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Individual Differences in Temperament and Cognitive Biases in Middle Childhood: Vulnerability to Internalizing Psychopathology

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A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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Abstract

A multi-trait multi-method study was conducted exploring associations between individual differences in child temperament and cognitive vulnerability for depression and anxiety. Two-hundred and five 7-year-old children and their parents participated. Low positive emotionality and high negative emotionality predicted a depressogenic attributional style as well as attentional biases for positive and sad stimuli. Individual differences in child fearfulness were also associated with attentional biases to threat-related information. Associations between child cognitive vulnerability and parental history of depression and anxiety were also explored, as well as associations between child internalizing symptoms and (1) child temperament and (2) cognitive vulnerability. Paternal, but not maternal depression, was associated with child cognitive vulnerability for depression. Child current symptoms of depression and anxiety were related to both individual differences in child temperament and markers of cognitive vulnerability for depression and anxiety.

Keywords

Temperament, Depression, Anxiety, Cognitive Vulnerability, Attention, Attributional Style, Schematic Processing, Automatic Thoughts

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Chapter 1

1 Introduction

Depressive and anxiety disorders are highly prevalent among adults in North America (e.g., Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005; Kessler, Chiu, Demler, & Walters, 2005; Offord, Boyle, Campbell, Goering, Lin, & Wong, 1996), and are associated with significant impairment and social costs (e.g., Kessler, Berglund, Demler, Jin, Kortez, Merinkangas, et al., 2003; Lepine, 2002; Nock, Hwang, Samson, & Kessler, 2010; Olatunji, Ciselr, & Tolin, 2007; Waghorn, Chant, White, & Whiteford, 2005). Although less prevalent in children (e.g., Costello, Foley, & Angold, 2006; Merikangas, He, Burstein, Swanson, Avenevoli, Cui, et al., 2010; Rapee, Schniering, & Hudson, 2009), early onset leads to a more chronic and severe course (Essau, Conradt, & Peterman, 2002; Garber, Kriss, Koch, & Lindholm, 1998; Roza, Holstra, van der Ende, & Verhulst, 2003; Weems, 2008), interferes with academic and social achievements (Asendorpf, Denissen, & van Aken, 2008; Ashcraft, 2002; Cole, 1990; Crozier & Hostettler, 2003; Owens, Stevenson, Norgate, & Hadwin, 2008), and is associated with the development of other mental health problems (Lewinsohn, Holm-Denoma, Small, Seeley, & Joiner, 2008; Roza et al, 2003). Early identification and intervention provide an opportunity to reduce the impact of these disorders, but require a clear understanding of vulnerability.

Family risk studies indicate that both depression and anxiety aggregate in families. Offspring studies, for example, demonstrate up to a threefold increase in risk related to parental depression (e.g., Lieb, Isensee, Hofler, Pfister, & Wittchen, 2002; Weissman, Warner, Wickramarante, Moreau, & Olfson, 1997; Williamson, Birmaher, Axelson, Ryan, & Dahl, 2004). Maternal depression is a particularly strong indicator of depression risk (e.g., Hammen, Brennan, & Keenan-Millier, 2008; for a review see Gotlib, Joorman, Minor, & Cooney, 2006), and recent research suggests that children with a history of both parental and grandparental depression are at significant risk for the development of depression (e.g., Pettit, Olino, Roberts, Seeley, & Lewinsohn, 2008). Likewise, children of anxious parents demonstrate higher rates of anxiety disorders than children of non-anxious parents (e.g., Biederman, Rosenbaum, Bolduc, Faraone, & Hirshfeld-Becker, 1991; Hirshfeld-Becker, Micco, Simoes, & Henin, 2008; Micco, Henin, Mick, Kim, Hopkins, Biederman, & Hershfeld-Becker, 2009). A recent meta-analysis, for

example, suggests that children of anxious parents are four times more likely to develop an anxiety disorder than children of parents without any psychopathology, and twice as likely as offspring from a psychiatric control group (Micco et al., 2009).

Although family history is strongly associated with increased risk for depression and anxiety, the mechanisms by which vulnerability for these disorders is transmitted remains unclear, and delineating pathways of vulnerability is complicated by several factors. Depression and anxiety, for example, are highly comorbid (e.g., Axelson & Birmaher, 2001; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Sorensen, Nissen, Mors, & Thomsen, 2005), and children of depressed or anxious parents demonstrate high rates of internalizing psychopathology in general (e.g., Beidel & Turner, 1997; Micco et al., 2009; Williamson et al., 2004). These findings suggest some shared vulnerability. Identifying early-emerging markers of vulnerability, and studying their role in the development of depression and anxiety, will help to clarifying the mechanisms involved in the development of these disorders by distinguishing between risk factors uniquely associated with depression or anxiety, and by highlighting the role of potentially interacting factors. One possible marker of vulnerability is temperament (see Silberg & Rutter, 2002).

Defined as early-emerging individual differences in emotional reactivity and regulation (Rothbart & Bates, 2006), temperament is partially heritable (see Gange, Vendlinksi, & Goldsmith, 2009), and moderately stable across development (e.g., Caspi, 2000; Durbin, Hayden, Klein, & Olino, 2007; Roberts & DeVecchio, 2000). Many theorists have posited a relation between temperament and risk for internalizing disorders (e.g., Clark, Watson, & Mineka, 1994; Meehl, 1975) and there is growing empirical evidence that early individual differences in temperament are associated with increased vulnerability to depression and anxiety (e.g., Dougherty, Klein, Durbin, Hayden, & Olino, 2010; Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Schwartz, Snidman, & Kagan, 1999). Furthermore, consistent with research demonstrating familial risk, there is also evidence linking individual differences in child temperament to parental history of depression (e.g., Durbin et al., 2005; Hayden et al., 2005; Olino et al., 2010; Olino, Lopez-Duran, Kovacs, George, Gentzler, & Shaw, 2010) and anxiety disorders (e.g., Battaglia, Bajo, Strami, Brambilla, Castronovo, Canni, et al., 1997; Biederman et al., 2001; Kelvin, Goodyer & Altham, 1996; Manassis, Bradley, Goldberg, & Hood, 1995; Masi, Mucci, Favilla, Brovendini, Millipiedi, & Perugi, 2003; Rosenbaum, Biederman, Gersten,

Hirshfeld, Meminger, Herman, et al., 1988). Taken together, these findings suggest that children inherent a temperamental disposition that predisposes them to the development of depression or anxiety (Costello et al., 2002; Silberg & Rutter, 2002).

Identifying the mechanisms by which temperament confers risk is important in further understanding patterns of comorbidity and familial aggregation, as well as in the development of early intervention and prevention strategies to reduce the impact of internalizing disorders. Although the precise mechanisms remain unclear, temperament is likely to shape adaptive and maladaptive adjustment through an array of processes, both by influencing a child's responses to the environment and by eliciting patterns of environmental feedback (Clark & Watson, 1999; Rothbart & Bates, 1998; Shiner, 2000, 2006). Individual differences in temperament, for example, are likely to influence peer relations, parenting style, academic accomplishments and mastery experiences, as well as niche-picking behaviour and individual differences in reactivity to stress (Depue & Collins, 1999; Frederickson, 2001; Meehl, 1975; Rutter, 1990; Rutter et al., 1997; Shiner, 2000, 2006).

A potentially important mechanism through which temperament may confer risk for internalizing disorders is through its influence on cognition and the development of maladaptive patterns of information processing (e.g., Davidson et al., 2002; Depue & Collins, 1999). A number of prominent models have linked affective style or temperament to individual differences in sensitivity to environmental rewards and punishments, as well as differences in motivational drives for behavioural approach or withdrawal (i.e., Behavioral Activation System/Behavioral Inhibition System; Clark, 2005; Depue & Collins, 1999; Davidson, 1992, 1998; Fowles, 1994; Gray, 1990). According to these models, depression vulnerability is associated with diminished activation of the behavioural approach system and reduced sensitivity to environmental rewards, while anxiety vulnerability is associated with heightened activation of the withdrawal system and increased sensitivity to punishment. Such individual differences have important implications for information processing. A propensity to approach or withdraw, for example, will systematically affect an individual's level of social and environmental engagement, biasing the types of information available for cognitive processing. Likewise, individual differences in sensitivity to rewards and punishments will influence one's interpretations of events (i.e., as more or less pleasurable or aversive). Variability in motivational drives is also likely to affect attention by

promoting individual differences in orienting toward or away from particular types of environmental stimuli. Low approach motivation and diminished sensitivity to positive reinforcement, for example, may make positive stimuli less salient to the attentional system, resulting in reduced orienting towards positive information. Likewise, a heightened motivation to withdraw and an increased sensitivity to punishment may make negative or threatening stimuli more salient, leading to greater attentional orienting toward negative information. Over time, these differences are likely to shape one's higher-order representations of the world and expectations for future events.

Such temperament-cognition interactions are useful in understanding specific pathways in the development of depression and anxiety. Based on Meehl's (1975) earlier conjecture, for example, Hamburg (1998) argues that a diminished hedonic capacity (i.e., the ability to experience pleasure) leads to a decrease in sensitivity to positive reinforcement. According to Hamburg (1998) the intermittent schedule of reinforcement typical of everyday events is experienced by those with low hedonic capacity as an extinction schedule. Coupled with a low motivation to seek out positive experiences, this pattern of reinforcement leads to limited mastery experiences, increased negative affect, a general sense of helplessness, and the development of a negative explanatory style thought to confer vulnerability for depression (Hamburg, 1998; see Davidson et al. 1992 and Collins and Depue, 1999 for further discussion of the role of temperament in shaping cognitive vulnerability to depression).

Similarly, anxiety vulnerability is linked to attentional biases to threat, which could be shaped by temperament. The primary function of the Behavioral Inhibition System, for example, is to increase vigilance and promote the attentional selection of threat-related information (LeDoux, 2000). Heightened stress and fearfulness, therefore, promote attentional narrowing, and this attentional narrowing has a direct impact on subsequent emotional and cognitive processes (e.g., Mathews, 1990). The saliency of potentially punishing or threatening information, for example, will lead to greater exposure to and processing of threat-related information, and promote the formation of representations of the world as dangerous. Such higher-order representations will provide top-down support of continued hyper-vigilance for threat, while tendencies to withdraw from novelty will provide little opportunity to experience contradictory positive reinforcement. Over time, these biases in information processing are likely to affect cognition across a number

of domains (e.g., social information processing, representations of the self and the world) and will contribute to the continuity of temperamental fearfulness and the development of anxiety (see Fox, Henderson, Marshall, Nichols, & Ghera, 2005 for review).

One hypothesis, then, is that the association between early emerging individual differences in temperament and the onset of internalizing psychopathology is mediated by the development of cognitive vulnerability. Although these temperament-cognition interactions are important across development, the effects of individual differences in temperament are likely to be particularly striking in early to middle childhood when cognitive structures and functions are developing (see Goswami, 2011 for review) and individual differences in temperament are becoming stable (Caspi, 2000). Furthermore, middle childhood is a period in which rates of depressive disorders remain low (Garber & Horowitz, 2002), making it a good time to begin the study of the role of temperament-cognition interactions on the development of internalizing disorders, as associations between temperament and cognition can be clearly identified without the potentially confounding effects of symptoms of psychopathology.

Using a multi-trait/multi-method design, this study explores associations between individual differences in child temperament and cognitive vulnerability in a large community sample of 7-year-old children. Of particular interest is whether specific variations in temperament will be differentially associated with particular patterns of cognitive vulnerability uniquely associated with depression or anxiety. Given that children of parents with depression or anxiety are at particularly high risk to develop these disorders, it is also hypothesized that parental history of depression or anxiety will be associated with child cognitive vulnerability.

Chapter 2

2 Literature Review

2.1 Temperament and Internalizing Psychopathology

Theoretical models of the association between temperament and psychopathology have focused on individual differences in the propensity towards positive and negative emotions, as well as individual differences in sensitivity to environmental rewards and punishments (Clark et al., 1994; Davidson, 1992; Depue & Collins, 1999; Gray, 1990). Two of the primary constructs of

interest in major models of temperament are positive emotionality and negative emotionality (Clark & Watson, 1991, 1999), which are generally considered orthogonal dimensions (Chorpita, Daleiden, Moffit, Yim, & Umemoto, 2000; Laurent, Catanzaro, & Joiner, 2004). A number of different terms have been used in the literature to describe the construct of positive emotionality (PE), including positive affectivity and extraversion (see Klein, Durbin, & Shankman, 2009 for review). PE and related constructs, however, are generally characterized across theoretical models by positive mood, sensitivity to rewards, appetitive behaviour, sociability, and surgency (Clark & Watson, 1991; 1999; Shiner & Caspi, 2003). Major models of temperament characterize negative emotionality (NE) as consisting of negative mood reactivity, anger, irritability, sadness, and fearfulness (Clark & Watson, 1991; 1999).

One of the most influential models of temperament-psychopathology relations, the tripartite model (Clark et al., 1994), posits that high levels of NE confer general vulnerability for internalizing disorders, and that low PE is specifically related to depression vulnerability. The tripartite model further posits that individual differences in a third factor, physiological arousal, are uniquely related to anxiety vulnerability. On this account, depression vulnerability is associated with high NE and low PE, while anxiety vulnerability is characterized by high NE and high physiological arousal. In a more recent model, Clark (2005) argues that vulnerability for psychopathology is related to individual differences in three innate bio-behavioural dimensions: PE, NE, and disinhibition. This model argues that the activation of the two emotional systems, PE and NE, are manifested as general behavioural systems of approach/withdrawal, respectively, and that these systems are regulated by the third dimension, inhibition/disinhibition. According to this model, high NE is related to a broad range of psychopathology, including both depression and anxiety, while low PE is more specifically related to depression.

Research using concurrent self-report measures of temperament and symptoms of anxiety and depression provides general support for the tripartite model in community and clinical samples of adults (e.g., Beck, Benedict, & Wrinkler, 2003; Brown, Chorpita, & Barlow, 1998; Clark et al., 1994; Cook, Orvaschel, Simco, Hersen, & Joiner, 2004; Joiner, Steer, Beck, Schmidt, Rudd, & Catanzano, 1999) and children (e.g., Anderson & Hope, 2008; Austin & Chorpita, 2004; Chorpita et al., 2000; Fox, Halpern, Ryan, & Lowe, 2010; Jacques & Mash, 2004; Joiner & Lonigan, 2000; Lonigan, Carey, & Finch, 1994). Longitudinal studies suggest that high NE is a

general risk factor for the development of either depression or anxiety (e.g., Clark et al., 1994; Lonigan, Phillips, & Hooe, 2003), and there is some limited longitudinal work supporting the specific hypothesized relations between low PE, high NE, and the development of depression. Specifically, two studies have reported relations between diminished approach-related behaviours and apathy in childhood, and the subsequent development of depression (Caspi, Moffit, Newmann, & Silva, 1996; van Os, Jones, Lewis, Wadsworth, & Murray, 1997). Furthermore, research using both laboratory and parent-report measures of child temperament, report that lower PE at age 3 predicts greater depressive symptoms at age 10, and that children with both low PE and high NE demonstrate the greatest increase in depressive symptoms over time (Dougherty et al., 2010).

The most influential model of temperamental vulnerability for anxiety has come from developmental research with young children focusing on fearfulness and behavioural inhibition (BI). BI refers to the tendency to be fearful or wary in response to novelty, and may also be associated with an increased sensitivity to punishment, as well as diminished social and environmental exploration (Fox et al., 2005; Hirshfeld-Becker, Micco, Henin, Bloomfield, Biederman, & Rosenbaum, 2008, Kagan, 1997; Kagan, Reznick, & Snidman, 1988). According to this account, anxiety vulnerability is associated with heightened BI.

Individual differences in child fearfulness and BI are associated with concurrent symptoms of anxiety (e.g., Biederman, Hirshfeld-Becker, Rosenbaum, Herot, Friedman, Snidman et al., 2001; Goldsmith & Lemery, 2000; Muris, Bos, Mayer, Verkade, Thewissen, & Dell-Awento, 2009; Muris, Mercklbach, Schmidt, Gaget, & Bogie, 2001; Muris, Mercklbach, Wessel, & Van de Ven, 1999). Retrospective studies demonstrate positive associations between self-reported childhood BI and lifetime history of anxiety disorders (e.g., Gladstone, Parker, Mitchell, Wilhelm, & Malhi, 2005). Individual differences in child fearfulness and BI also prospectively predict the onset of anxiety disorders (e.g., Biederman, Rosenbaum, Bolduc-Murphy, & Faraone, 1993; Goldsmith & Lemery, 2000; Hayward, Killen, Kraemer, & Taylor, 1998; Hirshfeld-Becker, Biederman, Henin, Faraone, Davis, Harrington, & Rosenbaum, 2007; Schwartz et al., 1999). In one study, for example, adolescents who had been classified as inhibited as infants demonstrated higher rates of social anxiety than adolescents who had been classified as uninhibited (Schwartz et al., 1999). Likewise, laboratory assessed behavioural inhibition during the preschool period

has been shown to prospectively predict the onset of social anxiety in middle childhood (Hirshfeld-Becker et al., 2007).

