory bias toward threat-related words.

Dalgleish and colleagues (2003) reported that PTSD displayed a bias away from depression-related words. This bias away from depression-related words was also found

by Dalgleish et al. (2001). The reason for this bias is unclear, although it seems specific to youth diagnosed with PTSD. Perhaps the bias toward threat-related words displayed by PTSD youth is related to the hypervigilance that is typically associated with PTSD, whereas exposure to depression-related words somehow activates the avoidance that is also related to the disorder. However, such speculation is preliminary and further research is necessary to understand how PTSD youth attend to depression-related information.

Considering this study along with dot-probe studies by Vasey et al. (1995), Taghavi et al. (1999), and Dalgleish et al. (2001), there is mounting evidence that AD youth experience an attentional bias to threat-related stimuli. However, these studies used words as the stimuli of interest. Whereas the studies reviewed indicated that anxious youth selectively attend to threat-related words, Waters, Lipp, and Spence (2004) detected a bias in both AD and NAD youth using pictures as the target stimuli.

Waters and colleagues (2004) compared the attentional reactions of 23 AD youth and 23 NAD youth, ages 9-12. The authors administered a dot-probe task to all participants in which threat-related and neutral pictures served as the target stimuli. They administered the dot-probe task to the AD group and compared these data to those of a sample of NAD children from a previous experiment. Both AD and NAD youth displayed a threat-related attentional bias, and the difference between the groups was nonsignificant. Waters et al. suggested that selective attention to threat might be common to all children, and not specific to AD youth. This hypothesis was elaborated by Kindt, Bierman, and Brosschot (1997) and is discussed more thoroughly later in this review.

Whereas the findings of Waters et al. (2004) suggest that a threat-related attentional bias in AD youth is perhaps not as robust as previous studies indicate, they

should be interpreted cautiously. The use of threat-related pictures by Waters and colleagues may have led both AD and NAD youth to selectively attend to them. One danger of using pictures in studies assessing youth samples is that the pictures may be objectively threatening enough that both AD and NAD youth draw their attention toward them. Two studies in the adult literature found that individuals displayed an attentional bias toward stimuli associated with high threat regardless of anxiety level, and that the attentional bias displayed by AD (but not NAD) individuals occurred with regard to stimuli associated with mild to moderate threat (Mogg et al., 2000; Wilson & MacLeod, 2003). Considering that children generally attend to threat-related stimuli more than adults (Kindt & van den Hout, 1999), the threat-related pictures used by Waters and colleagues may have been associated with a level of threat high enough to elicit an attentional bias in both AD and NAD youth.

Using a dot-probe task consisting of pictures, Pine and colleagues (2005) also reported findings inconsistent with earlier studies, specifically that PTSD youth selectively attended away from photographs of angry faces. Their sample included 34 maltreated children and 21 children who had not been maltreated (all aged 7-13). All maltreated children had experienced domestic abuse and had been removed from their homes. Of the 34 maltreated children, 29 children were diagnosed with definite or probable PTSD based on clinical interview and self- and parent-report. All children completed a dot-probe task consisting of happy, angry, and neutral faces. In analyses comparing youth diagnosed with PTSD with youth with neither abuse history nor history of psychiatric diagnoses, the authors found that PTSD youth avoided angry faces,

whereas the controls did not. Moreover, avoidance of angry faces was negatively correlated with age.

These findings are not consistent with previous studies (Dalgleish et al., 2001; Dalgleish et al., 2003) that reported an attentional bias toward threatening stimuli in PTSD youth. Two plausible explanations exist for the discrepancy. First, the PTSD youth in Pine et al.'s (2005) study all experienced domestic abuse, whereas PTSD youth in studies by Dalgleish et al. had experienced car accidents and violent events, but not domestic abuse. It may also be the case that, because youth in the Pine et al. study were removed from the home, the abuse they received was severe and/or repeated. Without making undue claims about differences between the PTSD samples in these studies, it seems that the groups were not homogenous in terms of the events leading to their post-traumatic symptoms and may have responded differently to threat-related information. However, previous studies in adults and youth have reported a threat-related attentional bias across several different anxiety disorders and severity of symptoms. An additional explanation for the difference may be that Pine et al. employed the use of face photographs in their study, whereas previous studies had used words as the target stimuli.

In sum, four studies employing the dot-probe task found that AD youth selectively attend to threat-related information, whereas two did not. Interestingly, the four studies that reported a bias (Dalgleish et al., 2001; Dalgleish et al., 2003; Taghavi et al., 1999; Vasey et al., 1995) used words as target stimuli in their tasks. To the contrary, the two studies that did not find an attentional bias (Pine et al., 2005; Waters et al., 2004) used pictures in their task. Studies with adult samples have found AD individuals to attend away from angry faces (Chen, Ehlers, Clark, & Mansell, 2002; Mansell, Clark,

Ehlers, & Chen, 1999), whereas the majority of the literature supports an attentional bias toward other threat-related stimuli in AD adults (e.g., Eysenck, 1992; Mathews & MacLeod, 1994; Mogg & Bradley, 1998). Indeed, words and pictures may serve as different types of threat indicators. For instance, it could be that exposure to angry faces may trigger memories of past abuse and lead to avoidance for PTSD youth, whereas threat-related words may serve as cues that threat may be imminent, leading to hypervigilance. Research is needed to determine whether AD youth do indeed respond differently to threat-related words and threat-related pictures, specifically angry faces.

Studies Using the Startle Eyeblink Modification Task

Although used much less frequently than the Stroop task or dot probe detection task, the startle eyeblink modification (SEM) task has been used to measure attentional bias via speed of eyeblink response to a blast of white noise that occurs while visual stimuli, or lead intervals, are presented. Studies indicate that during long lead intervals, blink facilitation is larger for attended stimuli than ignored stimuli, whereas during short lead intervals, blink inhibition is larger for attended stimuli than ignored stimuli (Filion, Dawson, & Schell, 1993; Lipp, Siddle, & Dall, 1997). According to Waters and colleagues (2000), the SEM paradigm allows for the separation of attentional response and emotional response to the lead interval, insofar as "attentional processes enhance the extent of blink inhibition, whereas emotional processes reduce it" (Waters et al., 2000, p.144).

Only one study (Waters et al., 2000) used the SEM task to measure threat-related attentional bias in AD youth. Their sample included 16 children ages 9-13 who received an anxiety diagnosis according to the ADIS-C/P parent interview (Silverman & Albano,

1996). In their task, Waters et al. included threat words and neutral words that were presented for intervals of 60, 120, 240, or 3500 ms. They found that AD children blinked more quickly at the 60ms and 3500ms lead intervals, and they experienced blink inhibition at the 240ms lead interval. There was no significant difference in their responses to threat and neutral words, but children's startle latencies shortened moreso when exposed to threat words compared to neutral words at the 60ms lead interval. Essentially, these results provide weak evidence for the presence of threat-related attentional bias in AD youth.

Critique

Studies using the Stroop, dot-probe and SEM tasks suggest that AD youth display an attentional bias toward threat-related stimuli. The ability to detect this bias across three different tasks provides multi-method evidence for the existence of threat-related attentional bias in AD youth. However, it is unclear if and how threat-related attentional bias may differ at different levels of attentional development. As noted previously, executive attention skills develop throughout childhood and adolescence (Luna et al., 2004), and it is reasonable to assume that these changes may influence attentional biases to threat. However, none of the studies reviewed above included measures of executive functioning, or of attentional control in specific.