Further support for temperament-psychopathology linkages comes from offspring studies demonstrating associations between parental depression or anxiety and child temperament. Infants and toddlers of depressed mothers, for example, have been reported to exhibit diminished positive affect and environmental engagement (Field, 1992; Neff & Klein, 1992). Research using a temperamental framework has reported an association between low PE in young children and parental history of depression (Durbin et al., 2005; Hayden et al., 2005). One study, for example, demonstrated a specific association between low child PE and maternal depression, but not other forms of maternal psychopathology (Durbin et al., 2005). Likewise, individual differences in child BI are associated with parental history of anxiety disorders (e.g., Battaglia, Bajo, Strami, Brambilla, Castronovo, Canni, et al., 1997; Biederman et al., 2001; Kelvin, Goodyer & Altham, 1996; Manassis, Bradley, Goldberg, & Hood, 1995; Masi, Mucci, Favilla, Brovendini, Millipiedi, & Perugi, 2003; Rosenbaum, Biederman, Gersten, Hirshfeld, Meminger, Herman, et al., 1988). Finally, consistent with the tripartite model, one recent study found that high levels of child NE are related to both parental depression and parental anxiety (e.g., Olino et al., 2010).

Taken together, these findings are consistent with the hypothesis that children inherent a temperamental disposition that may predispose them to the development of internalizing psychopathology. Little attention, however, has been given to delineating the mechanisms through which individual differences in temperament may confer vulnerability for depression and anxiety. A number of factors are likely to interact with temperament in conferring vulnerability for depressive and anxiety disorders, such as parenting (e.g., Coplan, Arbeau, & Armer, 2008; Hudson, Comer, & Kendall, 2008; Lengua & Kovacs, 2004; Rubin, Brugess, & Hastings, 2002) and peer relations (e.g., Gleason, Gower, Hohmann, & Gleason, 2005; Rubin, Wojslawowicz, Rose-Krasnor, Booth-LaForce, & Burgess, 2006). The association is also likely to be mediated by individual differences in cognition. Specifically, temperament may interact with information processing, shaping the development of maladaptive patterns of cognition that confer vulnerability for depression or anxiety (see Davidson et al., 2002; Depue & Collins, 1999; Jordon & Morton, in press). The following section provides brief review of the literature on

cognitive vulnerability for depression and anxiety, and motivates hypotheses regarding temperament-cognition associations.

2.2 Temperament, Cognition, and Internalizing Psychopathology

Biases in information processing are central to cognitive models of internalizing disorders, which argue that depression and anxiety are produced and maintained by the preferential processing of mood-congruent information (e.g., Abramson, et al.,1989; Beck, 1976; Mathews & Mackintosh, 1998; Mathews & MacLeod, 2005; Mogg & Bradley, 1998; Williams, et al., 1997). According to cognitive models of depression, vulnerability is characterized by an increased processing of negative information, as well as a diminished processing of positive information. Beck's (1967; 1976) cognitive theory of depression, for example, posits that individuals prone to depression possess negative schemas about the self, the world, and the future, which centre around themes of disappointment, rejection, and loss. When activated, negative schemas influence the selection, encoding, and retrieval of information, giving preference to negative and filtering out positive information. On this account, cognitive vulnerability is observed both in the content of self-schemas as well as in memory biases for negative over positive information, particularly with respect to information that is self-referent. This style of preferential processing promotes negative patterns of thinking, and produces and maintains states of depression. Another major model, hopelessness theory (Abramson et al., 1989), argues that depression vulnerability is associated with a maladaptive attributional style. By this account, tendencies to attribute negative events to internal, global, and stable causes, while attributing positive events to external, specific, and unstable causes, leads to a sense of hopelessness, which is argued to be a proximal and sufficient cause of depression.

Similarly, cognitive vulnerability to anxiety is characterized by the preferential processing of threat-related information. According to Beck's model (1976), danger- or threat-related schemas bias cognition at multiple levels of processing. In contrast, contemporary models have focused on biases in early attentional selection or orienting, describing vulnerability as an attentional hyper-vigilance for threat (e.g., Eysenck, 1992; Mogg & Bradley, 1998; Williams et al., 1997). Cognitive models differ with respect to characterizations of the role of later, more strategic attentional processes, with some arguing that anxiety is related to difficulties disengaging attention from threat (e.g., Fox, Russo, Bowles, & Dutton, 2001; Fox, Russo, & Dutton, 2002;

Yiend & Mathews, 2001), and others suggesting that there is a strategic avoidance of threatening information in later stages of processing (e.g., Amir, Foa, & Coles, 1998; Mogg, Bradley, De Bono, & Painter, 1997). There is, however, a general consensus that anxiety vulnerability is related to an increased processing of threatening information, which serves to produce and maintain states of anxiety, disrupt goal-directed behaviour, and reinforces attentional biases to threat (see Cisler & Koster, 2010 for review).

A rich history of empirical data supports cognitive models of depression (see Gotlib & Joorman, 2010 for a recent review). Consistent with Beck's model, the content of the self-schemas of currently depressed adults and children are more negative and less positive than their non-depressed counterparts (e.g., Dozois & Dobson, 2001; Dozois & Beck, 2008; Gencoz, Voelz, Gencoz, Pettit, & Joiner, 2001; Neshat-Doost, Taghavi, Moradi, Yule, & Dagleish, 1998; Simmons, Cooper, Drinkwater, & Stweart, 2006; Timbremont, Braet, Bosmans, & Van Vlierberghe, 2008). Reliable associations are also found between depression and a negative attributional style (e.g., Fresco, Alloy, & Reilly-Harrington, 2006; Gladstone & Kaslow, 1995). Memory biases for negative information and impaired memory for positive information are evident both in depressed adults (e.g., Gotlib, Kasch, Traill, Joormann, Arnow, & Johnson, 2004; Levens & Gotlib, 2009; Mathews & MacLeod, 2005) and children (e.g., Hughes, Worchel, Stanton, Stanton, & Hall, 1990; Neshat-Doost et al, 1998; Timbremont et al., 2008). Finally, although data on attentional biases in depression are mixed (see Gotlib et al. 2004 and Mathews & MacLeod, 1994 for reviews), recent research suggests that depression is related to increased attention towards negative information and decreased attention towards positive information when stimuli are presented for longer durations or when pictorial stimuli are used rather than linguistic stimuli (e.g., Bradley, Mogg, & Millar, 2000; Caseras, Garner, Bradley & Mogg, 2007; Kujawa, Torpey, Kim, Hajcak, Rose, Gotlib, & Klein, 2011; Leyman De Raedt, Schacht, & Koster, 2007; Mogg, Bradley & Williams, 1995).

Strong support also exists for cognitive models of anxiety, particularly with respect to biases in attention towards threatening information (e.g., Bar-Haim et al., 2007; Cisler et al., 2009; Mogg & Bradley, 1998; Williams et al., 1996). In a recent meta-analysis, for example, Bar-Haim and colleagues (2007) argue that attentional biases to threat are a relatively robust phenomenon - observable across age and anxiety diagnoses, as well as across a number of different tasks (i.e.,

emotional Stroop and emotional dot-probe tasks), stimulus modalities (i.e., linguistic and pictorial stimuli), and experimental manipulations (e.g., varying the duration of stimulus exposure). Recent research exploring the attentional components involved in threat-related biases provides support for hypotheses that anxiety is related to both a hyper-vigilance for threatening information (Mogg & Bradley, 1998, 2002, 2006; Vassilopoulos, 2005) as well as difficulties disengaging attention from threatening information (e.g., Buckner, Maner, & Schmidt, 2010; Fox et al. 2001, 2002; Koster, Crombez, Verschuere, & De Houwer, 2004; Salemink, van den Hout, & Kindt, 2007; Yiend & Mathews, 2001; see Cisler et al., 2009 and Cisler & Koster, 2010 for reviews). A significant literature exploring associations between anxiety and attention in children also provides support for cognitive models of anxiety vulnerability (see Hadwin & Field, 2010 for review). Finally, although data have been mixed, there is some support for the hypothesis that anxiety is related to biases at other levels of information processing, such as memory biases for threat-related information (e.g., Coles, Turk, & Heimberg, 2007; Watts & Weems, 2006), biases in the interpretation of ambiguous stimuli (e.g., Muris, 2010), and the presence of anxious automatic thoughts and cognitive errors (e.g., Schniering & Rapee, 2004a; Watts & Weems, 2006).

Importantly, from a developmental perspective, there is some evidence looking at cognition prospectively, particularly with respect to depression vulnerability. The Temple-Wisconsin Cognitive Vulnerability to Depression Project (CVD; Alloy & Abramson, 1999), for example, followed college students hypothesized to be at high or low cognitive risk for depression. In a series of follow-up assessments, negative cognitive style predicted first onset and recurrences of depressive disorders (Alloy, Abramson, Whitehouse, et al., 1999; Alloy Abramson, Whitehouse, Hogan, Panzarella, et al., 2006; Alloy, Abramson, Safford, & Gibb, 2006), and those at high cognitive risk demonstrated a more severe and chronic course of depression than their low risk counterparts (Iacoviello, Alloy, Abramons, Whitehouse, & Hogan, 2006). Similar results have been reported in other short-term prospective studies of college students (Sanjuan & Magallares, 2009), adolescents (e.g., Abela, Parkinson, Stowlow, & Starrs, 2009; Abela & Sullivan, 2003; Hankin, Abramson, & Siler, 2001; Lewinsohn, Joiner, & Rhode, 2001), and children (e.g., Conley, Haines, Hilt & Metalsky, 2001; see Abela & Hankin, 2008 and Lakdawalla, Hankin, & Mermelstein, 2007 for reviews). It is important to note, however, that the majority of prospective data comes from studies with adolescents and adults, and much of the prospective research with

children uses only self-report measures (e.g., Abela & Hankin, 2008). Although there are a number of recent studies exploring short-term prospective relations between cognitive vulnerability and symptoms of depression in children, with the exception of one study (Conley et al., 2001), there is no prospective research that assesses cognitive vulnerability in children under 8-years-old. The current study will add to this literature by assessing cognitive vulnerability in a sample of 7-year-old children. Although the data presented in this paper are cross-sectional, they will provide the baseline for a series of longitudinal studies that will contribute significantly to this literature.

To date, there is a dearth of prospective studies of the role of information processing biases in the development of anxiety. Recent research, however, has shown that threat-related attentional biases can be experimentally manipulated, and that such manipulations directly affect anxiety in both adults (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Mathews & MacLeod, 2002) and children (Eldar, Ricon, & Bar-Haim, 2008). These data provide support for the hypothesis that threat-related attentional biases play a causal role in the development of anxiety. Further research exploring the origins and developmental implications of threat-related anxiety biases, however, are needed.

Finally, there is an emerging literature exploring cognitive vulnerability in high-risk samples (i.e., children of parents with depression or anxiety). Children of depressed mothers, for example, demonstrate more negative attributional styles, more negative self-schemas, and more negative interpretations of ambiguous stimuli than children of mothers without depression (Dearing & Gotlib, 2009; Garber & Robinson, 1997; Jaenicke, Hammen, Zupan, & Hiroto, 1987). Furthermore, a recent series of papers demonstrates attentional biases in children of depressed parents. Specifically, one study demonstrated increased attentional biases towards negative stimuli and decreased attention towards positive stimuli in daughters of depressed mothers as compared to a non-psychiatric control group (Joormann et al., 2007). Another study reports attentional biases for sad faces in a group of 5- to 7-year-old daughters of depressed mothers (Kujawa et al., 2011).

2.3 Summary & Rationale for Current Study

Although there is strong support for individual differences in temperament as an early marker of risk for depression and anxiety, the existing literature is characterized by a number of limitations. First, with the exception of a few longitudinal studies (e.g., Dougherty et al., 2010; Hirshfeld-Becker et al., 2010; Schwartz et al., 1999), the majority of research examines cross-sectional or retrospective relations between temperament and internalizing symptoms, often in adolescents or adults (e.g., Beck et al., 2003; Clark et al., 1994; Cook et al, 2004; Gladstone et al., 2005). Second, a large proportion of the research on the role of temperament in conferring vulnerability for depression or anxiety uses high risk samples (i.e., children of parents with depression or anxiety; e.g., Biderman et al., 2011; Rosenbaum et al., 1988, 2000). This is problematic, because offspring studies may confound the effects of child temperament with unique characteristics of parent-child interactions (i.e., the effects of being raised by a parent with depression or anxiety). Research indicates, for example, that depressed parents demonstrate less warmth and greater negativity towards their children, and are likely to model thoughts and behaviours associated with depression (e.g., Downey & Coyne, 1990; Foster, Carger, & Durlack, 2008; Foster et al., 2008; Goodman & Golib, 1999; Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Wilson & Durbin, 2010). Likewise, anxious parents may model anxiety-related thoughts and behaviours, and demonstrate either an over-protective or critical style of parenting as a result of their own anxiety (e.g., Hirshfeld, Biederman, Brody, Faraone, et al., 1997; Knappe, Lieb, Beesdo, Fehm, Chooi Ping Low, Gloster, & Wittchen, 2009). Indeed, research indicates that this type of parenting style mediates relations between child BI and the development of anxiety disorders (e.g., Coplan, Arbeau & Armer, 2008). Examination of the association between temperament and vulnerability in a community sample, therefore, is required to adequately test the predictive power of this association while reducing the confounds of other parenting factors.

Third, research with children often relies solely on parent-report measures of child behaviour. Parent-report measures of child temperament, however, have been shown to demonstrate limited predictive validity of child internalizing psychopathology and to correlate only moderately with laboratory assessments of child behaviour (e.g., Hayden et al, 2005; Mesman & Koot, 2001). Several reasons may account for this finding. Many parents, for example, may lack a normative basis for rating their child's behaviour. Personality- or psychopathology-related biases in parent-

reports of child behaviour may also be contributing to these discrepancies. Several studies demonstrate, for example, that mothers with depression over-report child behaviour problems and depressive symptoms (e.g., Gartstein, Bridgett, Dishion & Kaufman, 2009; Jensen, Traylor, Xenakis, & Davis, 1988; Youngstrom, Izard, & Ackerman, 1999). Another study (Hayden, Durbin, Klein, & Olino, 2010) demonstrated that maternal NE moderated relations between maternal reports and laboratory measures of child temperament. Specifically, this study showed greater convergence in maternal ratings and laboratory measures of child negative emotions for mothers high in NE than mothers low in NE. These findings indicate that parental personality and psychopathology can have a substantial impact on perspectives and reporting patterns of child behaviour.

An alternative to the use of parent reports is the use of laboratory assessment measures. Although laboratory assessment of child temperament correlates with both parental history of internalizing psychopathology and child symptoms of depression and anxiety (e.g., Dougherty et al., 2010; Durbin et al., 2005; Hayden et al., 2005; Hirshfeld-Becker et al., 2007), the exclusive use of this type of assessment is also problematic. Laboratory assessments, which are typically restricted to a single observation, are usually limited in terms of the amount of behaviour observed. Furthermore, the novel and controlled environment of a laboratory assessment may cause some children to behave in way that is different from their typical behaviour. In the absence of a gold-standard for the assessment of child temperament, therefore, a multi-method approach, employing both parent-report and behavioural measures is warranted (Kagan, 2009).

One of the major limitations of existing research is that very little employs a temperament framework, leading to the assessment of behaviours that are only indirectly related to temperament, such as apathy or shyness (e.g., Caspi et al. 1996; Coplan et al. 2008). This is problematic in that the underlying motivational or emotional drives related to these behaviours are not clearly specified. Temperament traits are more operationally defined and are directly linked to theoretical models of vulnerability, and are, therefore, likely to provide more meaningful information regarding the nature of temperament-psychopathology associations. Recent studies using a temperament framework (e.g., Durbin et al. 2005; Hayden et al., 2005; Olino et al., 2010) have demonstrated consistent links between child temperament, parental history of depression and anxiety, and child internalizing psychopathology. The current literature

on relations between parental depressive and anxiety disorders and child temperament, however, remains small, and the findings are mixed. Some research, for example, has linked high BI with parental history of mood disorders (e.g., Kochanska, 1991; Olino et al., 2008; Rosenbaum et al., 1988, 2000).