In addition, the distinction between trait anxiety and state anxiety has not been adequately considered in the assessment of attentional bias in AD youth. As defined by Spielberger et al. (1983), trait anxiety is defined as a more enduring tendency to experience anxiety. In contrast, state anxiety refers to the varying level of anxiety experienced at a given moment. Whereas trait anxiety can be considered a reasonably

stable personality characteristic, state anxiety frequently fluctuates based on an individual's given situation, although trait anxiety may influence state anxiety levels in given situations (Kendall, 1978). As Mathews and MacLeod (1994) noted, comparisons of AD and NAD individuals make it difficult to determine whether attentional bias is associated with long-term trait anxiety or elevations in state anxiety. According to both Williams et al. (1988, 1997) and Eysenck (1992, 1997), threat-related attentional bias is associated with elevated trait anxiety, but increases in state anxiety magnify this bias. In the adult literature, empirical support exists for the relationships between threat-related attentional bias and both trait anxiety (e.g., Mogg et al., 2000; Mogg, Kentish, & Bradley, 1993), and state anxiety (e.g., Mathews & MacLeod, 1985).

Threat-Related Attentional Bias and Trait Anxiety/State Anxiety

Several studies have examined the relationship between threat-related attentional bias and trait anxiety or self-reported anxiety in youth, and just three have assessed the relationship between threat-related attentional bias and state anxiety. Although further research is needed, a review of the existing studies informs the findings reported in studies with AD youth.

Kindt, Brosschot, and Everaerd (1997b) used the emotional Stroop task to compare children high and low in trait anxiety (HTA and LTA, respectively). They selected 25 HTA children and 22 LTA children (ages 8-9) based on their responses to several self-report measures, including the STAIC Trait and State Versions (Spielberger, 1973). To assess if state anxiety was associated with attentional interference, Kindt et al. administered the emotional Stroop task to children shortly before they were to receive a

medical inoculation. The Stroop task consisted of four categories of words based on their threat values and their relatedness to medical issues.

Results revealed that both HTA and LTA children displayed greater interference toward medical threat-related words compared to non-threat-related words. There was no evidence for differential attentional responses to threat-related information based on trait anxiety or state anxiety level. Kindt et al. suggested that the anticipation of inoculation might have minimized any bias effects in high-anxious children. This proposal is supported by previous research (Mathews & Sebastian, 1993) indicating that, in the presence of a real-life stressor, high anxious individuals do not display an attentional bias toward threat-related words. Mathews and Sebastian (1993) argued that, in such a situation, attention is allocated towards the more proximal and real threat, not towards the threat implied by the Stroop task. However, in a replication of their study in a non-threatening context (no upcoming inoculation), Kindt et al. again found a bias toward threat-related words in both high- and low-anxious children. Again, there was no association between state anxiety and attentional bias.

To the contrary, Schippell, Vasey, Cravens-Brown, and Bretveld (2003) reported that HTA youth do selectively attend to threat-related stimuli. In a study measuring attentional bias in aggressive youth, Schippell and colleagues included several measures of anxiety in their study, including the STAIC (Spielberger, 1973), to control for the relationship between anxiety and threat-related attentional bias. They assessed attentional bias via a dot-probe detection task using social-threat related words, physical-threat related words, and neutral words as the target stimuli. Indeed, they found that state

anxiety and a composite internalizing score were both positively correlated with response time to threat-related words.

Vasey, El Hag, and Daleiden (1996) investigated the relationship between state anxiety and threat-related attentional bias, although their main objective was to study attentional bias in test-anxious youth. Vasey and colleagues administered a dot-probe task to high test-anxious (n = 20) and low test-anxious (n = 20) children. The task was similar to the one used in the Vasey et al. (1995) study. Before completing the dot-probe task, participants were administered the STAIC Trait Version and a one-item measure assessing state anxiety. In addition, they listened to a message stating that they would be taking a test on the computer. This message was included to elevate state anxiety levels in test-anxious children.

As hypothesized, high test-anxious children displayed an attentional bias toward threat-related words. Furthermore, test anxiety was more strongly correlated with attentional bias than trait anxiety, and state anxiety was not associated with attentional bias. However, this finding may be limited by the fact that state anxiety was assessed. merely by a 5-point (0-4) Likert-type scale question asking participants to rate their nervousness. This instrument led to a restricted range of responses. In fact, only two participants rated their nervousness at 2 or higher. As the authors recognized, administration of the STAIC State Version would have improved state anxiety measurement. Nevertheless, the Vasey et al. findings provide indirect support for an association between state anxiety and threat-related attentional bias in youth. Participants were categorized based on test-anxiety levels and then were administered a task described as a test. It seems reasonable to believe that, at the time of the task, state anxiety levels

were considerably higher in high test-anxious participants than in low test-anxious participants. Therefore, it is likely that differences reported between high and low test-anxious participants were at least partially due to differing levels of state anxiety. Assessing state anxiety as part of the methodology would provide a more direct examination of the association between state anxiety and attentional bias.

Most recently, Heim-Dreger, Kohlmann, Eschenbeck, and Burkhardt (2006) assessed the associations between attentional bias and both trait anxiety and state anxiety in 112 children, ages 7-10. They administered a Stroop task and a dot-probe detection consisting of threatening and neutral faces to participants. Heim-Dreger et al. found that Stroop interference on threat-related words was associated with state anxiety, but not trait anxiety. Moreover, the absolute value of the index used to measure Stroop interference to threat-related and neutral words was even more strongly related to state anxiety, and was related to trait anxiety. As the absolute value of the Stroop index accounts for slowed and speeded responses to target stimuli, these findings suggest that participants higher in state anxiety and trait anxiety may have responded more quickly to threat-related stimuli, which the authors attributed to cognitive avoidance. Finally, interference on the dot-probe task was significantly related to trait anxiety but not state anxiety, and performance on the Stroop task and the dot-probe task were not correlated.

Whereas these studies provide some support for the associations between threat-related attentional bias and both trait anxiety and state anxiety, studies employing adult samples have found that the interaction of state anxiety and trait anxiety may be more strongly associated with threat-related attentional bias than either construct alone. However, the nature of this interaction is unclear. Broadbent and Broadbent (1988) and

Egloff and Hock (2001) both reported that state anxiety was only associated with threat-related attentional bias in individuals with high trait anxiety. To the contrary, Rutherford and colleagues (2004) found that, in the absence of elevated state anxiety, high trait anxiety was not associated with attentional bias. Finally, MacLeod and Mathews (1988) found that HTA individuals displayed a threat-related attentional bias in both stressful and non-stressful situations, but that the magnitude of the bias was increased during the stressful situation when state anxiety was elevated.

Taken together, research suggests that elevated levels of state anxiety may contribute to threat-related attentional bias. This relationship is only modestly supported in youth, but just three studies have examined this relationship, and one study did not measure state anxiety in a preferred manner. To better understand threat-related attentional bias in anxious youth, future studies of threat-related attentional bias need to assess both trait anxiety and state anxiety. Manipulation of state anxiety in attentional bias studies may be a valuable strategy to understand the anxiety and attentional bias connection.

Threat-related Attentional Bias in Spider-Fearing Youth

A number of studies by Kindt and colleagues (Kindt, Bierman, & Brosschot, 1997a; Kindt & Brosschot, 1999; KIndt, van den Hout, de Jong, & Hoekzema, 2000; Morren, Kindt, van den Hout, & van Kasteren, 2003) have examined the relationship between spider fear in youth and attentional bias to threat-related stimuli. These studies have provided inconsistent results, but have offered new insights into the relationship between anxiety and threat-related attentional bias.

Using the Stroop task, Kindt and colleagues (1997a) assessed spider-related attentional bias in 72 spider-fearing children and 73 non-spider-fearing children, ages 8-12. The spider-fearing children did not meet diagnostic criteria for a specific phobia, but were labeled spider-phobic based on a self-report measure. Kindt and colleagues used two versions of the Stroop task, one in which participants were exposed to spider-related words, color words, control words, and nonwords on a single card, and one in which these words were presented sequentially. Results revealed that all youth displayed an attentional bias toward spider-related words, indicating no specific attentional bias in spider-fearing children.

Based on these findings, Kindt et al. (1997a) put forth the cognitive-inhibition hypothesis. They proposed that all young children (generally ages 9 and under) selectively attend to threat-related stimuli in their environment. As they grow older, low anxious children learn to inhibit this attentional bias. However, high levels of fear prevent anxious children from doing the same, which maintains a threat-related attentional bias in these individuals. Essentially, as attentional directing abilities mature, the difference between AD and NAD individuals may widen.

The cognitive-inhibition hypothesis bears resemblance to the argument that effortful control influences threat-related attentional bias (Lonigan et al., 2004; Muris & Ollendick, 2005). Indeed, the findings from Kindt et al. (1997a) are consistent with the argument that children may lack sufficient effortful control to suppress attentional responses to threat-related stimuli. The hypothesis was further supported by Kindt, van den Hout, de Jong, and Hoekzema (2000), who administered a Stroop task to both spider-fearing children (n = 55) and non-spider fearing children (n = 58), all females ages 8-11.

They found that both groups selectively attended to spider-fearing words compared to neutral words, but that this bias increased with age in spider-fearing youth and decreased with age in non-spider fearing youth.

Morren, Kindt, van den Hout, and van Kasteren (2003) conducted a study specifically designed to test the cognitive-inhibition hypothesis. They administered a Stroop task consisting of spider-related words and neutral words to 170 spider-fearing youth and 215 non-spider-fearing youth, aged 7-11. Contrary to the cognitive-inhibition hypothesis, children in both groups and of all ages responded more quickly to spider-related words than to neutral words. The authors concluded that speeded responding to spider-words was due to childrens' avoidance of these threat-related stimuli. However, this responding was uniform across spider-fearing and non-spider fearing youth, regardless of age. Indeed, the majority of attentional bias studies in youth reviewed above found that non-anxious youth do not display a bias to threat-related stimuli or attend away from threat-related stimuli. These findings suggest that threat-related attentional bias may not be found generally among children. As suggested by Lonigan and colleagues (2004), both high negative affect and low effortful control may be necessary to activate this bias.

Kindt and Brosschot (1999) reported a threat-related attentional bias in spider-fearing youth. Because the Stroop task may assess response interference, as well as attentional interference, Kindt and Brosschot developed a novel Stroop paradigm to minimize effects of response interference. One version of the Stroop task (integrated Stroop) was similar to that used in previous studies (Kindt et al., 1997a; Kindt et al, 1997b). On the other version (nonintegrated Stroop), the displayed word was not typed in

colored ink, but was superimposed over a colored circle. The purpose of this manipulation was to separate the threat-related stimulus (the word) from the neutral task (naming the color of the circle), because interference in color-naming on the traditional emotional Stroop task may be due to the individual's emotional reaction to the threat-related word.

Kindt and Brosschot (1999) administered both versions of the Stroop task to 28 spider-fearing youth and 30 non-spider-fearing youth, all aged 8-12. Spider fear was assessed by a behavioral approach test. Interestingly, spider-fearing children differed from controls in their attentional bias on the nonintegrated Stroop task, but the two groups did not differ in their responses to the integrated Stroop task. These findings suggest that the integrated, and more traditionally used, Stroop task may confound response bias and attentional bias. In children, who may be prone to react with more emotion to threat-related stimuli than adults (Kindt & van den Hout, 1999), it seems that the Stroop task may not sufficiently differentiate anxious and non-anxious children.

There are several explanations for the inconsistent findings reported in studies of spider-related attentional bias. First, the youth in these studies did not necessarily meet criteria for a specific phobia of spiders. It may be that attentional bias is stronger in youth who actually have an anxiety disorder than in those with subclinical anxiety. Consistent with this argument, Kindt and Brosschot's (1999) behavioral method of assessing spider fear most likely led to inclusion of youth with more severe spider phobia than in the other studies, and theirs was the only study to detect a specific bias in spider-fearing youth.

In addition, the Stroop task may not have been sufficiently sensitive to detect a bias in subclinically anxious youth. This point is understated by the fact that Kindt and

Brosschot's (1999) modified Stroop task detected a bias in their sample of spider-fearing youth, whereas the traditional Stroop task did not. Taken together, these studies suggest that the emotional Stroop task may not be the optimal method of assessing threat-related attentional bias in anxious youth.

Other Studies Examining Threat-Related Attention Bias in Anxious Youth

The studies reviewed below did not employ samples of AD, HTA, or spider-fearing youth. However, each of these studies provides support for the presence of threat-related attentional bias in youth and warrant consideration in the current review.

Whereas several studies have measured anxiety via clinical interview or self-report measures of state anxiety and trait anxiety, Richards, Richards, and McGeeney (2000) examined the relationship between self-reported anxiety symptomatology and threat-related attentional bias. Their sample included 30 adolescents (aged 16-18) who were divided into two groups using a median split of their scores on the Beck Anxiety Inventory (Beck & Steer, 1990). To assess attentional bias, participants completed a Stroop task consisting of eight threat-related words and eight neutral words matched for length and frequency of usage. The words were presented on two cards, one of which consisted of the threat words and the other consisting of the neutral words. The presentation of the cards was balanced so that each card was presented first during half of the trials.

As hypothesized, Richards et al. (2000) found that the high anxiety group took longer to respond to threat-related words compared to neutral words, whereas the low anxiety group showed no such difference. Furthermore, the authors found a linear relationship between anxiety level and interference on threat-related words. However, the

findings are somewhat limited by the manner in which the Stroop task was presented. Specifically, each participant was exposed to all 48 words from one category and then all 48 words from the other. This presentation may have led to an interference effect caused by the grouping of threat-related words together. That is, if it is presumed that selective attention to threat represents hypervigilance for danger (e.g., Eysenck, 1992, 1997), then exposure to 48 threat-related words in a row may increase attention bias considerably more so than exposure to a threat-related word amidst other emotion and neutral words. Thus, the effect reported by Richards and colleagues may be inflated to some extent.

Three studies have supported the relationship between anxiety and threat-related attentional bias without directly examining anxious youth. For example, Pine and colleagues (2005) assessed the presence of threat-related attentional bias in youth (ages 9-19) whose parents were diagnosed with panic disorder (PD). The offspring of PD adults were compared to the offspring of MDD adults and controls on a computer task that measured how quickly they responded to happy, angry, and scared faces. Unlike the dot-probe task, however, participants were presented with each face and asked (a) how scared they were of the face, (b) how hostile the face appeared, and (c) how wide the face's nose appeared. They found that, compared to a parental diagnosis of MDD, a parental diagnosis of PD predicted longer response time to the first question ("How afraid are you?") for angry faces, and also higher fear ratings to angry faces. Furthermore, SP in youth was associated with longer response times to angry faces, but other child diagnoses were not.