Finally, little attention has been given to delineating the mechanisms through which individual differences in temperament may confer vulnerability for depression and anxiety. One possible mechanism is through its influence on cognitive processing. Positive affect, for example, has been linked with individual differences in cognitive flexibility and creativity (Ashby, Isen, & Turkin, 1999; Fredrickson, 2001), and individual differences in personality (e.g., neuroticism and extraversion) are associated with attentional biases for positive and negative information (e.g., Derryberry & Reed, 1994). On this account, individual differences in child temperament may predispose children to the development of maladaptive patterns of cognition, that mediate longitudinal associations between temperament and internalizing psychopathology (e.g., Dougherty et al., 2010; Goldsmith & Lemery, 2000; Hankin & Abramson, 2001; Hirshfeld-Becker et al., 2007).

There is some research linking temperament, cognitive vulnerability, and the development of symptoms of depression in adults. One study, for example, reports that individual differences in NE predicted depressive symptoms in a group of young adults, and that this association was mediated by both stress generation and cognitive vulnerability (Lakdawalla & Hankin, 2008). In another study, temperament was shown to moderate the relationship between stress and cognitive vulnerability (Mezuliz, Hyde, & Abramson, 2006). There is a small literature examining associations between child temperament and cognitive biases. In one study, for example, low PE at age 3 predicted greater interpersonal helplessness, and diminished positive schematic processing at age 7 (Hayden, Klein, Durbin, & Olino, 2006).

There is also emerging evidence of associations between temperament and cognitive vulnerability for anxiety. One study, for example, demonstrated cross-sectional associations between high NE and attentional biases to threat-related stimuli (Lonigan & Vasey, 2009). Another study (Perez-Edgar, Bar-Haim, McDermott, Chronis-Tuscano, Pine, & Fox, 2010) demonstrated a longitudinal relation between BI in childhood and threat-related attentional biases in adolescence. These authors argue that individual differences in threat-related attentional

biases moderate relations between childhood BI and social withdrawal in adolescence, suggesting that the development of cognitive biases contributed to the stability of BI across development.

The purpose of the current study is to build on previous research by examining linkages between PE, NE, and BI in childhood and established markers of vulnerability to depression and anxiety. Specifically, the primary aim of the study is to explore the relations between temperament and patterns of cognition thought to confer vulnerability to these disorders, in a community sample of children. The current study is an advance in that it uses multiple methods for assessing child temperament and cognitive vulnerability: child temperament is measured using parent-report and laboratory assessment methods; and cognitive vulnerability is assessed through a number of experimental tasks, laboratory tasks, and child self-report questionnaires. This study will also assess multiple temperament traits (PE, NE, and BI), allowing for an examination of the specificity of such traits to patterns of cognitive vulnerability. While there is some emerging research exploring associations between parental depression and cognitive vulnerability in offspring, a significant proportion of this small research base has been with older children or adolescents, and none has explored anxiety-related cognitive vulnerability in offspring. This study will add to this literature by exploring associations between child cognitive vulnerability and parental depression and anxiety in a younger population. Although not the primary purpose of this study, the data will also contribute to the growing literature exploring associations between temperament and internalizing disorders as well as between cognitive vulnerability and symptoms of depression and anxiety.

2.4 Hypotheses

2.4.1 Hypotheses 1: Temperament & Cognition

It was hypothesized that individual differences in child temperament would be associated with patterns of cognition linked with vulnerability for depression and anxiety. Specifically, low PE and high NE were hypothesized to be associated with cognitive biases associated with depression vulnerability, such as a depressogenic attributional style, and a more negative and less positive self-schema. Although the evidence on attentional biases as a vulnerability marker for depression is mixed, some research has demonstrated associations between attentional biases for negatively

valenced stimuli and depression (e.g., Caseras et al., 2007; Leyman et al., 2007; Mogg et al., 1995). It was hypothesized, therefore, that NE would be positively related to attentional biases toward negative stimuli, particularly sad or depressogenic stimuli. There was also a possibility that PE would be positively related attention to positive stimuli. BI was predicted to be related to cognitive vulnerability for anxiety. The primary prediction was that individual differences in BI would be positively associated with attentional biases to threat-related stimuli. It was also predicted that children high in BI would also demonstrate more anxiety-related automatic thoughts than their low BI counterparts.

An additional purpose of the current project was to take a process-oriented approach to understanding the nature of potential associations between temperament and information-processing. Specifically, additional analyses were conducted to examine the nature of potential associations between temperament and biases in attention. As mentioned above, attention has been broadly implicated in models of anxiety (e.g., Beck & Clark, 1997; Beck, et al., 1985, Mathews & MacLeod, 1985, 1996). To date, however, there is little consensus as to what process or processes contribute to attentional biases towards threatening information. Some models have emphasized the role of hyper-vigilance or attentional capture (Beck et al., 1985, Mathews, 1990; Williams et al., 1997), whereas others have proposed that anxious individuals struggle to disengage attention from potentially threatening information (e.g., Fox et al., 2001; Koster et al., 2004; Yiend & Mathews, 2001). Disentangling the relative contributions of each of these processes in producing attentional biases is important both for clarifying theoretical models of the nature of cognitive vulnerability to anxiety and for informing clinical practice. Understanding the contributions of hyper-vigilance versus disengagement difficulties in the proposed sample provides an important opportunity to explore how such processes are related to temperament and to study longitudinally their role in producing vulnerability in subsequent follow-up.

Although data implicating attentional biases in producing vulnerability to depression are mixed (e.g., Beevers & Carver, 2003; Dalgleish, Taghavi, Neshat-Doost, Moradi, Canterbury, & Yule, 2003; Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 2000), the application of a process-oriented approach is also important in the study of associations between attention and depression. Specifically, although biases in participants' behaviour (i.e., a dot-probe bias score) may not be apparent, focusing on individual processes may elucidate subtle differences in information

processing that are not apparent at the level of the overall bias score. Furthermore, it is possible that biases in attention may initially play a critical role in the development of higher-order cognitive biases (such as in the production of self-schema or attributional style). On this account, although there is limited evidence that individuals with depression demonstrate attentional biases either away from positive information or towards sad information, it is possible that associations between temperamental vulnerability and attentional biases may exist and be related to the development of other biases in cognition over time. This hypothesis is supported by recent research reporting that offspring of depressed mothers demonstrate diminished attention towards positive information and enhanced attention towards to negative information, as compared to their lower-risk counterparts (Joormann, Talbot, & Gotlib, 2007).

2.4.2 Hypotheses 2: Parental Psychopathology & Child Cognition

Just as child temperament was hypothesized to be related to cognitive markers of vulnerability, parental history of depression and anxiety was hypothesized to show unique associations with child cognitive vulnerability. Specifically, it was hypothesized that offspring of parents with a history of depression would demonstrate cognitive vulnerability associated with depression, such as a depressogenic attributional style and a more negative and less positive self-schema. There was also the possibility that these children would demonstrate increased attention toward negative information and diminished attention toward positive information, as compared to children with parents without a history of depression. Similarly, it was hypothesized that offspring of parents with a history of an anxiety disorder would demonstrate anxiety-related patterns of cognition, such as increased attention to threat-related stimuli.

Chapter 3

3 Methods

Participation in the study consisted of an initial visit to a research laboratory, where behavioral measures of child temperament and cognitive style were collected. At this visit, parents were given a package of questionnaires to complete, which included parent-report measures of child temperament and psychopathology. At a subsequent home visit, an experimenter assisted children with completion of self-report measures of cognitive style and

symptoms of anxiety and depression. During this visit, parents completed structured clinical interviews to assess parental history of psychopathology.

3.1 Participants

A community sample of 205 7-year-old children and their parents were recruited from London, Ontario and the surrounding areas. Participants were recruited through a psychology department database, and advertisements placed in local newspapers and online. Children with a diagnosis of any psychological or developmental disorder were not eligible to participate. Families were compensated monetarily for their participation.

3.1.1 Sample Characteristics

The sample consisted of approximately equal numbers of boys (n = 96; 46.83%) and girls. The mean age of children at study enrollment was 88.44 months (*SD* = 3.58; range: 84 to 96 months). The Peabody Picture Vocabulary Test, Fourth Edition (Dunn & Dunn, 2007) was administered as a general measure of cognitive functioning. Children performed within the normal range (*M* = 111.92; *SD* = 12.15), and boys and girls scored equivalently, *t* (202) = 1.13, *ns*.

Parents identified their child's race as Caucasian (*n* = 180; 87.80%), Asian (*n* = 4; 1.95%) or other (*n* = 16; 7.80%). The vast majority of the children (*n* = 187; 91.22%) came from two-parent homes. Approximately half of the families participating (*n* = 103; 50.24%) reported a family income ranging from $40,000-$100,000; 26.83% (n = 55) of families reported a family income greater than $100,000, and 15.12% (*n* = 31) of families reported a family income of less than $40,000. Approximately half of the mothers (*n* = 100; 48.78%) and fathers (*n* = 107; 52.20%) reported that they either graduated from high school (or received a GED), attended some college, or received a 2-year degree as their highest level of educational attainment. Just under half of the mothers (*n* = 93; 45.37%) and approximately one-third of the fathers (*n* = 78; 30.05%) received a 4-year college/university degree or beyond. A small proportion of mothers (*n* = 6; 2.93%) and fathers (*n* = 10; 4.88%) reported having not finished high school. These sample characteristics are comparable to data pertaining to race, income and educational attainment reported in the 2006 census for London, Ontario (Statistics Canada, 2008). The mean age of parents was 37.48 years (*SD* = 8.96) for mothers and 40.43 years (*SD* = 11.50) for fathers.

Both parents were asked to participate in the study. In most cases in which parents were not living in the same home, permission was obtained from the primary caregiver to contact the other parent to request their participation. Almost all mothers (n = 203; 99.02%) and most fathers (n = 186; 90.73%) participated. One mother and five fathers living with the participating child declined to complete study materials. Two fathers living apart from the participating child were contacted and refused to participate. The remainder were parents (1 mother and 12 fathers) who were unavailable to participate. A parent was deemed unavailable if they were deceased or incarcerated, or if the participating parent did not know how to contact them or refused to allow study personnel to contact them.

3.2 Measures

3.2.1 Child Assessment: Laboratory Visit

During the laboratory visit, children completed a battery of laboratory tasks designed to assess individual differences in cognitive style, which included an auditory emotional Stroop task, an emotional dot-probe task, and a Self-Referent Encoding Task. Child temperament was assessed using a battery of laboratory tasks based on the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Riley, Lemery, Longely, & Prescott, 1995). Each of these tasks is described below. Although measures of cognitive style will be described together, it should be noted that the auditory emotional Stroop and the emotional dot-probe were administered first, followed by the temperament battery, and then the Self-Referent Encoding Task. This ordering was necessary due to changes in the equipment needed for task administration. The laboratory visit took approximately 2 hours to complete.

3.2.1.1 Auditory Emotional Stroop

The emotional Stroop task is one of the most widely used experimental tasks in psychopathology research (Williams, Mathews, & MacLeod, 1996) and assesses the degree to which individuals are susceptible to interference of task performance due to emotional information. In most versions of this task, participants are visually presented words of varying emotional content printed in different ink colors and are asked to identify the ink color while ignoring the meaning of the word. Interference from emotional content (i.e., slower response times to identify the ink color for emotional words as compared to neutral words) is thought to reflect underlying biases

in attention to emotional information (e.g., Mathews & MacLeod, 1994; Williams et al., 1996). The Stroop interference effect, however, is contingent on the automaticity of reading processes, and preliminary data collection indicated that the reading abilities of most 7-year-old children were likely insufficient to produce such an effect. Therefore, as auditory versions of Stroop paradigms have been shown to yield analogous Stroop effects (e.g., Gregg, & Purdy, 2007; Jerger, Martin, & Pirozzolo, 1988), children in the current study completed a computerized auditory version of this task. In this version, children were presented with auditory recordings of words that varied in emotional content (i.e., neutral, positive, sad, and mildly threatening). Words were spoken by either a male or female speaker, and children were asked to identify, as quickly as possible, the sex of the speaker via a button press.

As no studies were found using linguistic Stroop stimuli with children this young, potential word stimuli were collated from previous research with older children and adults (Martin, Cole, Clausen, Logan, & Strosher, 2003; Mathews et al., 1989; Neshat-Doost et al., 2000, Perez-Edgar & Fox, 2003; Taghavi et al., 2003). Word stimuli considered as neutral, positive, sad, or threatening by previous research were collected. Those words demonstrating the highest frequency in everyday use for young children (Carroll, Davies, & Richman, 1971) were used in this study. Both sad and threat stimuli were negatively valenced. Sad stimuli, however, tended to be socially oriented whereas threat stimuli tended to reflect potential physical harm (see Appendix A for a list of stimuli). Words in each valence category were matched for frequency and word length. Analyses of these variables indicate that words in each of the valences did not differ with respect to length (i.e., the mean number of syllables), $F(3, 44) = 0.95$, *ns*, or frequency, $F(3, 44) = 0.23$, *ns*. The task was programmed using E-Prime software (Psychology Software Tools Inc., 2002) and consisted of 2 blocks of 96 trials (12 words of each emotional valence spoken once by a male and once by a female). Trials were presented in a different random order for each participant, and blocks were separated by a one-minute break.

One-hundred and ninety-seven children completed the auditory emotional Stroop. Data for five children could not be included in the sample because they completed an earlier, traditional version of the task in which children were visually presented with words. The remaining missing data consists of two participants whose data was lost due to equipment failure and one additional child who refused to follow task instructions. The data were cleaned by removing response time

(RT) data for trials in which children committed errors (i.e., misidentified the speaker's sex; 3.76% of trials), and for correct trials in which a participant's RT data were more than 3 standard deviations above or below the participant's mean for that trial type (approximately 1.12% of correct trials).

Interference scores for each emotional valence were calculated by subtracting each child's mean RT on neutral trials from their mean RT on valence-specific trials (e.g., Positive Interference Score = Mean Positive RT – Mean Neutral RT). Higher interference scores indicate longer response times on trials of that valence compared to neutral trials, and are thought to reflect interference related to the processing of the emotional content. Mean interference scores (in milliseconds) were 58.46 (*SD* = 66.92), 5.93 (*SD* = 60.78), and 34.42 (*SD* = 57.09) for positive, sad, and threat-related stimuli, respectively. Boys and girls demonstrated similar levels of interference on positive ($t(192) = 0.15$, *ns*) and sad trials ($t(192) = -0.08$, *ns*). Girls, however, showed greater interference on threat trials than did boys, $t(192) = -1.86$, $p < .05$.

Error data in emotional Stroop tasks have demonstrated meaningful associations with mood states in child samples (e.g., Eschenbeck et al., 2004). Error rates, therefore, were used as an additional indicator of emotion-related interference. The average number of errors committed were 1.72 (*SD* = 2.27), 1.65 (*SD* = 2.12), and 1.53 (*SD* = 2.09) for positive, sad, and threat trials, respectively. Although boys and girls performed equivalently on positive trials ($t(192) = 0.97$, *ns*), boys committed more errors than girls on both sad trials ($t(192) = 2.36$, $p < .05$) and threat trials ($t(192) = 2.74$, $p < .05$).

3.2.1.2 Emotional Dot-Probe

The dot-probe task is a widely used computerized measure of information processing, designed to identify attentional biases in the processing of emotional information (e.g., MacLeod et al., 1986). In this task, participants are presented with a series of picture pairs typically consisting of one emotionally neutral image and one emotionally valenced image. At stimulus offset, one of the images is replaced with a probe stimulus and participants are required to identify, as quickly as possible, the location of the probe. Quicker responses to identify the location of probes replacing emotional images than probes replacing neutral images are thought to reflect attentional biases for information of this emotional valence (MacLeod et al., 1986).

Children completed a computerized version of this task programmed using E-Prime software (Psychology Software Tools Inc., 2002). Four types of picture pairs (neutral-neutral, positive-neutral, sad-neutral, and threat-neutral) were created using images taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1997). The IAPS provides normative data for both the valence (i.e., pleasant versus unpleasant) and intensity of emotional arousal evoked by each image. Pleasant images rated as low to moderate in arousal were chosen as positive stimuli. Sad and threat stimuli were similar in that they were both rated as unpleasant, but differed with respect to ratings of arousal. Specifically, low arousal-unpleasant images were chosen for sad stimuli and high arousal-unpleasant stimuli were chosen for threat stimuli. Only stimuli for which there were norms for children of this age were used (see Appendix B for a list of stimuli).