Schwartz, Snidman, and Kagan (1996) examined threat-related attentional bias in adolescents who were categorized as behaviorally inhibited (BI) as toddlers. They

hypothesized that adolescents categorized as BI would remain more vigilant to environmental threat than non-BI adolescents. Schwartz and colleagues administered the emotional Stroop task to 41 BI and 33 non-BI adolescents with a mean age of 13.03. The Stroop task included threat-related and neutral words. They found no differences between the BI and non-BI groups on the Stroop task. In a further analysis, though, Schwartz et al. examined the words that led to the longest latencies for each participant. They found that BI participants had a higher proportion of threat words among their longer latencies than non-BI participants.

Finally, Boyer et al. (2006) assessed threat-related attentional bias in 59 children (ages 9-17) who suffered from recurrent abdominal pain. Based on literature indicating that youth who focused on their abdominal pain as a coping strategy reported higher levels of pain (Walker, Smith, Garber, & VanSlyke, 1997). Boyer and colleagues administered a dot-probe task to participants that consisted of pain-related words, social-threat-related words, and neutral words. They found that youth with abdominal pain displayed an attentional bias toward pain-related words presented for 20ms, but displayed a bias away from pain-related words presented for 1250ms. The authors concluded that youth with recurrent abdominal pain selectively attend to pain-related information subliminally, or outside of their consciousness, but not supraliminally.

Critique

It is clear from an examination of studies of threat-related attentional bias in non-disordered anxious youth that this bias is not specific to youth with a diagnosed anxiety disorder. However, the findings from these studies are considerably less consistent than those examining attentional bias in AD youth. Perhaps a plausible explanation for this

difference is that attentional bias is either stronger or more persistent in AD youth than in subclinically anxious youth. Indeed, Richards and colleagues (2000) found a linear relationship between self-reported anxiety level and extent of attentional bias to threat. Furthermore, two studies found that adults treated for anxiety disorders no longer displayed a threat-related attentional bias (Mathews, Mogg, Kentish, & Eysenck, 1995; Mogg, Bradley, Millar, & White, 1995).

As Wikstrom and colleagues (2003) argued, trait anxiety may contribute to a pre-conscious, but not conscious, attentional bias. In such a scenario, subclinically anxious individuals would selectively attend to threat-related stimuli pre-consciously, but would orient their attention away from such stimuli when becoming consciously aware of them. AD individuals, on the other hand, would continue to display a bias at pre-conscious and conscious levels. Indeed, this pattern of attention to threat was reported by Boyer and colleagues (2006). This hypothesis bears extra importance when considering children, who generally have premature attention orienting abilities (e.g., Brodeur & Boden, 2001; Enns & Brodeur, 1989; Tipper, Bourque, Anderson, & Brehaut, 1989).

Additionally, the failure of several studies to find attentional biases in subclinically anxious youth may be due to reliance on youth self-report to measure anxiety. Children and adolescents tend to inconsistently report anxious symptomatology, often underreporting anxious symptoms (Comer & Kendall, 2004). Therefore, studies that categorize youths into high- and low-anxious groups based on their self-report of anxiety may be considerably inaccurate. Specifically, the low-anxious groups may comprise youth who underreport anxious symptoms as well as youth who accurately reported little anxiety. Unfortunately, few studies of threat-related bias in anxious youth

have employed parent, teacher, or independent rater report. It is important for future studies to utilize multiple informants of anxious symptomatology (Kendall & Flannery-Schroeder, 1998) to provide a more accurate description of children's anxiety levels.

Conclusions and Recommendations

Despite only fifteen years of research, a critical analysis of the existing research on threat-related attentional bias in anxious youth strongly indicates that AD youth display an attentional bias toward threat-related information, similar to the bias found in AD adults. These findings are in accord with theories stating that the information processing of AD youth may be biased towards threat-related information in the environment (e.g., Daleiden & Vasey, 1996; Lonigan et al., 2004). A review of the literature also suggests that subclinically anxious youth may also display a threat-related attentional bias, although these findings are somewhat less consistent. Taken together, these findings strongly suggest that anxious youth and adolescents selectively attend to threat-related information similarly to anxious adults.

The presence of a threat-related attentional bias in anxious youth has considerable clinical implications. First, it opens the possibility that threat-related attentional bias helps to maintain anxiety in youth. Essentially, children and adolescents who selectively attend to threat in their environments perceive the world as a considerably more dangerous place than their non-anxious counterparts. This biased perception may lead to increased anxiety, as the cognitive theory of anxiety suggests (Beck & Clark, 1988). More ambitiously, the presence of threat-related attentional bias may suggest that it plays a role in the development of anxiety disorders in children and adolescents. This role of threat-related attentional bias as a risk factor for anxiety

pathology has been suggested by many attentional bias researchers (Eysenck, 1992, 1997; Lonigan et al., 2004; Mogg and Bradley, 1998; Williams et al., 1988, 1997) and has been indirectly supported by two recent studies. MacLeod, Rutherford, Campbell, Elsworthy, and Holker (2002) found that individuals trained to selectively attend to threat-related stimuli became more anxious when faced with stressful tasks than did control groups. Similarly, Mathews and Mackintosh (2000) reported that individuals trained to interpret ambiguous stimuli as threat-related also experienced increases in anxiety when confronted with a difficult task. These studies imply that selective attention to threat-related information leads to increased anxiety, especially in stressful situations. Moreover, a recent study by Field (2006) found that providing negative information to children about unfamiliar animals increased their fear about these animals and caused them to selectively attend to those animals compared to unfamiliar animals for whom they received positive or no information. These results suggest that threat-related attentional bias is not merely a symptom of anxiety, but may indeed play a role in the onset of anxiety.

If threat-related attentional bias does indeed maintain anxiety in youth, it follows that some form of attentional training may be beneficial in the treatment of anxiety disorders. It may be that cognitive-behavioral treatments of anxiety indirectly minimize patients' attentional biases through cognitive restructuring and corrective exposure experiences. Indeed, two studies have reported that threat-related attentional bias decreased or disappeared altogether in individuals who no longer met criteria for an anxiety disorder after completing cognitive-behavioral treatment (Mathews, Mogg, Kentish, & Eysenck, 1995; Mogg, Bradley, Millar, & White, 1995). Nevertheless, the use

of direct strategies related to attentional training may improve the effectiveness of anxiety treatments in youth. Attentional training techniques have already been suggested by Teasdale, Segal, and Williams (1995) for the treatment of depression and would complement techniques currently used in treating anxiety-disordered youth.

The aforementioned clinical implications may be somewhat premature. Although research does suggest that anxious youth display a threat-related attentional bias, this finding is by no means unanimous across studies. Several studies have failed to detect a threat-related attentional bias specific to anxious youth (Kindt et al., 1997a, 1997b, 2003; Pine et al., 2005; Waters et al., 2004). There are several potential reasons for the discrepancies in the literature. First, inconsistencies across studies may be due to variability in methodology. Attentional bias studies employing youth samples have traditionally used either the emotional Stroop task or the dot-probe detection task, except for one study (Waters et al., 2000) that employed the SEM paradigm. A comparison of studies using the dot-probe and Stroop tasks suggests that they measure different processes. In fact, studies that administered both the Stroop task and the dot-probe detection task to youth have found that performance on the tasks is not correlated (Dalgleish et al., 2003; Heim-Dreger et al., 2006). Based on previous research, it appears that the emotional Stroop task measures a general attentional interference (although interference may be caused by a response bias), whereas the dot-probe task more specifically assesses selective visual attention to threat-related information. Unfortunately, both tasks have been used to measure the same construct. Future studies must remain mindful of the differences between these tasks. Moreover, evidence that the Stroop task may not sufficiently detect a threat-related attentional bias in subclinically

anxious youth (e.g., Kindt & Brosschot, 1999) should guide the decisions of future researchers planning to study attentional bias.