On each trial, picture pairs were presented on the left- and right-hand sides of the screen against a black backdrop for 1200 ms, after which both images disappeared and one was replaced with a probe stimulus (a small white dot). Children were required to indicate the location of the probe via button press. The probe stimulus remained on the screen until children responded. The task consisted of three blocks of 60 trials (15 of each pairing type). New picture pairings were created for each of the three blocks so that no two images were paired on more than one trial. The probe location (left or right) was counterbalanced, and half of the neutral-valence trials were congruent (i.e., the probe was located at the same location as the emotional image) and half were incongruent (i.e., the probe was located at the same location as the neutral image). Trials within each block were presented in a different random order for each participant. Blocks were separated by a one-minute break.

One-hundred and ninety-seven children completed the emotional dot-probe task. Missing data include data from five children who refused to complete the task, two instances of equipment failure, and data from one child whose parent did not provide consent for the dot-probe to be administered. The data were cleaned by removing RT data for trials in which children committed errors (2.89% of trials) and for correct trials in which children responded faster than 100 ms or slower than 2000 ms (1.27% of correct trials). This method of removing extremely fast and slow trials is consistent with data cleaning procedures in published studies using the dot-probe

paradigm with children (e.g., Dalgleish et al., 2003; Heim-Dreger et al., 2006; Hunt, Keogh, & French, 2007; Joormann et al., 2007; Kimonis et al., 2006).

Traditional bias scores (MacLeod & Mathews, 1988) were calculated for each valence, which reflect response time differences between congruent and incongruent trials, controlling for probe location (e.g., Threat Bias Score = 1/2 [(TrPl – TlPl) + (TlPr – TrPr)], where TrPl refers to the response time on incongruent trials in which the threat-related stimulus is located on the right and the subsequent probe is located on the left, and TlPl refers to the response time on congruent trials in which the threat-related stimulus and the subsequent probe both appear on the left, etc.). Using this method, positive scores reflect attentional biases towards emotional information, while negative scores reflect attentional biases away from emotional information. Mean bias scores (in milliseconds) were 4.53 (*SD* = 62.66), -0.23 (*SD* = 70.63), and 16.36 (*SD* = 70.09) for positive, sad, and threat trials, respectively. Boys and girls performed similarly for trials of all types (all *p*-values > .21).

As noted in the Introduction, differentiating between initial orientation and disengagement processes may provide important information regarding attentional processes in psychopathology. Therefore, two separate scores were constructed based on children's performance on this task. Facilitation scores, which assess biases in orienting to emotional information, and interference scores, which assess difficulties disengaging attention from emotional information, were calculated by comparing performance on congruent and incongruent trials with neutral-neutral trials, respectively (see Koster et al., 2004). Facilitation scores for each valence were calculated by subtracting each participants' mean RT for congruent trials of that valence from their mean RT for neutral-neutral trials (e.g., Threat Facilitation Score = Mean Neutral RT – Mean Threat Congruent RT). Higher scores reflect greater more rapid orienting to information of that valence. Mean facilitation scores (in milliseconds) were -15.00 (*SD* = 56.04), -12.40 (*SD* = 58.81), and -9.88 (*SD* = 58.13) for positive, sad, and threat trials, respectively. There were no sex differences in facilitation scores for any stimulus type (all *p*-values > .43).

Valence-specific interference scores were calculated by subtracting the mean RT for neutral-neutral trials for each participant from their mean RT on incongruent trials for each valence (e.g., Threat Interference Score = Mean Threat Incongruent RT – Mean Neutral RT). Higher scores

reflect greater difficulty disengaging attention from emotional information. Mean interference scores (in milliseconds) were 17.50 (*SD* = 57.50), 10.69 (*SD* = 55.80), and 25.70 (*SD* = 54.73) for positive, sad, and threat trials, respectively. Boys and girls demonstrated equivalent amounts of interference for all stimulus types (all *p*-values > .15).

3.2.1.3 Mood Induction

In order to produce mild negative affect and activate latent cognitive vulnerability (Taylor & Ingram, 1999; Teasdale & Dent, 1987), a mood induction procedure was administered prior to the Self-Referent Encoding Task, in which children were shown a sad movie clip. This method has previously been shown to be successful in producing sad affect in children (e.g., Brenner, 2000), and the specific clips and procedures used here have been shown to increase children's facial expressions of negative affect (Hayden et al., 2006), and to lead to decreases in children's self-reported positive mood (Hayden et al., under review). The majority of children (n = 192; 94%) in the current study viewed a clip from the Disney movie "Flash," which depicted the reaction of a boy to the death of his grandmother. It was important that children had not previously seen the mood induction clip. Children, therefore, were asked prior to being shown the clip if they had already seen the movie. In cases where children reported having seen this movie (n = 13; 6%), they viewed one of a series of alternative clips taken from the following films: "My Girl," "Gilbert Grape," and "The Cure." Children were offered the clips in the same order and were shown the first clip they reported not having seen before.

3.2.1.4 Self-Referent Encoding Task

The Self-Referent Encoding Task (Kuiper & Derry, 1982) is a widely used information processing task used to assess memory biases for positive and negative self-referent information, as well as the extent to which individuals hold positive and negative self-views. In this task, participants are presented with a series of positive and negative adjectives and are asked to indicate whether each adjective is self-descriptive. This is followed by an unexpected free recall period in which participants are asked to recall as many of the presented adjectives as possible.

Immediately following the mood induction procedure, children were presented with 26 words (13 positive and 13 negative) taken from previous research using this task with young children (Hayden et al., 2006; see Appendix C for a list of stimuli). Words were presented on flash cards

and spoken aloud by the experimenter. Following each word, children were asked "Is this like you?" Words were presented in a different random order for each participant with two neutral buffer words presented at both the beginning and the end of the list to address primacy and recency effects. This portion of the task was followed by an unexpected incidental recall period in which children were asked to recall as many of the words as possible from the list.

Two-hundred and three children completed the Self-Referent Encoding Task. Missing data consisted of data from one child who refused to complete the task and one child whose parent did not provide consent for this task to be administered. Two indices of memory processing relevant to depression were calculated: a positive schematic processing score (the proportion of positive words rated as self-descriptive and recalled relative to all words rated as self-descriptive) and a negative schematic processing score (derived in the same manner using negative words). Endorsement rates of positive and negative words were also used as measures of self esteem or self-concept. Finally the latency, in words, to recall a positive adjective and to recall a negative adjective was used as a general assessment of memory bias for positive and negative information.

The average number of positive and negative words endorsed as self-referent were 11.88 (*SD* = 1.06) and 0.98 (*SD* = 1.57), respectively. Endorsement rates were similar for boys and girls for positive adjectives ($t(201) = -1.04$, *ns*), but boys endorsed more negative adjectives ($M = 1.35$, $SD = 1.86$) than girls ($M = 0.66$, $SD = 1.19$; $t(201) = 3.06$, $p < 0.01$). The average positive processing score was 0.18 (*SD* = 0.13) and the average negative processing score was 0.01 (*SD* = 0.03). There were no sex differences for either of the processing scores (both *p*-values > 0.12). The average latency to recall a positive adjective (in words) was 2.96 (*SD* = 2.62) and the average latency to recall a negative adjective was 2.62 (*SD* = 2.05). There were no sex differences in either of these latency scores.

Both the number of negative adjectives endorsed and the negative processing score demonstrated a high degree of positive skewness and kurtosis, due to a high number of scores of zero. Because there was a range of scores for the number of negative adjectives endorsed, a logarithmic transformation (base 10) was performed on this variable. This significantly improved both the skew and kurtosis of the distribution. The range of scores for the negative processing score was quite small, with more than half of the scores being zero. Data transformations did not improve

the normality of the distribution of this variable. The variable was, therefore, coded parametrically, with those having scored zero being coded as 0 and those having scored greater than zero being coded as 1.

3.2.1.5 Laboratory Assessment of Temperament

Child temperament was assessed using a battery of laboratory tasks based on the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith et al., 1995) adapted to be appropriate for older children. Tasks were designed to elicit individual differences in emotionality (PE, BI and fearfulness, and aspects of NE such as sadness and anger/frustration), as well as behavioural indicators of temperament, such as interest/engagement, sociability, and activity level. Tasks were designed to simulate naturalistic events likely to be experienced by children in their everyday lives (e.g., being allowed to play with a novel toy, interacting briefly with a stranger, or attempting to complete a frustrating puzzle), and were ordered to minimize carry-over effects in that no episodes presumed to evoke a similar affective response occurred consecutively. Children were also provided with a short break between tasks in order to return to a neutral state. Such laboratory measures of temperament have been shown to tap meaningful differences in children's emotionality and behaviour (e.g., Buckley, Klein, Durbin, Hayden, & Moerk, 2002; Durbin et al., 2007; Hayden, Klein, & Durbin, 2005) and to be related to relevant constructs, such as affective tone during parent-child interactions (Kochanska, Coy, Tjebkes, & Husarek, 1998), emotion regulation (e.g., Buss & Goldsmith, 1998), parental history of psychopathology (e.g., Durbin, Klein, Hayden, Buckley, & Moerk, 2005), as well as genetic (Hayden, Dougherty, Maloney, Durbin, Olino, Nurnberger, et al., 2007) and cognitive (e.g., Hayden et al., 2006) markers of risk for internalizing disorders. Tasks were video-recorded for coding and are described below in the order that they were administered along with the traits they were designed to elicit.

Exploring New Objects (BI and Fearfulness, PE)

The child was left alone to play freely in room containing several ambiguous or mildly "scary" objects: a cloth tunnel and tent, a remote-controlled spider, a plastic skull covered with a red cloth, a Halloween mask, and a box containing a plastic beating heart and fake spider webs.

After four minutes, the experimenter returned and asked the child to approach and touch each object.

Racing Cars (NE, PE)

The child was given photographs of an exciting/desirable toy (a remote-controlled race car) and of a relatively boring toy (a small plastic doll with unmoving parts) and was told to choose which s/he wanted to play with. Next, the child was told that the requested toy was lost and was given the non-preferred toy to play with. Following a short delay, the desirable toy was given to the child.

Stranger Approach (BI, Fearfulness)

The child was left alone in the main experimental area to play with a toy golf set. Following a short delay, a friendly male research assistant entered the room. The stranger attempted to engage the child following a scripted set of prompts and gradually approached the child. The experimenter then returned and introduced the stranger as her friend.

Frustrating Puzzle (NE – Anger/Frustration)

The child was left alone to complete a puzzle that the experimenter said was easy but actually contained pieces that would not fit together. After 3 minutes, the experimenter returned and explained that she had made a mistake and had given the child the wrong pieces. The child was then given the correct pieces and allowed to complete the puzzle.

Practical Joke (PE)

The experimenter showed the child how to use a remote-controlled whoopee cushion, and the child was invited to surprise his/her parent with the toy when they sat in a chair in the experimental room.

Object Fear (BI, Fearfulness)

The child was shown a pet carrier and told that it contained "something scary." The child was subsequently left alone in the room and instructed to look inside. If the child did not look inside the carrier after 1 minute, the experimenter returned and showed him/her that the carrier actually contained a stuffed toy animal.

Toy Parade (PE)

The child was given a bell and told that each time they rang it, a research assistant would bring them a new toy, but that they would have to trade in the toy they had for the new toy. Toys were intended to be fun and included Mr. Potato Head, a Fun Hop, a Gearation Toy, a floor piano and guitar, and legos.

Affective Coding

Video recordings of each laboratory episode were coded by undergraduate, post-baccalaureate, and graduate students who were blind to all other study variables. As part of the training process, coders initially rated videos with a trained "master coder" and then coded sets of 10-15 videos independently until they were able to code 5 videos with a minimum ICC = 0.80. Ongoing reliability checks were done to maintain interrater reliability. Specifically, half of the all coder's affect coding was also coded by the master coder, and if the ICC was below 0.80, coders met with the master coder to discuss the video and make a final rating.

Affective variables of interest were PE, sadness, anger, and fear. For each laboratory episode, coders recorder the number of low, moderate, and high intensity displays of facial, vocal, and bodily emotion for each of the four affective variables of interest. The number of instances of low, moderate, and high behaviours were weighted to account for the intensity of the emotional display (i.e., N of low intensity behaviours x 1; N of moderate intensity behaviours x 2; N of high intensity behaviours x 3). An average of these weighted scores across all episodes and channels was calculated for PE, sadness, anger, and fear, creating a total score for each participant in each of these emotional valences. A composite NE score was also created by averaging all weighted scores across all episodes for all facets of NE (i.e., sadness, anger, and fear). Internal consistencies, indexed by Cronbach's α were moderate to high for each of these affective scales: PE (α = .83) NE (α = .68), anger (α = .68), fear (α = .65), and sadness (α = .67).

Global ratings of each child's level of sociability and interest in the task were also coded for each episode. Children were scored on a 3-point scale (1, 2, and 3) based on their overall behaviour in the episode. Average levels of sociability and interest for each particular episode were assigned scores of 2, with children displaying more or less sociability or interest being assigned higher or lower scores, respectively. Composite scores for sociability and interest were also created by

averaging scores for each variable across all episodes. Descriptive data for each of the affective scores as well as sociability and interest ratings are reported in Table 1, along with correlations between each of these variables. Boys scored significantly higher on anger ($M = 0.46$, $SD = 0.30$) than did girls ($M = 0.35$, $SD = 0.27$), $t(198) = 2.73$, $p < .01$. There were no other sex-related differences.

Behavioural Coding

In addition to the global affective coding, behavioural coding was applied to the three tasks designed to assess BI (Exploring New Objects, Stranger Approach, and Object Fear). This system was designed to assess traditional behavioural components of BI, such as approach, withdrawal, and fear responses. Coding involved recording the presence/absence of specific behaviours in each of the BI tasks. Whether children approached and touched each of the novel objects, demonstrated a fear response, and made a vocalization were coded for Exploring New Objects, as well as the latency to perform each of these behaviours. The amount of time children spent playing with each of the objects was also coded for Exploring New Objects by dividing the task into 10 second segments (epochs) and counting the number of epochs in which children played with each object. Behavioural coding for Stranger Approach included whether children replied to each of the prompts made by the stranger, whether he attempted to engage the stranger in play, and whether the child displayed a fear response. The latency to engage in each of these behaviours was also coded, as was whether or not the child physically approached the stranger and the quality of this approach (i.e., was it incidental or in an attempt to engage with the stranger). Object Fear coding consisted of the presence/absence and latencies to perform each of the following behaviours: approaching the pet carrier, looking inside of the pet carrier, touching the pet carrier, touching the toy inside of the carrier, fear response, verbalization, and withdrawal attempt.

All coding was completed by undergraduate students blind to other study data. Coders were trained by a master coder until a minimum ICC of 0.80 was achieved on 5 videos. To ensure ongoing reliability, a subset of all coders' videos was coded by the master trainer. Inter-rater reliability was quite high for each task, with Cronbach's α ranging from 0.90 to 1.00 for Exploring New Objects, from 0.79 to 1.00 for Stranger Approach, and from 0.82 to 1.00 for Object Fear.

Principal component analysis (PCA) with a varimax rotation was used to identify the underlying structure of the behavioural inhibition micro-coding variables. The following criteria were used for factor retention: (a) eigen value > 1 rule, (b) scree test, and (c) the configuration accounted for at least 50% of the total variance. Factor loadings that exceeded .30 were considered meaningful. A three-factor solution was retained, which accounted for 50.88% of the total variance. The factor analysis includes data for 187 participants. Eighteen participants were excluded from the factor analysis due to missing data for the Object Fear task. Specifically, these children did not wait for task instructions prior to examining the carrier and identifying the toy hidden inside. The object fear task, therefore, did not have the same meaning for these children as they already knew that there was nothing scary in the pet carrier prior to the experimenter leaving the room, and could, therefore, not be coded. Given that this missing data was non-random (i.e., these children had a systematically different experience than the other children in the study) no attempts to impute the data were made. Table 2 presents variables included in the factor analysis and factor loadings.

Factors were named according to the items that loaded onto them. Factor I (BI) reflects behaviours characteristic of BI in the context of Object Fear, which include limited, slow, or tentativeness approach behaviours, reduced verbalizations, quicker fear responses, and behavioural withdrawal (Cronbach's $\alpha = 0.70$). Factor II (Exploration) contains only variables for Exploring New Objects and reflects an increased tendency to explore or play with ambiguous objects (Cronbach's $\alpha = 0.67$). Factor III (Surgency) was less clearly defined. In addition to variables from Stranger Approach that would reflect tendencies towards sociability or social approach (e.g., intentionally approaching the stranger, engaging the stranger in play, and decreased latency to respond to the stranger's initial prompt), the degree to which children explored or played with the tent/tunnel during Exploring New Objects also loaded onto this factor. In contrast to the other factors, which demonstrated adequate internal consistency, the internal consistency for this third factor was extremely low (Cronbach's $\alpha = 0.07$). Given the lack of internal consistency and the poor definition of the factor, this factor was excluded from data analyses.

3.2.2 Child Assessment: Home Visit & Parent-Report Questionnaires

Following the laboratory assessment, a home visit was scheduled with each family. An average of 40.02 days (*SD* = 29.65) elapsed between the laboratory visits and home visits.
During the home visit, children were assisted in the completion of a package of questionnaires assessing individual differences in cognitive vulnerability to depression and symptoms of anxiety and depression. For each questionnaire, an experimenter read items aloud to the child and recorded children's responses. Child report questionnaires included the Children's Automatic Thought Scale (Schneiring & Rapee, 2002), the Children's Attributional Style Questionnaire – Revised (Thompson, Kaslow, Weiss, & Nolan-Hoeksema, 1998), the Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1978) and the Depression Self-Rating Scale (Birelson, 1981). Two-hundred and three children completed the questionnaires (2 families did not complete home visits). Parents completed measures of child temperament (Temperament in Middle Childhood Questionnaire, Simonds & Rothbart, 2004) and child psychopathology (Child Behavior Checklist/4-18, Achenbach, 1991).

3.2.2.1 Children's Automatic Thoughts Scale

The Children's Automatic Thoughts Scale (Schneiring & Rapee, 2002) is a 40-item self-report measure of negative automatic thoughts in youth 7- to 16-years. Children are provided with a series of self-statements and are asked to indicate how often they have had each thought over the last week. Ratings are made on a 5-point scale ranging from "not at all" (0) to "all the time" (4). The Children's Automatic Thoughts Scale yields a total score, as well as four subscales: Physiological Threat, Social Threat, Personal Failure, and Hostility, all of which have been shown to have good internal consistency and test-retest reliability (Micco & Ehrenreich, 2009; Schneiring & Lyneham, 2007; Schneiring & Rapee, 2002).

The Physiological Threat and Social Threat subscale scores have been shown to be related to symptoms of anxiety in youth, whereas the Personal Failure subscale has been related to symptoms of depression (Micco & Ehrenreich, 2009; Schniering & Rapee, 2002; Schniering & Rapee, 2004a). The Physiological Threat and Social Threat subscales, therefore, were used as indicators of negative automatic thoughts associated with anxiety and the Personal Failure subscale as an indicator of negative automatic thoughts associated with depression. Each of these

scales demonstrated good internal consistency (Cronbach's α = 0.78, 0.87, and 0.79 for the Physiological Threat, Social Threat, and Personal Failure subscales, respectively). The overall sample means were low (Physical Threat: M = 6.16, SD = 6.47; Social Threat: M = 5.35, SD = 6.94; Personal Failure: M = 4.00, SD = 5.36) and consistent with those observed in community samples (Micco & Ehrenreich, 2009; Schniering & Rapee, 2002; Schniering & Rapee 2004a). Boys and girls scored equivalently on all three subscales (all p-values > .33).

3.2.2.2 Children's Attributional Style Questionnaire – Revised

The Children's Attributional Style Questionnaire - Revised (Thompson et al., 1998) is a 24-item self-report measure of children attributions for positive and negative events. It consists of 12 positive and 12 negative events that children are asked to imagine happening to them. Children are then provided with two possible reasons or explanations for the event reflecting internal and external loci of control and are asked to choose which explanation reflects why the event would have happened to them. The Children's Attributional Style Questionnaire yields a positive composite and a negative composite score. Lower positive composite scores reflect a tendency to attribute positive events to external, unstable, and specific factors, while higher negative composite scores reflect a tendency to attribute negative events to internal, stable, and global factors; thus, lower positive composite and higher negative composite scores are viewed as "depressogenic." Although the reliability of these composite scores is less than optimal (e.g., Conley, Haines, Hilt, & Metalsky, 2001; Hayden et al., 2006; Thompson et al. 1998), higher scores on the negative composite and lower scores on the positive composite have consistently been shown to be related to symptoms of depression (e.g., Hayden et al., 2006; Lau, Rijsdijk, Gregory, McGuffin, & Eley, 2007; Thompson et al., 1998). Positive composite and negative composite scores were used as indicators of depressive attributional styles.

The internal consistency of the negative composite in the current sample was moderate (Cronbach's α = 0.50), but consistent with previous research (e.g., Conley et al., 2001; Hayden et al. 2006; Thompson et al., 1998). The overall sample mean of the negative composite was low (M = 2.44, SD = 1.81), and comparable reported means for other community samples (e.g., Conley et al., 2001; Thompson et al., 1998). Higher negative composite were observed for boys (M = 2.77, SD = 2.06) than girls (M = 2.15, SD = 1.52; $t(198)$= 2.41, $p < .05$). The internal consistency of the positive composite was poor (Cronbach's α = 0.29). The internal consistency

could be improved slightly (Cronbach's $\alpha = 0.39$) by removing five items from the subscale (items 1, 5, 13, 16, and 23). Preliminary analyses revealed, however, despite the improved reliability, the nature of the relations between the revised composite and other study measures was the same as those observed with the original composite. Therefore, despite its low internal consistency, the original positive composite was retained for all subsequent analyses. The overall mean of the positive composite was similar to that observed in other nonclinical samples (M = 8.18, SD = 1.77; Conley et al., 2001;Thompson et al., 1998), and there was no sex difference in mean scores, $t(199) = -0.92$, *ns*.

3.2.2.3 Revised Children's Manifest Anxiety Scale

The Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1978) is a 37-item self-report measure designed to assess the level and nature of anxiety in children between the ages of 6- and 19-years. Children respond to each item by indicating "yes" if the item is self-descriptive or "no" if the item is not self-descriptive. This measure yields a total anxiety score as well as three subscale scores (Physiological Anxiety, Worry/Oversensitivity, and Social Concerns/Concentration). Psychometric data indicate that, while the internal consistency of each of the scales is good, total scores tend to be the most reliable (Muris et al., 1998; Muris et al., 2002; Ryngala, Shields & Caruso, 2005). Total scores on the Revised Children's Manifest Anxiety Scale have been shown to correlate positively with scores on other self-report measures of anxiety (e.g., Muris et al., 1998; Muris et al., 2002; Perrin & Last, 1992), and have been shown to reliably discriminate between anxious and nonanxious children (Dierker, Albano, Clarke, Heimberg, Kendall, Merikangas, et al., 2001; Perrin & Last, 1992; Seligman, Ollendick, Langley, & Baldacci, 2004). Total scores on the Revised Children's Manifest Anxiety Scale, therefore, were used as an indicator of current anxious symptoms in children. The Revised Children's Manifest Anxiety Scale total score demonstrated good internal consistency (Cronbach's $\alpha = 0.84$). Consistent with other community samples (e.g., Turgeon & Chartrand, 2003), the overall average was low (M = 15.49, SD = 6.38) and boys and girls scored similarly, $t(200) = 0.85$, *ns*.

3.2.2.4 Depression Self Rating Scale

The Depression Self Rating Scale (Birleson, 1981) is a 24-item self-report measure of depression in children and youth, with items tapping affective, cognitive, behavioural, and somatic symptomatology (Asarnow & Carlson, 1985; Kazdin & Petti, 1982). Children are asked to rate themselves regarding how often they experience a depressive symptom (i.e., "most of the time," "sometimes," or "never"). The Depression Self Rating Scale is thought to be more readily understood by younger children than other child self-reports of depressive symptoms (Costello & Angold, 1988). The Depression Self Rating Scale demonstrates good psychometric properties (e.g., Asarnow & Carlson, 1985) and scores are related to symptoms of depression as assessed by other measures (e.g., Asarnow & Carlson, 1985; Birleson,1981; Ivarson, Gillberg, Arvidsson, & Broberg, 2002; Ivarsson, Lidberg & Gillberg, 1994; Kashani, Reid, & Rosenberg, 1989; Kashani, Rosenberg, & Reid, 1989). Total scores on the Depression Self Rating Scale were used as an indicator of current depressive symptoms of children. Depression Self Rating Scale scores demonstrated good internal consistency (Cronbach's $\alpha = 0.73$). The average score in the current sample was 12.44 ($SD = 5.32$), which is comparable to that observed in other nonclinical samples. For example, Asarnow and Carlson (1985) reported a mean Depression Self Rating Scale score of 11.3 ($SD = 4.2$) in a nondepressed group of children and Hayden and colleagues (2006) reported a mean Depression Self Rating Scale score of 10.3 ($SD = 5.4$) in a community sample of 7-year-old children. Boys and girls scored similarly, $t(200) = 1.35$, *ns*, which is consistent with prior research indicating that sex differences in rates of depression are not observed until adolescence (e.g., Hankin, Abramson, Moffitt, Silva, McGee, & Angell, 1998; Hankin, Wetter & Cheely, 2008; Nolen-Hoeksema & Girgus, 1994).

3.2.2.5 Temperament in Middle Childhood Questionnaire

The Temperament in Middle Childhood Questionnaire (Simonds & Rothbart, 2004) is a 157-item parent-report measure of temperament for children between the ages of 7- and 10-years, and is an upward adaptation of the Children's Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001). Parents respond to a series of statements by indicating how true each statement is of their child, considering their child's behaviour over the last 6 months. The High Intensity Pleasure, and Low Intensity Pleasure subscales were used as parent-report indicators of PE. The Anger/Frustration, Sadness, and Fear subscales were used as measures of NE. The Temperament

in Middle Childhood Questionnaire does not measure BI per se. The Shyness scale, however, may tap related behaviours in a social context, and was therefore included as a parent-reported indicator of BI-related behavior. Correlations between maternal and paternal ratings on each of these scales as well as means, standard deviations, and reliability data, are presented in Table 3.

The internal consistency for all PE scales was good. Girls were rated as higher in Low Intensity Pleasure than boys by both mothers [Girls: $M = 3.96$, $SD = 0.42$; Boys: $M = 3.75$, $SD = 0.42$; $t(201) = -3.48$, $p < .01$] and fathers [Girls: $M = 3.79$, $SD = 0.41$; Boys: $M = 3.61$, $SD = 0.46$; $t(180) = -2.81$, $p < .05$]. Boys were rated as higher than girls in High Intensity Pleasure by both mothers [Girls: $M = 3.41$, $SD = 0.60$; Boys: $M = 3.70$, $SD = 0.53$; $t(201) = 3.57$, $p < .001$] and fathers [Girls: $M = 3.36$, $SD = 0.53$; Boys: $M = 3.69$, $SD = 0.46$; $t(180) = 4.37$, $p < .001$].

The internal consistency of the NE scales and the Shyness scales were also good. Girls were rated as lower in Anger/Frustration by both mothers [Girls: $M = 2.87$, $SD = 0.69$; Boys: $M = 3.07$, $SD = 0.71$; $t(199) = 2.06$, $p < .05$] and fathers [Girls: $M = 2.86$, $SD = 0.57$; Boys: $M = 3.07$, $SD = 0.72$; $t(179) = 2.21$, $p < .05$]. Boys and girls scored equivalently on both maternal and paternal reported Sadness (both p-values > .80), as well as on maternal and paternal reported Fear (both p-values > .05). There were no differences between mother's ratings of Shyness for boys and girls ($t(199) = -0.08$, *ns*). Fathers, however, rated girls ($M = 2.77$, $SD = 0.65$) as slightly higher in Shyness than boys ($M = 2.54$, $SD = 0.86$), $t(179) = -2.0$, $p < .05$). These sex differences are consistent with a recent meta-analysis of gender differences in parent-reported temperament traits (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006).

3.2.2.6 Child Behavior Checklist

The Child Behavior Checklist (Achenbach, 1991) is a widely used measure designed to identify social, emotional, and behavioural problems in children, and was used as a measure of child psychopathology. Traditional scoring of the Child Behavior Checklist yields standard scores for 8 empirically derived problem areas as well as three composite scores assessing overall Internalizing, Externalizing, and Total Problems (Achenbach, 1991). Although such scales differentiate between clinical and nonclinical samples (e.g., Achenbach, 1991; Drotar, Stein, & Perrin, 1995; Rishel, Greeno, Marcus, Shear, & Anderson, 1995), the lack of correspondence between items in these scales and diagnostic criteria for various disorders makes them less useful

for differentiating among specific disorders (see Lengua, Sadowski, Friedrich, & Fisher, 2001). Given that the presence and severity of symptoms of anxiety and depression were of primary interest, alternative scale scores derived to be consistent with DSM-IV diagnostic criteria for anxiety and depressive disorders were used (Lengua et al., 2001).

The internal consistency of maternal (Cronbach's $\alpha = 0.64$) and paternal (Cronbach's $\alpha = 0.52$) ratings of anxiety were moderate, and the average scores for both maternal ($M = 1.49$, $SD = 1.87$) and paternal-rated ($M = 1.12$, $SD = 1.39$) anxiety were low and consistent with published means reported for a community sample and lower than those observed in a clinical sample (Lengua et al. 2001). There were no sex differences in maternal reports of anxiety, $t(199) = -0.78$, *ns*. Fathers, however, rated boys ($M = 1.35$, $SD = 1.65$) as more anxious than girls ($M = 0.91$, $SD = 1.07$), $t(179) = 2.11$.

The internal consistency of maternal (Cronbach's $\alpha = 0.64$) and paternal (Cronbach's $\alpha = 0.58$) ratings of child depression were also moderate. Average scores for mother-reported ($M = 1.38$, $SD = 1.87$) and father-reported ($M = 0.99$, $SD = 1.50$) depression were quite low and consistent with published means for a community sample and lower than those that would be expected in a clinical sample (Lengua et al., 2001). There were no sex differences in maternal reports of depression, $t(199) = -0.50$, *ns*. Paternal ratings of depression, however, were higher for boys ($M = 1.23$, $SD = 1.71$) than girls ($M = 0.79$, $SD = 1.25$), $t(179) = 1.97$, $p < .05$.

3.2.3 Parent Assessment

Parents completed the Structured Clinical Interview for DSM-IV (SCID; First et al., 1996), a semi-structured interview used for making DSM-IV Axis I diagnoses (current and past). The non-patient version of the SCID, a version for use in research studies in which participants are not identified as psychiatric patients (First et al., 1996), was administered to participating parents. Interviews occurred during the home visit assessment and were administered and scored by graduate students in clinical psychology who were blind to other aspects study data. Inter-rater reliability was assessed by having each interviewer video-record a subset of interviews, which were then rescored by one of the other interviewers. Agreement between raters was high, with Cohen's Kappa = 1.00, $p < .001$ for a diagnosis of any depressive disorder and Cohen's Kappa = 0.83, $p < .001$ for a diagnosis of any anxiety disorder ($N = 14$).

In instances in which one of the biological parents was unavailable to complete a SCID (i.e., they were deceased, incarcerated, or the participating parent did not know how to contact them or did not grant permission for them to be contacted), the Family History-Research Diagnostic Criteria (FH-RDC; Andreasen, Endicott, Spitzer, & Winokur, 1997) was used to obtain an assessment of history of psychopathology. The FH-RDC describes specific operational criteria for determining a diagnosis on the basis of information obtained by the family history method. Information for completing the FH-RDC was be gathered by the same clinical graduate students administering the SCIDs and was obtained from the participating parent.

The majority of mothers (n = 202; 98.54%) and most fathers (n = 183; 89.27%) completed the SCID. Clinical interview data was obtained via the FH-RDC for one additional mother and thirteen additional fathers. Missing interview data consists of parents (2 mothers and 8 fathers) who were available to participate but refused to complete the SCID or have the co-parent complete the FH-RDC on them.

Of interest was whether parents had ever met diagnostic criteria for Major Depression, Dysthymia Disorder, or any Anxiety Disorder. These variables were coded categorically and were used as indicators of parental psychopathology. Table 4 outlines the prevalence for depressive and anxiety disorders in the current sample. Seven mothers (3.45% of sample) and seven fathers (3.57% of sample) met criteria at the time of the interview for a current diagnosis of either major depression or dysthymia. Twenty-four mothers (11.82%) and ten fathers (5.10%) met criteria for a DSM-IV-TR anxiety disorder at the time of the study (including Panic Disorder, Agoraphobia, Social Phobia, Specific Phobia, Obsessive Compulsive Disorder, Post Traumatic Stress Disorder, Generalized Anxiety Disorder, and Anxiety Disorder not otherwise specified). Consistent with research demonstrating high depression-anxiety comorbidity (e.g., Kessler et al., 2005; Mineka et al., 1998), 22 mothers and 9 fathers from the current sample had a lifetime history of both an anxiety disorder and either major depression or dysthymia.