There is also considerable variability across attentional bias studies with regard to the type of stimuli that are employed and the length of time that target stimuli are presented. In the studies reviewed in this manuscript, both words and pictures were used as proxies for threat-related stimuli. Moreover, many researchers developed their own word and picture banks or loosely borrowed these stimuli from previous studies, as opposed to using the exact target stimuli as other studies. As argued by Vasey, Dalgleish, and Silverman (2003), attentional bias studies suffer from experimenters' failure to provide psychometric properties for their paradigms. Essentially, because of the vast variability across attentional bias studies, it is unclear whether many of the tasks used to measure attentional bias are valid. Moreover, the failure of studies to use common paradigms and target stimuli prevents reliability assessment and complicates comparison across studies.

The utilization of different target presentation times in the reviewed dot-probe task studies may be additionally problematic. Several studies in the adult literature suggest that anxious individuals initially attend selectively to threat (at presentation times of ~500ms), but later avert their attention from the threat-related stimulus (at presentation times of ~1500ms; Mogg, Bradley, Miles, & Dixon, 2004; Koster, Verschuere, Crombez, & Van Damme, 2005). This phenomenon, known as the vigilance-avoidance pattern (Mathews, 1990), has not yet been assessed in children and adolescents. Whereas many studies assessing attentional bias in children presented word and pictures for 1250ms (e.g. Vasey et al., 1995), other studies presented stimuli for 1500ms (e.g. Dalgleish et al.,

2001) and 1700 ms (e.g., Moradi et al., 1999). Many of these studies employed presentation times over 1000ms to ensure that participants had time to read the target words. Nevertheless, future studies should remain mindful of the length of time that target stimuli are presented, especially in light of studies supporting the vigilance-avoidance model of attentional bias.

Importantly, the executive functioning developments that occur throughout childhood and adolescence have not been sufficiently considered. The majority of studies examining threat-related attentional bias in anxious youth have not assessed executive functioning abilities, such as processing speed and voluntary response suppression. These abilities directly impact the way in which youth attend to threat-related information and disengage from it. For example, poor voluntary response suppression (or with regard to attention, attentional control) may result in a child's increased attention to distracting stimuli, whether those stimuli are threat-related or otherwise. Thus, to better understand threat-related attentional bias in youth, it is essential to assess executive functioning abilities. Inclusion of measures such as the Test of Everyday Attention for Children (TEA-ch; Manly et al., 2001), which assesses various components of executive attention skills, would allow attentional bias studies to examine the relationship between threat-related attentional bias and these abilities.

Related to the need to consider executive functioning skills is the need to assess the role of effortful control in the relationship between anxiety and threat-related attentional bias. Although effortful control is considered a temperamental factor (e.g., Rothbart & Bates, 1998), it is related to executive functioning in that it involves the suppression of dominant responses, including attention (Muris & Ollendick, 2005).

Lonigan et al.'s (2004) model proposes that effortful control moderates the relationship between threat-related attentional bias and anxiety disorder onset. That is, as youth high in negative affect develop effortful control, they would be more likely to suppress the dominant response to attend to threat-related information. High negative affect individuals possessing low effortful control, however, would not be able to suppress the response towards threat-related information. Thus, as children with high negative affect develop effortful control, the discrepancy in threat-related attentional bias between these youth and those with low effortful control may increase (Lonigan et al., 2004; Lonigan & Phillips, 2001; Muris & Ollendick, 2005). Indeed, a study by Muris, de Jong, and Engelen (2004) reported that, in a non-clinical sample of youth, anxiety was positively associated with neuroticism and negatively associated with attentional control.

Similarly, Derryberry and Reed (2002) proposed that threat-related attentional bias is partially a function of effortful control, in that low effortful control may facilitate focused attention to threat-related information. Supporting their argument, studies using adult samples have reported that AD and HTA individuals experience difficulty disengaging from threat-related stimuli after they have already attended to them (Amir et al., 2003; Derryberry & Reed, 2002; Fox, Russo, & Dutton, 2002; Yiend & Mathews, 2001). These findings suggest that anxious individuals have some difficulty with the more voluntary process of attention disengagement, which is strongly related to the attention component of effortful control. Unfortunately, no studies have examined disengagement from threat-related stimuli in anxious youth, but such work would certainly inform the current literature.

Finally, the roles of trait anxiety and state anxiety as they relate to threat-related attentional bias in youth have not yet been established. Evidence for an association with either trait anxiety or state anxiety and attentional bias has been mixed. Perhaps most promising to this issue is research examining how the interaction of trait anxiety and state anxiety may contribute to threat-related attentional bias. However, studies of this nature using youth samples have not yet occurred. As research examining attentional bias in HTA youth continues, it is hoped that these issues will become clearer, leading to a greater understanding of threat-related attentional bias in anxious youth.

In sum, the body of research assessing threat-related attentional bias in anxious youth is promising and carries with it several important clinical implications. However, to better understand the relationship between this attentional bias and anxiety in youth, future studies must (a) converge upon reliable and valid measures of threat-related attentional bias, (b) include measures of executive functioning abilities and effortful control in attentional bias studies, and (c) investigate the association between threat-related attentional bias and both trait anxiety and state anxiety. The advances that follow from such research may improve our understanding of threat-related attentional bias and its association with anxiety disorders in youth.

References

Albano, A.M., Chorpita, B.F., & Barlow, D.H. (1996). Childhood anxiety disorders. In E.J. Mash & R.A. Barkley (Eds.), *Child Psychopathology* (pp. 196-241). New York: Guilford Press.

Amir, N., Elias, J., Klumpp, H., & Przeworski, A. (2003). Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat? *Behaviour Research and Therapy, 41*, 1325-1335.

Anderson, V.A., Anderson, P., Northam, E., Jacobs, R., & Catroppa, C. (2001). Development of executive functions through late childhood and adolescence in an Australian sample. *Developmental Neuropsychology, 20*, 385-406.

Asmundson, G.J.G., & Stein, M.B. (1994). Selective processing of social threat in patients with generalized social phobia: Evaluation using a dot-probe paradigm. *Journal of Anxiety Disorders, 8*, 107-117.

Barrett, P.M., Rapee, R.M., Dadds, M.R., & Ryan, S.M. (1996). Family enhancement of cognitive style in anxious and aggressive children: Threat bias and the FEAR effect. *Journal of Abnormal Child Psychology, 24*, 187-203.

Beck, A.T., & Clark, D.A. (1988). Anxiety and depression: An information processing perspective. *Anxiety Research, 1*, 23-36.

Beck, A.T., Emery, G., & Greenberg, R. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York: Basic Books.

Beck, A.T., & Steer, R.A. (1990). *The Beck Anxiety Inventory*. Austin, TX: The Psychological Corporation.

Bell-Dolan, D.J. (1995). Social cue interpretation of anxious children. *Journal of Clinical Child Psychology, 24*, 1-10.

Boyer, M.C, Compas, B.E., Stanger, C., Colletti, R.B., Konik, B.S., Morrow, S.B., & Thomsen, A.H. (2006). Attentional biases to pain and social threat in children with recurrent abdominal pain. *Journal of Pediatric Psychology, 31*, 209-220.

Broadbent, D.E., & Broadbent, M. (1988). Anxiety and attentional bias: State and trait. *Cognition and Emotion, 2*, 165-183.

Brocki, K.C., & Bohlin, G. (2004). Executive functions in children aged 6 to 13: A dimensional and developmental study. *Developmental Neuropsychology*, *26*, 571-593.