In the case of depressive disorders, research indicates that relatives of individuals with early onset, or recurrent or chronic forms are at particularly high risk (e.g., Klein, Lewinsohn, Rhode, Seely, & Durbin, 2002; Sullivan, Neale, & Kendler, 2000). Identifying individuals with early onset, or chronic course may serve as a means of assessing a particular form of depression that may be more biologically based and more susceptible to familial transmission. In addition to

lifetime history of depressive disorders, therefore, two additional scores based on onset and course were also created. Following the method used by Durbin and colleagues (2005) a three-level onset variable was created (0 = no Major Depressive Disorder or Dysthymic Disorder; 1 = onset $\geq$ 21 years; 2 = onset < 21 years). Likewise a 3-level course variable was created (0 = no Major Depressive Disorder or Dysthymic Disorder; 1 = single episode, non chronic Major Depressive Episode; 2 = recurrent Major Depressive Disorder, chronic Major Depressive Disorder, or Dysthymic Disorder). Each of these scores served as an additional measure of the severity of parental depression.

Chapter 4

4 Results

A general description of relations among study measures will be provided prior to presenting hypothesis specific analyses. First, relations between parent-reports and laboratory measures of child temperament will be explored. Associations between child temperament and symptoms of internalizing disorders will then be presented, followed by a description of the relations between child cognitive vulnerability and symptoms of internalizing disorders. These analyses are exploratory in nature and serve as preliminary analyses for informing subsequent hypothesis testing. Given the exploratory nature of these analyses, correlations will be presented without correcting for multiple comparisons. Hierarchical linear regression will then be used to test hypotheses about: (a) relations between child temperament and patterns of cognitions; and (b) relations between parental psychopathology and child cognitive vulnerability.

4.1 Associations among Measures of Child Temperament

Child temperament was assessed using both laboratory methods and parent-report questionnaires. In the majority of cases, parental reports of child temperament were obtained from both parents (maternal reports were obtained for 99% of cases and paternal reports were obtained for 91% of cases). Correlations between mother and father reports of child temperament were presented in Table 3. In general, there was good agreement between mothers' and fathers' reports, which demonstrated moderate positive correlations for all subscale scores of the Temperament in Middle Childhood Questionnaire.

Zero-order correlations between laboratory-assessed temperament variables were reported in Table 1. Consistent with the literature describing PE and NE as orthogonal constructs, laboratory-assessed PE and laboratory-assessed NE demonstrated only a weak positive correlation, $r = .17$, $p < .05$. Examination of associations between laboratory-assessed PE and lower-level facets of laboratory-assessed NE demonstrated that this overall correlation is accounted for by a moderate correlation between laboratory-assessed PE and laboratory assessed-anger, $r = .33$, $p < .001$. This finding is consistent with Harmon-Jones' conceptualization of anger, which argues that anger and positive affect should be positively related as both emotions are characterized by activation of approach-related motivational systems (e.g., Harmon-Jones, Harmon-Jones, Abramson, & Peterson, 2009; Harmon-Jones, Schmeichel, Mennitt, & Harmon-Jones, 2011).

Strong positive correlations were observed between laboratory-assessed PE and both laboratory-assessed sociability ($r = .68$, $p < .001$) and interest ($r = .64$, $p < .001$), as well as between laboratory-assessed sociability and laboratory-assessed interest ($r = .67$, $p < .001$). Major models of temperament suggest that sociability and interest are facets of PE or surgency (e.g., Clark & Watson, 1991, 1999; Shiner & Caspi, 2003). Given the strength of these correlations, a composite PE score was created by averaging the *z*-scores for each of these variables (PE, sociability, and interest). This composite score was used in subsequent analyses exploring associations between PE and other study variables, and will be referred to as the PE composite.

There was also good convergence between laboratory measures of fearfulness and BI. Laboratory-assessed fear was positively correlated with laboratory-assessed BI, $r = .55$, $p < .001$, and negatively correlated with laboratory-assessed exploration, $r = -.28$, $p < .001$.

Zero-order correlations between parent-report and laboratory measures of temperament are reported in Table 5. Consistent with previous research, there was little agreement. Parent reports of child high and low intensity pleasure, for example, were unrelated to laboratory-assessed measures of child PE. Similarly associations between mother- and father-reports of child anger and laboratory-assessed NE and anger did not reach conventional levels of statistical significance, and correlations between parent ratings of child sadness laboratory assessed sadness and NE were weak. In contrast, mother- and father-reports of child fearfulness were positively related to both laboratory-assessed fear (mother reports: $r = .28$, $p < .001$; father reports: $r = .33$,

$p < .001$) and laboratory-assessed BI (mother reports: $r = .24$, $p < .01$; father reports: $r = .20$, $p < .01$).

4.2 Child Cognitive Vulnerability and Symptoms of Depression and Anxiety

Based on an extensive literature supporting cognitive models of vulnerability for depression and anxiety, it was hypothesized that individual differences in children's patterns of cognition would demonstrate meaningful associations with symptoms of depression and anxiety. Specifically, it was hypothesized that symptoms of depression would be related to a more negative and less positive self-schema (as assessed by the Self-Referent Encoding Task), and a less positive and more negative attributional style (as assessed by the Children's Attributional Style Questionnaire). It was also hypothesized that symptoms of depression would be related to attentional biases toward negative and away from positive information (as assessed by the Auditory Emotional Stroop and the Dot-Probe) and negative automatic thoughts related to personal failure (as assessed by the Children's Automatic Thoughts Scale). Symptoms of anxiety were primarily hypothesized to be related to attentional biases towards threat (Auditory Emotional Stroop and the Dot-Probe) and negative automatic thoughts pertaining to social threat and physical threat (Chidren's Automatic Thoughts Scale).

Preliminary data analyses indicated that ratings of child depression and anxiety made by the same rater were significantly correlated (maternal ratings of child depression and anxiety: r = .55, $p < .001$; paternal ratings of child depression and anxiety: $r = .43$, $p < .001$; child self-report ratings of depression and anxiety: $r = .77$, $p < .001$). In order to examine the specificity of relations between cognition and symptoms of depression or anxiety, therefore, it was important to examine depression-cognition associations and anxiety-cognition associations after controlling for individual differences in anxiety or depression, respectively. Partial correlations between measures of child internalizing symptoms and cognitive vulnerability variables are presented in Table 6. Partial correlations between ratings of depression and cognition control for ratings of anxiety made by the same rater, and partial correlations between ratings of anxiety and cognition control for ratings of depression made by the same rater. A summary of these findings is provided below.

4.2.1 Depression-Cognition Associations

As predicted, child self-reported symptoms of depression (as assessed by the Depression Self-Rating Scale) showed meaningful associations with Self-Referent Encoding Task and Children's Attributional Style Questionnaire performance, after controlling for self-reported symptoms of anxiety. Specifically, children who reported more symptoms of depression endorsed more negative ($r = .25$, $p < .01$) and fewer positive words as self-referent ($r = -.22$, $p < 01$), and demonstrated a less positive self-concept, at trend-level ($r = -.15$, $p < .10$), as compared to children reporting fewer symptoms of depression. Higher self-reported symptoms of depression were positively related to a negative attributional style ($r = .32$, $p < .001$) and negatively related to a positive attributional style ($r = -.28$, $p < .001$). Self-reported symptoms of depression were also positively correlated with total scores from the Children's Automatic Thoughts Scale ($r = .31$, $p < .001$). Although not reported in Table 6, significant positive correlations were also observed between symptoms of depression (controlling for self-reported symptoms of anxiety) and all subscale scores on the Children's Automatic Thoughts Scale (*r*s ranging from .21 for Hostility to .35 for personal failure, all *p*-values < .01). After controlling for self-reported symptoms of anxiety, self-reported symptoms were unrelated to measures of attentional bias for emotion-related information, as assessed by either the emotional Stroop or the dot-probe.

In contrast to child self-reports, maternal reports of child depression were unrelated to either Self-Referent Encoding Task performance or the positive composite of the Children's Attributional Style Questionnaire after controlling for maternal reports of child anxiety. Maternal reports were, however, positively associated with the negative composite of the attributional style questionnaire, after controlling for maternal ratings of child anxiety ($r = .15$, $p < .05$). Maternal reports of child depression were unrelated to scores on the Children's Automatic Thoughts Scale and measures of attention.

Fathers' reports of child depression were positively related to the number of negative adjectives endorsed as self-referent ($r = .20$, $p < .05$) as well as children's scores on the negative composite of the Children's Attributional Style Questionnaire ($r = .18$, $p < .05$). Although not presented in Table 6, examination of the subscale scores indicates that the only significant relation between paternal reports of child depression and negative automatic thoughts was a positive correlation with the social threat subscale score of the Children's Automatic Thoughts Scale ($r = .17$, $p <$

.05). After controlling for father-rated Child Behavior Checklist anxiety scores, paternal reports of child depression were unrelated to Stroop or dot-probe performance.

4.2.2 Anxiety-Cognition Associations

The central prediction was that child symptoms of anxiety would be related to attentional biases toward threatening information. Consistent with this hypothesis, children reporting more symptoms of anxiety, as assessed by the Revised Children's Manifest Anxiety Scale total score demonstrated greater attention to threatening information as assessed by the dot-probe threat bias score, than children reporting fewer symptoms of anxiety ($r = .14$, $p < .05$), after controlling for self-reported symptoms of depression. Total anxiety scores were unrelated to either threat facilitation or threat interference scores. Threat facilitation and interference scores, however, demonstrated an interesting pattern of association with subscale scores of the Revised Children's Manifest Anxiety Scale. Specifically, after controlling for self-reported symptoms of depression, the physical threat subscale score, which assesses automatic physiological responses associated with anxiety, was positively related with the dot-probe threat facilitation score, which assesses individual differences in the tendency to orient toward threat-related information, $r = .19$, $p < .01$, but was unrelated to the dot-probe threat interference score, $r = .09$, *ns*. In contrast, the concentration subscale score, which assesses difficulties concentrating as a result of anxiety symptoms, was positively related, at trend-level, to the threat interference score, which measures individual differences in difficulties disengaging attention from threat-related information, $r = .13$, $p = .06$ (after controlling for symptoms of depression). The concentration subscale was unrelated to the dot-probe facilitation score, $r = .08$, *ns.*

Errors on the auditory emotional Stroop were positively related to child self-reported anxiety, across all stimulus valences (*r*s ranging from .16 to .18, *p*-values < .05). Children who reported more anxiety were more error prone in general than children reporting less anxiety, after controlling for symptoms of depression. Child-reported anxiety was unrelated to Stroop interference scores.

It was also hypothesized that child anxiety would be positively related to negative automatic thoughts as assessed by the Children's Automatic Thoughts Scale, particularly in the physical threat and social threat domains. Children reporting more anxiety (Revised Children's Manifest

Anxiety Scale total score) also reported more negative automatic thoughts as assessed by the total score ($r = .44$, $p < .001$) and all subscale scores, after individual differences in Depression Self Rating Scale scores were partialed out.

Although there were no predictions regarding the nature of the association between child anxiety and either Self-Referent Encoding Task performance or attributional style, there were a number of interesting associations. In general, children reporting greater anxiety demonstrated a more negative self-schema than children reporting less anxiety, even after controlling for self-reported symptoms of depression . Specifically, children reporting more anxiety endorsed more negative adjectives as self-referent ($r = .18$, $p < .05$) and had a more negative self-concept (negative processing score, $r = .18$, $p < .05$) than children reporting less anxiety. Finally, self-reported symptoms of anxiety were positively related to a negative attributional style after controlling for symptoms of depression ($r = .14$, $p < .05$).

In contrast to child-report measures of anxious symptoms, parent-report measures demonstrated few associations with measures of cognition. Maternal and paternal reports of anxiety were unrelated to Self-Referent Encoding Task performance and Children's Automatic Thoughts scores, after controlling for parental reports of depression. Fathers' ratings of anxiety were also unrelated to dot-probe performance. Maternal reports of child anxiety demonstrated a significant negative association with dot-probe sad interference scores and a negative association with sad bias scores at trend level, after controlling individual differences in maternal ratings of child depression. Children described by mothers as more anxious demonstrated less of an attentional bias to sad information, specifically slower orienting to sad information, than children rated as less anxious by mothers. Maternal anxiety scores were unrelated to children's attributional style, though fathers' reports of child anxiety demonstrated a negative partial correlation with the positive composite of the Children's Attributional Style Questionnaire.

4.3 Child Temperament and Symptoms of Depression and Anxiety

Individual differences in child temperament have been linked with concurrent symptoms of depression and anxiety in children and adolescents (e.g., Biederman et al., 2001; Chorpita et al., 2000; Fox et al., 2010; Muris et al., 2001). As such, it was hypothesized that child depressive and anxious symptoms would demonstrate specific relations with individual differences in child

temperament. Specifically, it was hypothesized that symptoms of depression would be related to lower PE and higher NE, while anxiety should be related to higher NE in general and high fear and BI in particular.

As previously noted, preliminary analyses demonstrated moderate to strong correlations between ratings of depression and anxiety made by the same rater. Table 6, therefore, presents partial correlations between child temperament variables and ratings of depression and anxiety, controlling for ratings of anxiety and depression made by the same rater, respectively. Partial correlations between child temperament and self-report symptoms of depression, for example, reflect associations after controlling for self-reported symptoms of anxiety. A summary of these findings is presented below.

4.3.1 Child Temperament and Symptoms of Depression

After controlling for symptoms of anxiety made by the same rater, neither child self-reported symptoms of depression nor parent-reports of child symptoms of depression demonstrated significant associations with laboratory-assessed child PE or NE. There were, however, a number of meaningful associations between child symptoms of depression and parent-reports of child temperament.

Child self-reported symptoms of depression were assessed using the Depression Self-Rating Scale total score. Depression scores were unrelated to parent-report measures of NE (sadness, anger, and fear). After controlling for child self-reported symptoms of anxiety (Revised Children's Manifest Anxiety Scale total socres), depression scores were negatively associated with fathers' rating of child low intensity pleasure, and positively associated with mother's ratings of child high intensity pleasure (both at trend-level).

After controlling for parent-report ratings of child anxiety, both maternal and paternal ratings of child depression were positively related to both parents' ratings of child sadness on the Temperament in Middle Childhood Questionnaire (*r*s ranging from .21 to .43, all *p*-values < .01). Maternal depression scores were positively related to both maternal and paternal reports of child anger ($r = .26$, $p < .01$ and $r = .20$, $p < .01$, respectively), and paternal depression scores were positively related to paternal, but not maternal, ratings of child anger ($r = .25$, $p < .01$). There was also some evidence of associations between individual differences in PE and depression risk.

Specifically, after controlling for mother-rated anxiety, mother-rated child depression was negatively correlated with father's reports of child low intensity pleasure (r = -.16, p < .05). Taken together, these results are consistent with previous research linking depression risk with high levels of NE and low levels of PE. After controlling for fathers' ratings of child anxiety, fathers' ratings of child depression were also positively related to laboratory-assessed BI, at trend-level. These findings are consistent with research linking heightened BI with risk for both anxiety and depression.

4.3.2 Child Temperament and Symptoms of Anxiety

After controlling for parent-reports of child depression, neither mother nor father reports of child anxiety were related to laboratory-assessed temperament. In contrast, child self-reported symptoms of anxiety demonstrated a number of predicted associations with laboratory-assessed temperament. After controlling for self-reported symptoms of depression (DSRS total scores), self-reported symptoms of anxiety (Revised Children's Manifest Anxiety Scale total scores) were positively associated with laboratory-assessed NE (r = .18, p < .05), fear (r = .24, p <.01), and BI (r = .17, p < .05). Children rated as higher in NE, as well as BI and fear, therefore, self-reported higher levels of anxiety than children rated as lower in NE, BI, or fear in laboratory tasks. Similar findings were observed for parent-report measures of child temperament. After controlling for symptoms of depression, child self-reported symptoms of anxiety were positively related to mother- and father-rated child sadness (r = .17, p < .05 and r = .15, p < .10, respectively), as well as father-rated child fear (r = .17, p < .05). Similarly, maternal-rated child anxiety was positively correlated with maternal ratings of child fear (r = .22, p < .01), and paternal-rated child anxiety was positively correlated with a number of indices of NE (maternal and paternal ratings of anger, as well as paternal ratings of child fear, rs ranging from .18 to .22, ps < .01)). Taken together, these findings are consistent with models linking high NE with anxiety, as well as with models linking heightened fear and BI with anxiety-risk.

4.4 Hypothesis 1: Child Temperament and Cognitive Vulnerability

The primary purpose of this study was to explore associations between individual differences in child temperament and cognitive vulnerability for depression and anxiety. It was hypothesized that individual differences in child temperament associated with risk for depression or anxiety

would be associated with patterns of cognition thought to confer vulnerability for these disorders. Table 7 provides zero-order correlations between all measures of child temperament and measures of cognitive vulnerability. Hypotheses regarding the nature of associations between child temperament and cognitive vulnerability are described below. Zero-order correlations between laboratory and parent-report measures of temperament and child cognition were explored and significant correlations were further examined using hierarchical linear regression to test specific hypotheses.

4.4.1 NE, PE, and Depression-Related Cognitive Vulnerability

It was hypothesized that high levels of NE and low levels of PE would be related to cognitive vulnerability markers of depression. Given the extent of existing evidence for the role of schematic processing and attributional style in conferring vulnerability for depression, it was hypothesized that individual differences in NE and PE should predict positive and negative processing scores from the Self-Referent Encoding Task, as well as positive and negative composite scores for the Children's Attributional Style Questionnaire. It was also hypothesized that diminished PE and heightened NE would be related to the frequency of negative automatic thoughts, particularly those related to personal failure (as assessed by the Children's Automatic Thoughts Scale). Although the role of emotion-related attentional biases is not prominent in major cognitive models of vulnerability for depression, it is also possible that attentional biases toward negative (particularly sad) information may be associated with high NE.

4.4.1.1 Schematic Processing

Contrary to hypotheses, examination of the zero-order correlations presented in Table 7 indicates that there were no significant correlations between laboratory-assessed child temperament and Self-Referent Encoding Task performance. Likewise, parental-reports of child temperament were unrelated to Self-Referent Encoding Task performance.

4.4.1.2 Attributional Style

Table 7 indicates that laboratory-assessed NE and PE were unrelated to children's attributional style. Maternal-reports of child sadness, however, were positively related to the negative composite ($r = .18$, $p < .05$), and paternal-reports of child low intensity pleasure were positively

related to the positive composite ($r = .22$, $p < .01$) and negatively related to the negative composite ($r = -.21$, $p < .01$). These correlations were explored further using hierarchical regression analyses. Separate regression analyses were conducted for maternal and paternal ratings of child temperament to permit the exploration of potentially different patterns of results. Parental reports of child sadness and low intensity pleasure were entered as temperament traits of interest, as these ratings were the only ones that demonstrated significant correlations with children's attributional style.

In the first set of hierarchical regression analyses (Table 8), maternal reports of child temperament were used to predict negative composite scores. Preliminary analyses indicated that negative composite scores on the were negatively correlated with individual differences in Peabody Picture Vocabulary Test performance ($r = -.22$, $p < .01$). Peabody Picture Vocabulary Test scores, therefore, were entered in step 1. As reported in Table 6, there were a number of significant correlations between ratings of child symptoms of depression and cognitive vulnerability. In order to examine the unique prediction of attributional style, controlling for current symptoms of depression, ratings of child depression were entered in step 2. Maternal reports of child sadness and low intensity pleasure were entered together in step 3. Maternal reports of child temperament were unrelated to the negative composite scores after controlling for children's vocabulary scores and current symptoms of depression.

A similar set of hierarchical regressions explored predictive associations between paternal reports of child temperament and positive composite scores (Table 8). Unlike the negative composite scores, individual differences in Peabody Picture Vocabulary Test performance were unrelated to children's CASQ-R positive composite scores. In fact receptive vocabulary scores were not related to any other measure of cognitive vulnerability other than the negative composite score. To control for current symptoms of depression, ratings of child depression were entered in step 1, followed by paternal ratings of child sadness and low intensity pleasure in step 2. Fathers' reports of children's low intensity pleasure contributed significantly to the prediction of children's positive composite score after controlling current symptoms of depression, $\beta = .17$, $p < .05$. Paternal reports of child sadness did not contribute to the prediction of attributional style. These findings indicate that higher ratings of low intensity pleasure predicted a less depressogenic attributional style for positive events. These findings are consistent with the

hypothesis that diminished low intensity pleasure may confer risk for the development a depressogenic attributional style (at least with respect to attributions for positive events).

4.4.1.3 Negative Automatic Thoughts

It was also hypothesized that diminished PE and heightened NE would be related to the frequency of negative automatic thoughts, particularly those related to personal failure. Contrary to predictions, there were no significant relations between laboratory-assessed temperament and the frequency of negative automatic thoughts as assessed by the Children's Automatic Thoughts Scale total scores. It was possible, however, that there were associations between laboratory-assessed temperament and subscale scores of the Children's Automatic Thoughts Scale (Schniering & Rapee, 2004a). Although not reported in Table 7, correlations between measures of temperament and subscale scores were, therefore, also examined. There were no significant correlations between subscale scores and laboratory-assessed NE or sadness. Laboratory-assessed PE (composite score), however, was positively correlated with automatic thoughts related to physical threat, $r = .17$, $p < .05$, and hostility, $r = .15$, $p < .05$. These correlations were explored using a series of hierarchical regressions predicting physical threat and hostility scores (Table 9). In each of these analyses ratings of child current symptoms of depression were entered in step 1, followed by laboratory assessed NE and PE in step 2. Laboratory assessed PE, but not NE, contributed to the prediction of both physical threat, $\beta = .17$, $p < .05$, and hostility scores, $\beta = .17$, $p < .05$, after controlling for current symptoms of depression. Higher PE demonstrated during laboratory tasks, predicted a higher frequency of negative automatic thoughts related to hostility and physical threat.

Like laboratory-assessed temperament, parent ratings of child sadness and low intensity pleasure were also unrelated to Children's Automatic Thoughts Scale total scores. Parent-reports of child sadness and low intensity pleasure were also unrelated to subscale scores. There were, however, significant positive correlations between total scores and paternal ratings of child anger ($r = .21$, $p < .01$) and maternal ratings of high intensity pleasures ($r = .21$, $p < .01$). These correlations were explored using a series of hierarchical regressions predicting Children's Automatic Thoughts Scale total scores (Table 9). Separate regression analyses were conducted for maternal and paternal ratings of child temperament. Ratings of child current symptoms of depression were entered in step 1, followed by parental ratings of child anger and high intensity pleasure in step

2. After controlling for current symptoms of depression, maternal ratings of child anger and high intensity pleasure did not contribute to the prediction of total scores. Paternal ratings of child anger, however, did contribute to the prediction the frequency of negative automatic thoughts after controlling for symptoms of depression, $\beta = .18$, $p < .05$.

4.4.1.4 Attention

Emotional Stroop

Although there were no specific hypotheses regarding potential biases in attention and individual differences in child temperament related to depression risk, it is possible that NE and PE might demonstrate meaningful associations with attentional biases for positive and negative (particularly sad) information. Stroop interference scores were unrelated to laboratory assessed measures of child temperament, and there was only one weak correlation between parental reports of child temperament and Stroop interference scores (as presented in Table 7). In contrast, there were a number of significant correlations between Stroop errors and measures of child temperament. A series of hierarchical regression analyses, was therefore, performed, exploring the role of laboratory-assessed and parent-report measures of child NE and PE in predicting errors on Stroop positive, sad, and threat trials. In each set of analyses, current symptoms of depression were entered in step 1 followed by relevant measures of temperament in step 2.

Significant correlations were observed between laboratory assessed PE and positive ($r = .17$, $p < .05$) and sad Stroop errors ($r = .15$, $p < .05$). A series of hierarchical regressions with Stroop positive and sad errors as dependent variables explored these relations further (Table 10). After controlling for symptoms of depression laboratory assessed NE did not contribute to the prediction of positive Stroop errors. Laboratory assessed PE was predictive of errors on positive Stroop trials at trend level, $\beta = .14$, $p < .10$. Likewise, laboratory assessed NE did not predict Stroop sad errors, but laboratory assessed PE did, $\beta = .15$, $p < .05$.

Stroop sad errors were significantly correlated with maternal reports of child sadness ($r = .15$, $p < .05$), anger ($r = .11$, $p < .05$), and high intensity pleasure ($r = .22$, $p < .01$). Maternal reports of child high intensity pleasure were also significantly correlated with Stroop threat errors ($r = .17$, $p < .05$). A series of hierarchical regressions with Stroop sad and threat errors as dependent

variables explored these relations further (Table 11). After controlling for symptoms of depression in step 1, maternal reports of child sadness, anger, low intensity pleasure, and high intensity pleasure were entered in step 2. Maternal reports of child high intensity pleasure predicted Stroop sad errors, after controlling for child current symptoms of depression, $\beta = .18$, $p < .05$. Maternal reports of child sadness also contributed to the prediction of Stroop sad errors at trend-level, $\beta = .17$, $p < .10$. Only maternal reports of child high intensity pleasure contributed to the prediction of threat errors at trend-level after controlling for current symptoms of depression $\beta = .14$, $p < .10$.

Stroop sad errors were correlated with paternal report of low ($r = -.28$, $p < .01$) and high intensity pleasure ($r = .22$, $p < .01$). Paternal reports of child low and high intensity pleasure were also significantly correlated with errors on threat trials of the emotional Stroop ($r = -.26$, $p < .01$ and $r = .17$, $p < .05$, respectively). A series of hierarchical regressions with Stroop sad and threat errors as dependent variables explored these relations further (Table 11). After controlling for symptoms of depression in step 1, paternal reports of child sadness, anger, low intensity pleasure, and high intensity pleasure were entered in step 2. After controlling for current symptoms of depression, both paternal ratings of child low intensity pleasure, $\beta = -.24$, $p < .01$, and high intensity pleasure, $\beta = .18$, $p < .05$, contributed significantly to the prediction of Stroop sad errors. Paternal reports of child low intensity pleasure also predicted errors on Stroop threat trials, after controlling for symptoms of depression, $\beta = -.24$, $p < .01$.

Dot-Probe

It was hypothesized that there may be relations between individual differences in child PE and NE and attentional biases to positive and sad stimuli on the dot-probe, respectively. Correlations between laboratory-assessed and parent reports of child temperament and dot-probe bias scores are presented in Table 7. Laboratory-assessed PE was unrelated to individual differences in dot-probe performance, and the only significant correlation between laboratory-assessed NE and dot-probe performance was a negative relation with dot-probe threat interference scores. Attentional biases to threat-related stimuli will be discussed below in relation to anxiety-vulnerability.

Paternal reports of child NE and PE were unrelated to either positive or sad attentional biases on the dot-probe. There were, however, a number of predicted correlations observed between

mothers' reports of child temperament and biases for positive and sad stimuli in the dot-probe. Positive bias scores were negatively correlated with maternal reports of child sadness (r = -.16, p < .05) and anger (r = -.15, p < .05), and positive interference scores were negatively correlated with maternal reports of sadness (r = -.15, p < .05). Increased NE (sadness and anger) were associated with less attention to positive stimuli. Sad facilitation scores were negatively correlated with maternal low intensity pleasure (r = -.18, p < .05). Lower levels of PE, therefore, were associated with greater attentional orienting to sad stimuli.

These correlations were explored in a series of hierarchical regressions with positive bias, positive interference, and sad facilitation scores as dependent variables (Table 12). For each set of regression, ratings of current symptoms of depression were entered in step 1 and maternal reports of child NE and PE (sadness, anger, and low intensity pleasure) were entered in step 2. Positive bias scores were unrelated to maternal reports of child temperament in regression analyses. Maternal reports of child sadness, β = -.25, p < .01, and low intensity pleasure, β = .18, p < .05, however, predicted positive interference scores, such that lower sadness and higher low intensity pleasure predicted greater difficulty disengaging attention from positive information. After controlling for current symptoms of depression, sad facilitation scores were also predicted by maternal reports of child sadness (at trend-level), β = .18, p < .10 and low intensity pleasure, β = -.27, p < .01, such that higher sadness and lower low intensity pleasure predicted greater attentional capture by sad stimuli.

4.4.2 Child Fear, BI and Anxiety-Related Cognitive Vulnerability

Given that BI and fearfulness are linked with anxiety-vulnerability, it was hypothesized that these temperament traits would demonstrate a positive association with cognitive vulnerability markers of anxiety, such as attentional biases toward to threat-related information. It was also hypothesized that individual differences in child fear and BI would be associated with negative automatic thoughts, particularly those related to physical and social threat. There were no predictions regarding the nature of associations between children's fear and BI and measures of schematic processing and attributional style, which are most strongly linked with depression-vulnerability.

4.4.2.1 Attention

Individual differences in child BI and fearfulness, as measured by both laboratory and parent report measures, were unrelated to children's performance on the Stroop. Likewise, laboratory-assessed fear and BI and maternal reports of child fear were unrelated to dot-probe performance. There were, however, a number of significant correlations between fathers' reports of child temperament and attentional biases on the dot-probe (Table 7). Dot-probe threat interference scores were positively correlated with fathers' reports of child fearfulness ($r = .15$, $p < .05$), whereas dot-probe threat facilitation scores were negatively related to both paternal reports of child fearfulness ($r = -.19$, $p < .05$) and low intensity pleasure ($r = -.16$, $p < .05$). Although unrelated to maternal reports of fear, dot-probe threat facilitation scores were also negatively related to maternal reports of low intensity pleasure ($r = -.18$, $p < .05$).

Hierarchical linear regression was used to explore these associations further (Table 13). In the first set of regression analyses, paternal reports of child fear were used to predict dot-probe threat facilitation scores (step 2). After controlling for current symptoms of anxiety as reported by all three raters (step 1), father's reports of child fear continued to predict threat interference scores, at trend-level, $\beta = .14$, $p < .10$. The second set of regressions predicted dot-probe threat facilitation scores. Paternal reports of child fear and low intensity pleasure were entered in step 2, along with maternal reports of child low intensity pleasure. After controlling for symptoms of anxiety in step 1, fathers' reports of child fearfulness negatively predicted threat facilitation scores, $\beta = -.24$, $p < .01$. Taken together, these results indicate that higher paternal ratings of child fear predicted less attentional capture by threat related stimuli, but greater difficulty disengaging attention from threat.

As reported above, paternal reports of child fearfulness were also negatively correlated with dot-probe positive facilitation scores. A third set of regression analyses explored this association. After controlling for current symptoms of anxiety in step 1, father's reports of child fearfulness negatively predicted dot-probe positive bias scores, $\beta = -.19$, $p < .05$.

4.4.2.2 Negative Automatic Thoughts

It was also hypothesized that children high in BI and fearfulness would demonstrated a higher frequency of negative automatic thoughts, particularly with respect to physical or social threat

(as assessed by the Children's Automatic Thoughts Scale). As reported in Table 7 neither laboratory-assessed nor parent-report indicators of fear or BI were significantly related to automatic thoughts total scores. Although not reported in Tables 7, parent-ratings of child fearfulness and laboratory-assessed fear and BI were unrelated to Children's Automatic Thoughts Scale subscale scores, with the exception of a negative correlation between maternal ratings of child fearfulness and negative automatic thoughts related to physical threat (r = -.14, p < .05).

4.4.2.3 Schematic Processing

Given that schematic processing has been most strongly linked with depression vulnerability, there were no hypotheses regarding associations between positive or negative schematic processing and child fearfulness or BI. Examination of the zero-order correlations presented in Table 7 indicate that there were no significant correlations between laboratory-assessed fear and BI and schematic processing as assessed by the Self-Referent Encoding Task. Likewise, parental-reports of child fear are unrelated to Self-Referent Encoding Task performance.

4.4.2.4 Attributional Style

Table 7 indicates that laboratory-assessed fear and BI were unrelated to children's attributional style, as assessed by the Children's Attributional Style Questionnaire. Likewise, paternal reports of child fearfulness were unrelated to either the positive or negative composite of the. Although maternal reports of child fear were unrelated to the negative composite, there was a positive correlation between maternal-rated fear and children's performance on the positive composite (r = .14, p < .05).

Hierarchical linear regression was performed using the positive composite score as the dependent variable and maternal reports of child fearfulness entered in step 2, after controlling for symptoms of anxiety in step 1. Maternal reports of child fearfulness positively predicted attributional style for positive events after controlling for child current symptoms of anxiety. β = .17, p < .05.