Brodeur, D.A. (2004). Age changes in attention control: Assessing the role of stimulus contingencies. *Cognitive Development, 19*, 241-252.

Brodeur, D.A., & Boden, C. (2001). The effects of spatial uncertainty and cue predictability on visual orienting in children. *Cognitive Development, 15*, 367-383.

Brodeur, D.A., & Enns, J.T. (1997). Covert visual orienting across the lifespan. *Canadian Journal of Experimental Psychology, 51*, 20-35.

Brosschot, J.F., de Ruiter, C., & Kindt, M. (1999). Processing bias in anxious subjects and repressors, measured by emotional Stroop interference and attentional allocation. *Personality and Individual Differences, 26*, 777-793.

Caspi, A., Henry, B., McGee, R.O., Moffitt, T.E., & Silva, P.A. (1995). Temperamental origins of child and adolescent behavior problems: From age three to age fifteen. *Child Development, 66*, 55-68.

Chen, Y.P., Ehlers, A., Clark, D.M., & Mansell, W. (2002). Patients with generalized social phobia direct their attention away from faces. *Behaviour Research and Therapy, 40*, 677-687.

Chorpita, B.F., Albano, A.M., & Barlow, D.H. (1996). Cognitive processing in children: Relationship to anxiety and family influences. *Journal of Clinical Child Psychology, 25*, 170-176.

Clark, L.A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*, 316-336.

Cohen, L.B. (1972). Attention-getting and attention-holding processes of infant visual preference. *Child Development, 43*, 869-879.

Comer, J.S., & Kendall, P.C. (2004). A symptom-level examination of parent-child agreement in the diagnosis of anxious youths. *Journal of the American Academy of Child and Adolescent Psychiatry, 43*, 878-886.

Costello, E. J., Angold, A., Burns, B.J., Stangl, D.K., Tweed, D. L., Erkanli, A., & Worthman, C.M. (1996). The Great Smoky Mountains Study of youth: Goals, design, methods, and the prevalence of DSM-III-R disorders. *Archives of General Psychiatry, 53,* 1129-1136.

Daleiden, E.L., & Vasey, M.W. (1997). An information-processing perspective on childhood anxiety. *Clinical Psychology Review, 17*, 407-429.

Dalgleish, T., Moradi, A.R., Taghavi, R., Neshat-Doost, H.T., Yule, W., & Canterbury, R. (2000). Judgments about emotional events in children and adolescents with

post-traumatic stress disorder and controls. *Journal of Child Psychology and Psychiatry, 41*, 981-988.

Dalgleish, T., Moradi, A.R., Taghavi, M.R., Neshat-Doost, H.T., & Yule, W. (2001). An experimental investigation of hypervigilance for threat in children and adolescents with post-traumatic stress disorder. *Psychological Medicine, 31*, 541-547.

Dalgleish, T., Taghavi, R., Neshat-Doost, H., Moradi, A., Canterbury, R., & Yule, W. (2003). Patterns of processing bias for emotional information across clinical disorders: A comparison of attention, memory, and prospective cognition in children and adolescents with depression, generalized anxiety, and posttraumatic stress disorder. *Journal of Clinical Child and Adolescent Psychology*, *32*, 10-21.

Dalgleish, T., Taghavi, R., Neshat-Doost, H., Moradi, A., Yule, W., & Canterbury, R. (1997). Information processing in clinically depressed and anxious children and adolescents. *Journal of Child Psychology and Psychiatry, 38*, 535-541.

De Luca, C.R., Wood, S.J., Anderson, V., Buchanan, J., Proffitt, T.M., Mahoney, K., & Pantelis, C. (2003). Normative data from the Cantab. I: Development of executive function over the lifespan. *Journal of Clinical and Experimental Neuropsychology, 25*, 242-254.

Derryberry, D., & Reed, M. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology, 111*, 225-236.

Egloff, B., & Hock, M. (2001). Interactive effects of state anxiety and trait anxiety on emotional Stroop interference. *Personality and Individual Differences, 31*, 875-882.

Ehrenreich, J.T., & Gross, A.M. (2002). Biased attentional behavior in childhood anxiety: A review of theory and current empirical investigation. *Clinical Psychology Review, 22*, 991-1008.

Enns, J.T., & Brodeur, D.A. (1989). A developmental study of covert orienting to peripheral visual cues. *Journal of Experimental Child Psychology, 48*, 171-189.

Eysenck, M.W. (1992). *Anxiety: The cognitive perspective.* London: Lawrence Erlbaum Associates Ltd.

Eysenck, M.W. (1997). Anxiety and cognition: A unified theory. Hove, England: Psychology Press/Erlbaum.

Field, A.P. (2006). Watch out for the beast: Fear information and attentional bias in children. *Journal of Clinical Child and Adolescent Psychology, 35*, 431-439.

Filion, D.L., Dawson, M.E., & Schell, A.M. (1993). Modification of the acoustic startle-reflex eyeblink: A tool for investigating early and late attentional processes. *Biological Psychiatry, 35*, 185-200.

Fox, E. Russo, R., & Dutton, K. (2002). Attention bias for threat: Evidence for delayed disengagement from emotional faces. *Cognition and Emotion, 16*, 355-379.

Hale, S. (1990). A global developmental trend in cognitive processing speed. *Child Development, 61*, 653-663.

Heim-Dreger, U., Kohlmann, C., Eschenbeck, H., & Burkhardt, U. (2006). Attentional biases for threatening faces in children: Vigilant and avoidant processes. *Emotion, 6*, 320-325.

Hope, D.A., Rapee, R.M., Heimberg, R.G., & Dombeck, M.J. (1990). Representations of the self in social phobia: Vulnerability to social threat. *Cognitive Therapy and Research, 14*, 177-189.

Huttonlocher, P.R. (1990). Morphometric study of human cerebral cortex development. *Neupsychologia, 28*, 517-527.

Ialongo, N., Edelsohn, G., Werthamer-Larsson, L., Crockett, L., & Kellam, S. (1995). The significance of self-reported anxious symptoms in first grade children: Prediction to anxious symptoms and adaptive functioning in fifth grade. *Journal of Child Psychology and Psychiatry, 36*, 427-437.

Ingram, R.E., & Kendall, P.C. (1987). The cognitive side of anxiety. *Cognitive Therapy and Research, 11*, 523-536.

Kashani, J.H., & Orvaschel, H. (1988). Anxiety disorders in mid-adolescence: A community sample. *American Journal of Psychiatry, 145*, 960-964.

Keller, M.B., Lavori, P., Wunder J., Beardslee, W.R., Schwarts, C.E., & Roth, J. (1992). Chronic course on anxiety disorders in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 312*, 595-599.

Kendall, P.C. (1978). Anxiety: traits, states – situations? *Journal of Consulting and Clinical Psychology, 46*, 280-287.

Kendall, P.C., & Flannery-Schroeder, E.C. (1998). Methodological issues in treatment research for anxiety disorders in youth. *Journal of Abnormal Child Psychology, 26*, 27-38.

Kindt, M., Bierman, D., & Brosschot, J.F. (1997a). Cognitive bias in spider fear and control children: Assessment of emotional interference by a card format and a

single-trial format of the Stroop task. *Journal of Experimental Child Psychology, 66*, 163-179.

Kindt, M., Bogels, S., & Morren, M. (2003). Processing bias in children with separation anxiety disorder, social phobia, and generalized anxiety disorder. *Behaviour Change, 20*, 143-150.

Kindt, M., & Brosschot, J.F. (1999). Cognitive bias in spider-phobic children: Comparison of a pictorial and a linguistic spider Stroop. *Journal of Psychopathology and Behavioural Assessment, 21*, 207-220.

Kindt, M., Brosschot, J.F., & Everaerd, W. (1997b). Cognitive processing of children in a real life stress situation and a neutral situation. *Journal of Experimental Child Psychology, 64*, 79-97.

Kindt, M., & van den Hout, M. (2001). Selective attention and anxiety: A perspective on developmental issues and the causal status. *Journal of Psychopathology and Behavioural Assessment, 23*, 193-202.

Kindt, M., van den Hout, M., de Jong, P., & Hoekzema, B. (2000). Cognitive bias for pictorial and linguistic threat cues in children. *Journal of Psychopathology and Behavioral Assessment, 22*, 201-219.

Koster, E.H.W, Crombez, G., Verschuere, B., De Houwer, J. (2004). Selective attention to threat in the dot-probe paradigm: Differentiating vigilance and difficulty to disengage. *Behaviour Research and Therapy, 42*, 1183-1192.

Koster, E.H.W., Verschuere, B., Crombez, G.,, & Van Damme, S. (2005). Time-course of attention for threatening pictures in high and low trait anxiety. *Behaviour Research and Therapy, 43*, 1087-1098.

Kovacs, M., & Devlin, B. (1998). Internalizing disorders in childhood. *Journal of Child Psychology and Psychiatry, 39*, 47-63.

LaGreca A.M., & Lopez N. (1998). Social anxiety among adolescents: linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*, 83-94.

Lengua, L.J. (2002). The contribution of emotionality and self-regulation to the understanding of children's response to multiple risk. *Child Development, 73*, 144-161.

Levin, H.S., Culhane, K., Hartmann, J., Evankovich, K., Mattson, A.J., Harward, H., & Mattson, A.J. (1991). Developmental changes in performance on tests of purported frontal lobe functioning. *Developmental Neuropsychology, 7*, 377-395.

Lipp, O.V., Siddle, D.A.T., & Dall, P.J. (1997). The effect of foreground stimulus modality on blink magnitude startle modulation. *Psychophysiology, 34*, 340-347.

Lonigan, C.L., & Phillips, B.M. (2001). Temperamental influences on the development of anxiety disorders. In M.W. Vasey & M.R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 253-277). New York: Oxford University Press.

Lonigan, C.L., Vasey, M.W., Phillips, B.M., & Hazen, R.A. (2004). Temperament, anxiety, and the processing of threat-relevant stimuli. *Journal of Clinical Child and Adolescent Psychology, 33*, 8-20.

Luna, B., Garver, K.E., Urban, T.A., Lazar, N.A., & Sweeney, J.A. (2004). Maturation of cognitive processes from late childhood to adulthood. *Child Development, 75*, 1357-1372.

MacLeod, C., & Mathews, A. (1988). Anxiety and the allocation of attention to threat. *Quarterly Journal of Experimental Psychology, 40*, 653-670.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15-20.

MacLeod, C., Rutherford, E., Campbell, L., Elsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology, 111*, 107-123.

Manly, T., Anderson, V., Nimmo-Smith, I., Turner, A., Watson, P., & Robertson, I.H. (2001). The differential assessment of children's attention: The Test of Everyday Attention for Children (TEA-ch), normative sample, and ADHD performance. *Journal of Child Psychology and Psychiatry, 42*, 1065-1081.

Mansell, W., Clark, D.M., Ehlers, A., & Chen, Y.P. (1999). Social anxiety and attention away from faces. *Cognition and Emotion, 13*, 673-690.

Martin, M., Horder, P., & Jones, G.V. (1992). Integral bias in naming of phobia-related words. *Cognition and Emotion, 6*, 479-486.

Mathews, A., & Mackintosh, B. (2000). Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology, 109*, 602-615.

Mathews, A. (1990). Why worry? The cognitive function of anxiety. *Behaviour research and Therapy, 28*, 455-468.

Mathews, A., & MacLeod, C. (1985). Selective processing of threat cues in anxiety states. *Behaviour Research and Therapy, 23*, 563-569.

Mathews, A., & MacLeod, C. (1994). Cognitive approaches to emotion and emotional disorders. *Annual Review of Psychology, 45*, 25-50.

Mathews, A., Mogg, K., Kentish, J., & Eysenck, M. (1995). Effect of psychological treatment on cognitive bias in generalized anxiety disorder. *Behaviour Research and Therapy, 33*, 293-303.

Mathews, A., & Sebastian, S. (1993). Suppression of emotional Stroop effects by fear-arousal. *Cognition and Emotion, 7*, 517-530.

Mattia, J.I., Heimberg, R.G., & Hope, D.A. (1993). The revised Stroop color-naming task in social phobics. *Behaviour Research and Therapy, 31*, 305-313.

Mogg, K., & Bradley, B.P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36,* 809-848.

Mogg, K., Bradley, B.P., Hyare, H., & Lee, S. (1998). Selective attention to food-related stimuli in hunger: Are attentional biases specific to emotional and psychopathological states, or are they also found in normal drive states? *Behaviour Research and Therapy, 36*, 227-237.

Mogg, K., Bradley, B.P., Miles, F., & Dixon, R. (2004). Time course of attentional bias for threat scenes: testing the vigilance-avoidance hypothesis. *Cognition and Emotion, 18*, 689-700.

Mogg, K., Bradley, B.P., Millar, N., & White, J. (1995). A follow-up study of cognitive bias in generalized anxiety disorder. *Behaviour Research and Therapy, 33*, 927-935.

Mogg, K., Kentish, J., & Bradley, B.P. (1993). Effects of anxiety and awareness on colour-identification latencies for emotional words. *Behaviour Research and Therapy, 31*, 559-567.

Mogg, K., Mathews, A., & Eysenck, M. (1992). Attentional bias to threat in clinical anxiety states. *Cognition and Emotion, 6*, 149-159.

Mogg, K., McNamara, J., Powys, M., Rawlinson, H., Seiffer, A., & Bradley, B.P. (2000). Selective attention to threat: A test of two cognitive models of anxiety. *Cognition and Emotion, 14,* 375-399.

Moradi, A.R., Taghavi, M.R., Neshat Doost, H.T., Yule, W., & Dalgleish, T. (1999). Performance of children and adolescents with PTSD on the Stroop colour-naming task. *Psychological Medicine, 29*, 415-419.

Moradi, A.R., Taghavi, M.R., Neshat Doost, H.T., Yule, W., & Dalgleish, T. (2000). Memory bias for emotional information in children and adolescents with posttraumatic stress disorder. *Journal of Anxiety Disorders, 14*, 521-534.

Morren, M., Kindt, M. van den Hout, M., van Kasteren, H. (2003). Anxiety and the processing of threat in children: Further examinination of the cognitive inhibition hypothesis. *Behaviour Change, 20*, 131-142.

Muris, P., De Jong, P.J., & Engelen, S. (2004). Relationships between neuroticism, attentional control, and anxiety disorders symptoms in non-clinical children. *Personality and Individual Differences, 37*, 789-797.

Muris, P., & Ollendick, T.H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8*, 271-289.

Musa, C., Lepine, C.P., Clark, D.M., Mansell, W., & Ehlers, A. (2003). Selective attention in social phobia and the moderating effect of a concurrent depressive disorder. *Behaviour Research and Therapy, 41*, 1043-1054.

Neshat-Doost, H., Moradi, A., Taghavi, R. Yule, W., & Dalgleish, T. (1999a). Lack of attentional bias for emotional information in clinically depressed children and adolescents on the dot-probe task. *Journal of Child Psychology and Psychiatry, 41*, 363-368.

Neshat-Doost, H., Moradi, A., Taghavi, R. Yule, W., & Dalgleish, T. (1999b). The development of a corpus of emotional words produced by children and adolescents. *Personality and Individual Differences, 27*, 433-451.

Neshat Doost, H.T., Taghavi, M.R., Moradi, A.R., Yule, W., & Dalgleish, T. (1997). The performance of clinically depressed children and adolescents on the modified Stroop paradigm. *Personality and Individual Differences, 23*, 753-759.

Pearson, D.A., & Lane, D.M. (1991). Visual attention movements: A developmental study. *Child Development, 61*, 1779-1795.

Pine, D.S., Klein, R.G., Mannuzza, S., Moulton, J.L., Lissek, S., Guardino, M., & Woldehawariat, G. (2005). Face-emotion processing in offspring at risk for panic disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 44*, 664-672.

Pine, D.S., Mogg, K., Bradley, B.P., Montgomery, L., Monk, C.S., McClure, E., Guyer, A.E., Ernst, M., Charney, D.S., & Kaufman, J. (2005). Attention bias to threat in maltreated children: Implications for vulnerability to stress-related psychopathology. *American Journal of Psychiatry, 162*, 291-296.

Posner, M.I. (1988). Structures and functions of selective attention. In T. Boll, & B. Bryant (Eds.), *Clinical neuropsychology and brain function* (pp. 173-202). Washington, D.C.: American Psychological Association.

Posner, M.I., & Petersen, S.E. (1990). The attention systems of the human brain. *Annual Review of Neuroscience, 13*, 25-42.

Richards, A., Richards, L.C., & McGeeney, A. (2000). Anxiety-related Stroop interference in adolescents. *The Journal of General Psychology, 127*, 327-333.

Rinck, M., & Becker, E.S. (2005). A comparison of attentional biases and memory biases in women with social phobia and major depression. *Journal of Abnormal Psychology, 114*, 62-74.

Rothbart, M.K., & Bates, J.E. (1998). Temperament. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Volume 3. Social, emotional, and personality development* (5th ed., pp. 105-176). New York: Wiley.

Rutherford, E.M., MacLeod, C., & Campbell, L.W. (2004). Negative selectivity effects and emotional selectivity effects in anxiety: Differential attentional correlates of state and trait variables. *Cognition and Emotion, 18*, 711-720.

Schippell, P.L., Vasey, M.W., Cravens-Brown, L.M., & Bretveld, R.A. (2003). Suppressed attention to rejection, ridicule, and failure cues: A unique correlate of reactive but not proactive aggression in youth. *Journal of Clinical Child and Adolescent Psychology, 32*, 40-55.

Schwartz, C.E., Snidman, N., & Kagan, J. (1996). Early temperamental predictors of Stroop interference to threatening information at adolescence. *Journal of Anxiety Disorders, 10*, 89-96.

Silverman, W. & Albano, A.M. (1996). *The Anxiety Disorders Interview Schedule for Children (DSM-IV).* San Antonio: Psychological Corporation.

Sowell, E.R., Thompson, P.M., Holmes, C.J., Jernigan, T.L., & Toga, A.W. (1999). *In vivo* evidence for post-adolescent brain maturation in frontal and striatal regions. *Nature Neuroscience,* 2, 859-861.

Spielberger, C.D. (1973). *Manual for the State-Trait Anxiety Inventory for Children.* Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). *Manual for the state-trait anxiety inventory.* Palo Alto, CA: Consulting Psychologists Press.

Strauss, C.C., Lahey, B.B., Frick, P., Frame, C.L., & Hynd, G.W. (1988). Peer social status of children with anxiety disorders. *Journal of Consulting and Clinical Psychology, 56*, 137-141.

Stroop, J.R. (1938). Factors affecting speed in serial verbal reactions. *Psychological Monograms, 50*, 38-48.

Taghavi, M.R., Dalgleish, T., Moradi, A.R., Neshat-Doost, H.T., & Yule, W. (2003). Selective processing of negative emotional information in children and adolescents with generalized anxiety disorder. *British Journal of Clinical Psychology, 42*, 221-230.

Taghavi, M.R., Neshat-Doost, H.T., Moradi, A.R., Yule, W., & Dalgleish, T. (1999). Biases in visual attention in children and adolescents with clinical anxiety and mixed anxiety-depression. *Journal of Abnormal Child Psychology, 27*, 215-223.

Teasdale, J.D., Segal, Z., & Williams, J.M.G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behaviour Research and Therapy, 33*, 25-39.

Tipper, S.P., Bourque, T.A., Anderson, S.H., & Brehaut, J.C. (1989). Mechanisms of attention: A developmental study. *Journal of Experimental Child Psychology, 48*, 353-378.

Vasey, M.W., Daleiden, E.L., Williams, L.L., & Brown, L.M. (1995). Biased attention in childhood anxiety disorders: A preliminary study. *Journal of Abnormal Child Psychology, 23,* 267-279.

Vasey, M.W., Dalgleish, T., & Silverman, W.K. (2003). Research on information-processing factors in child and adolescent psychopathology: A critical commentary. *Journal of Cilnical Child and Adolescent Psychology, 32*, 81-93.

Vasey, M.W., El-Hag, N., & Daleiden, E.L. (1996). Anxiety and the processing of emotionally threatening stimuli: Distinctive patterns of selective attention among high- and low-anxious children. *Child Development, 67*, 1173-1185.

Vasey, M.W., & MacLeod, C. (2001). Information-processing factors in childhood anxiety: A review and developmental perspective. In M.W. Vasey & M.R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 253-277). New York: Oxford University Press.

Walker, L.S., Smith, C.A., Garber, J., & VanSlyke, D.A. (1997). Development and validation of the pain response inventory for children. *Psychological Assessment, 9*, 392-405.

Waters, A.M., Lipp, O.V., & Cobham, V.E. (2000). Investigation of threat-related attentional bias in anxious children using the startle eyeblink modification paradigm. *Journal of Psychophysiology, 14*, 142-150.

Waters, A.M., Lipp, O.V., & Spence, S.H. (2004). Attentional bias toward fear-related stimuli: An investigation with nonselected children and adults and children with anxiety disorders. *Journal of Experimental Psychology: General, 89,* 320-337.

Wikstrom, J., Lundh, L., & Westerlund, J. (2003). Stroop effects for masked threat words: Pre-attentive bias or selective awareness? *Cognition and Emotion, 17*, 827-842.

Williams, J.M.G., Watts, F.N., MacLeod, C., & Mathews, A. (1988). *Cognitive Psychology and Emotional Disorders.* Chichester: Wiley.

Williams, J.M.G., Watts, F.N., MacLeod, C., & Mathews, A. (1997). *Cognitive Psychology and Emotional Disorders* (2nd ed.). Chichester: Wiley.

Wilson, E., & MacLeod, C. (2003). Contrasting two accounts of anxiety-linked attentional bias: Selective attention to varying levels of stimulus threat intensity. *Journal of Abnormal Psychology, 112*, 212-218.

Yaklovev, P.I., & Lecours, A.R. (1967). The myelogenetic cycles of regional maturation of the brain. In A. Minkowski (Ed.), *Regional development of the brain in early life* (pp. 3-70). Oxford, England: Blackwell Scientific.

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *The Quarterly Journal of Experimental Psychology, 54A*, 665-681.

Zald, D.H., & Iacono, W.G. (1998). The development of spatial working memory abilities. *Developmental Neuropsychology, 14*, 563-578.