4.5 Hypothesis 2: Parental Psychopathology and Child Cognitive Vulnerability

4.5.1 Parental Depression and Child Cognitive Vulnerability

Parental lifetime history of depression has been linked with increased risk for depression in children. Although clinical interviews provided information regarding parents current and lifetime diagnostic status, lifetime history of a depressive disorder (Major Depressive Disorder or Dysthymic Disorder) was used to capture risk related to parental psychopathology. Lifetime history for both mothers and fathers were coded separately. Risk related to parental history was also coded in a general parental history variable, which indicated whether either parent had a history of depression (e.g., children with one or two parents with a history of depression were coded 1 for parental history, while children without a parent with a history of depression were coded 0 for parental history). Early onset and chronic forms of parental depression are particularly related to risk for depression in offspring. In order to capture the increased risk presented by these variables, a three-level onset variable was created (0 = no Major Depressive Disorder or Dysthymic Disorder; 1 = onset $\geq$ 21 years; 2 = onset < 21 years), and a 3-level course variable was created (0 = no Major Depressive Disorder or Dysthymic Disorder; 1 = single episode, non-chronic; 2 = recurrent, chronic major depression or Dysthymic Disorder). Each of these scores served as an additional measure of the severity of parental depression.

Zero-order correlations between data pertaining to parental history of depression and child cognitive vulnerability are presented in Table 14. It was predicted that children whose parents had a history of depression should demonstrate higher degrees of depression-specific cognitive vulnerability factors, such as a more negative and a less positive self-schema, negative automatic thoughts, and a depressogenic attributional style. Based on the zero-order correlations between parental diagnostic status and child cognitive vulnerability, a series of logistic regressions were performed to determine if children's pattern of cognition would correctly classify parent's diagnostic status, controlling for child symptoms of depression, and parent symptoms of anxiety. Early onset and chronic course were also hypothesized to be related to greater risk. Ordinal regression analyses exploring predictive relations between parental depression risk (onset and course variables) and child cognitive vulnerability were also performed, based on zero-order correlations presented in Table 14. Contrary to predictions, parental history of depression was unrelated to children's attributional style. There were, however, significant correlations between

parental history of depression and measures of children's schematic processing, attentional biases, and negative automatic thoughts.

4.5.1 1 Schematic Processing

As shown in Table 14, only paternal history of depression was related to children's schematic processing, as assessed by the Self-Referent Encoding Task. Paternal lifetime history of either MDD or DD was positively correlated with negative processing scores($r = .23$, $p < .01$). A logistic regression, in which negative processing scores was used as a predictor of paternal history of depression, was conducted. Ratings of child current symptoms of depression (parent-report and child-report) were entered in step 1 and Self-Referent Encoding Task negative processing score was entered in step 2. After controlling child current symptoms of depression negative processing scores contributed to the correct classification of paternal diagnostic status, $p < .01$ (OR = 4.05; 95% CI: 1.49-11.01). Children with a more negative self-schema were more likely to have fathers with a history of depression than children with a less negative representation of the self.

Consistent with these findings, paternal depression onset, $r = .18$, $p < .05$, and course, $r = .16$, $p < .05$ variables were also significantly correlated with Self-Referent Encoding Task negative processing scores. These relations were explored further using ordinal regression with negative processing scores used as the predictor variable. The dependent variable for the first regression was paternal depression onset and the dependent variable for the second regression was paternal depression course. Individual differences in the negative processing score were positively associated with both paternal depression onset (*logit regression coefficient* = 10.70, $p < .05$) and paternal depression course variables (*logit regression coefficient* = 10.08, $p < .05$).

4.5.1.2 Attention

Parental history of depression was related to children's accuracy on the auditory emotional Stroop. As reported in Table 14, parental history of depression was positively correlated with the number of errors that children made on sad Stroop trials ($r = .16$, $p < .05$). Children with at least one parent with a history of depression demonstrated more errors on sad Stroop trials than children with parents without a history of depression. After controlling for child current

symptoms of depression (parent reports and child reports), however, number of sad Stroop errors did not contribute to the correct classification of parental depression in a logistic regression.

4.5.2 Parental Anxiety and Child Cognitive Vulnerability

Parental history of anxiety is associated with increased risk for anxiety in children. Although clinical interviews provided information regarding parents' current and lifetime diagnostic status, lifetime history of any anxiety disorder was used to capture risk related to parental psychopathology. Lifetime history of an anxiety disorder was coded separately for mothers and fathers. Risk related to parental history was also coded in a general parental history variable, which indicated whether either parent had a history of anxiety (e.g., children with one or two parents with a history of anxiety were coded 1 and children with no parental history were coded 0). Zero-order correlations between each of these variables and children's performance on measures of cognitive vulnerability are reported in Table 15. As shown in Table 15, the only significant association between parent history of anxiety and children's cognitive vulnerability was a weak correlation between fathers' lifetime history of any anxiety disorder and children's SRET positive processing score. Correlations were re-run using different criteria for parental history (e.g., excluding histories of simple phobia and anxiety disorder not otherwise specified). It was hypothesized that perhaps child cognitive vulnerability would be more strongly associated with more serious or debilitating forms of parental anxiety, such as panic disorder, generalized anxiety disorder, and posttraumatic stress disorder. There were, however, no significant correlations between markers of child cognitive vulnerability and parental history of anxiety even in this revised analysis. Given the lack of associations observed in the zero-order correlations, logistic regression analyses were not performed.

Chapter 5

5 Summary and Conclusions

The current study is a multi-trait/multi-method assessment of potential relations between individual differences in child temperament and vulnerability for internalizing psychopathology. The primary purpose of the study was to explore the hypothesis that longitudinal associations between child temperament and the development of depression and anxiety may be mediated by biases in information processing known to confer vulnerability for these disorders. As an initial

test of this hypothesis, associations between child temperament and markers of cognitive vulnerability for internalizing psychopathology were explored in a community sample of children. Associations between parental history of internalizing psychopathology and individual differences in child cognitive vulnerability were also explored.

5.1 Temperament-Cognition Associations

There is both cross-sectional and longitudinal evidence linking individual differences in schematic processing and attributional style to depression (e.g., Abela & Hankin, 2008; Alloy et al. 1999; Alloy et al., 2006; Gladstone & Kaslow, 1995; Iacoviello et al., 2006; Volez et al., 2001). It was hypothesized that individual differences in child temperament associated with depression (i.e., high NE and low PE) would also be related to schematic processing and attributional style. Partial support for this hypothesis was found in a previous study linking PE at age 3 with schematic processing at age 7 (Hayden et al. 2006). Specifically, this study found that PE, but not NE, at Time 1 predicted individual differences in child positive schematic processing at Time 2, after controlling for child cognitive ability and symptoms of depression. Hayden et al. (2006), however, did not find predictive associations between laboratory-assessed or maternal reports of child PE or NE at age 3 and attributional style assessed at age 7.

Contrary to predictions there were no associations between measures of PE or NE and children's performance schematic processing (as assessed by the Self-Referent Encoding Task) in the current study. Although laboratory-assessed and maternal reports of child PE and NE were unrelated to children's attributional style, paternal reports of child's low intensity pleasure were positively related with individual differences in positive attributional style. Higher paternal ratings of child low intensity pleasure were predictive of a more positive attributional style for positive events (i.e., attributing positive events to internal, stable, and global factors). Conversely, lower father-rated PE predicted a more depressogenic attributional style for positive events (i.e., attributing positive events to external, unstable, and specific factors). These findings are consistent with the hypothesis that low PE is associated with cognitive vulnerability for depression. Although these findings initially appear to differ from those reported by Hayden et al. (2006), it should be noted that neither study found associations between laboratory-assessed or maternal reports of child PE/NE and attributional study. The current study, however, does

demonstrate associations between child attributional style and fathers' ratings of child PE, which were not included in the previous study.

Although there were no strong predictions made about associations between PE/NE and attentional biases to emotional information, regression analyses revealed a general pattern of results suggesting that high NE (particularly sadness) and low PE were related to heightened attention for sad stimuli and diminished attention for positive stimuli. Maternal reports of child sadness and low intensity pleasures, for example, predicted dot-probe positive interference scores, such that greater sadness and lower positive emotionality predicted less difficulty disengaging attention from positive stumuli. Hierarchical regression analyses also revealed that temperamental-risk for depression was associated with increased attention to sad information. After controlling for current symptoms of depression, sad facilitation scores were predicted by both maternal reports of child sadness (at trend-level) and maternal reports of child low intensity pleasures, such that higher ratings of sadness and lower ratings of positive emotionality (low intensity pleasure) predicted greater attentional orienting to sad stimuli. Taken together, these findings provide some evidence of links between individual differences in child PE and NE and cognitive vulnerability for depression.

Interestingly, the strongest evidence for a temperament-cognition association was found for attentional biases for positive and sad stimuli in the dot-probe. To date, the data implicating attentional biases in depression-vulnerability is mixed (e.g., Beevers & Carver, 2003; Dalgleish, Taghavi, Neshat-Doost, Moradi, Canterbury, & Yule, 2003; Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 2000), while the evidence of associations between schematic processing and attributional style and depression is quite strong (e.g. Abela & Hankin, 2005; Alloy et al. 2006; Gladstone & Kaslow, 1995; Iacoviello et al., 2006; Lakdawalla et al., 2007). Some research, however, suggests that depression is related to increased attention toward negative information and decreased attention toward positive information when stimuli are presented for longer durations or when pictorial stimuli are used rather than linguistic stimuli (e.g., Bradley et al., 2000; Caseras et al., 2007; Kujawa et a.,, 2011; Leyman et al., 2007; Mogg et al., 1995). Consistent with these findings, the dot-probe procedures employed in the current study featured a relatively long stimulus exposure duration (1200 ms), and associations between temperament and

attentional biases were found only for the dot-probe, which used pictorial stimuli, and not for the auditory emotional Stroop (i.e., interference scores), which used linguistic stimuli.

This study assessed cognitive vulnerability in a younger sample compared to other studies, which have tended to focus on older children, adolescents, and adults (e.g., Abela et al., 2009; Abela & Sullivan, 2003; Alloy et al. 2006; Hankin et al., 2001; Lewinsohn et al., 2001; Sanjuan & Magallares, 2009). Furthermore, almost all of the longitudinal work that exists explores links between schematic processing or attributional style and depression. There is little longitudinal work exploring links between attentional biases and depression. It is possible, however, that increased attention toward sad information or diminished attention toward positive information is a relatively early emerging marker of vulnerability linked with temperament, and that over time attentional biases promote the development of higher-order cognitive processes, such as schematic processing or attributional style, by biasing the types of input available for processing early in development. As the data presented in the current study will ultimately be Time 1 data for a series of longitudinal studies exploring associations between temperament, cognition, and internalizing psychopathology, it will be important to explore whether associations between temperament and attention predict the development of other forms of cognitive vulnerability and/or depression over time. It is also possible that given the relatively young age of the children in this study that clear biases in schematic processing or attributional style had not yet developed. Again, this is a question to be explored in longitudinal follow-up.

Cognitive models of anxiety propose that anxiety-vulnerability is associated with attentional biases to threat-related information (e.g., Eysenck, 1992; Fox et al., 2001, 2002; Williams et al., 1997, Yiend & Mathews, 2001), and there is significant empirical support for the role of individual differences in attention in conferring vulnerability to anxiety (Bar-Haim et al., 2007; Cisler et al., 2009). It was, therefore, hypothesized that individual differences in fearfulness and BI would predict biases in attention for threat-related stimuli, but not other types of emotional information. Contrary to this prediction, laboratory-assessed fearfulness and BI, as well as maternal reports of child fearfulness, were unrelated to attentional biases. Paternal reports of child fearfulness, however, demonstrated predictive associations with dot-probe performance on threat trials. Although overall threat-bias scores were unrelated to child fearfulness, paternal rated fearfulness predicted decreased attentional facilitation for threatening stimuli and greater

attentional interference. Children who are more fearful (as rated by their fathers), therefore, demonstrated less attentional capture by threat-related stimuli in the dot-probe, but greater difficulty disengaging attention from potentially threatening stimuli.

These findings highlight the importance of assessing multiple facets of attention, as temperament-related biases were not found in analyses using the standard dot-probe bias score. Furthermore, the difference in findings for the attentional facilitation and attentional interference scores is theoretically important. Models of temperamental risk for anxiety have linked risk for anxiety with the behavioural inhibition system, and cognitive models of anxiety and attention have highlighted the role of fear in narrowing attention or promoting the selection of threat-related information for processing. Based on these models, one might expect that temperamental risk (i.e., high fearfulness or BI) would have been most strongly associated with biases in attentional orienting to threat. In contrast, the results of this study suggest that temperamental fearfulness is instead related to difficulties disengaging attention from threat-related information. These results are generally consistent with research demonstrating a significant associations between difficulties disengaging attention from threat and anxiety (e.g., Buckner et al,, 2010; Fox et al. 2001, 2002; Koster et al., 2004; Salemink et al., 2007; Yiend & Mathews, 2001), as well as with the findings of one other study using this type of analytic procedure with the dot-probe (Koster et al., 2004).Specifically, this study reports difficulties disengaging attention from threat-related stimuli, but no facilitation effect in a nonclinical sample of individuals high in trait anxiety.

The differing results for threat facilitation and threat interference scores highlight the need to conceptualize attentional biases using a two-factor model of attention that grants unique roles for reactive and regulatory components of attention (e.g., Deryrberry & Reed, 2002; Derryberry & Rothbart, 1997; Jordan & Morton, in press; Lonigan, Vasey, Phillips, & Hazen, 2004). Jordan and Morton (in press), for example, suggest that individual differences in attentional vulnerability for anxiety derive from a dynamic interplay between reactive and regulatory responses to threat over development. According to this account, reactive responses reflect relatively fast, bottom-up attentional processing that serves to disrupt ongoing processing and rapidly bring the threatening stimulus to the forefront of the mind (i.e., attentional orienting). In contrast, regulatory attentional processes are later-acting, top-down, and inhibitory processes that

either serve to keep threat-related distracters at bay (i.e., disengagement), or in instances in which they are fully processed, re-appraise them and attenuate their salience.

A two-factor framework is consistent with prominent neurocognitive models of attention that argue that distinct bottom-up and top-down processes underlie attention (e.g., Allport, 1989; Corbetta & Shulman, 2002; Posner, 1980; Posner et al., 1987). Two-factor models also offer a number of important developmental and clinical implications. Reactive and regulatory attentional components, for example, follow distinct developmental trajectories. Reactive processes, such as attentional orienting, emerge early in life (e.g., Derryberry & Rothbart, 1997). In contrast, regulatory components of attention, which are associated with the development of prefrontal cortex, follow a protracted developmental course (Diamond, 2002). As such, it is reasonable to expect that the relative contribution of each in conferring vulnerability is likely to change across development. Attentional reactivity should be more strongly associated with vulnerability early in development, prior to the maturation of sufficient regulatory abilities. Later in development, however, vulnerability is likely to depend more on regulatory aspects of attention that may moderate the influence of attentional reactivity. The results from the current study suggest that at least by age 7, individual differences in attentional regulation are linked with temperamental vulnerability for anxiety. Longitudinal exploration of the relative role of reactive and regulatory components of attention will be important in fully understanding the mechanisms involved in conferring vulnerability for anxiety.

It should be noted, however, that rather than a lack of facilitation effect, the current study found a negative association between biases in attentional orienting to threat and temperamental fearfulness (as reported by fathers). Fearful children, therefore, were less likely to initially orient their attention to threat-related stimuli than less fearful children in the current study. These findings are in contrast to the hypothesis that fearfulness confers attentional hyper-vigilance for threat. It should be noted, however, that a relatively long stimulus exposure duration was used in the current study (1200 ms) and that the strongest support for biases in attentional orienting come from studies that use relatively short stimulus exposure durations (see Bar Haim et al. 2007).

Another important consideration is the specificity of attentional biases for stimuli of particular emotional valences. Follow-up analyses indicated that paternal ratings of child fearfulness were unrelated to attentional biases for sad stimuli, suggesting that attentional biases did not

generalize to other types of negatively-valenced stimuli. A similar predictive pattern, however, was observed for positive stimuli, with paternal reports of child fearfulness predicting less attentional capture by positive stimuli, but greater difficulty disengaging attention. Dot-probe stimuli were chosen from the IAPS, which provides normative data on each image for emotional-valence as well as the level of arousal invoked by each image. Although positive and threatening images differed with respect to their emotional valence (positive versus negative), both categories of stimuli were coded as moderately high in arousal. Positive stimuli, therefore, were positive images that were moderate in arousal, and threatening stimuli were high arousal negative images (in contrast to sad stimuli which were low arousal negative stimuli). It is possible, therefore, that paternal-rated child fearfulness predicted attentional biases for stimuli associated with physiological arousal in general, regardless of the valence.

Although not directly related to the hypotheses of the current study, there were also some findings linking high levels of PE with markers of cognitive vulnerability. Specifically, laboratory-assessed PE positively predicted the frequency of negative automatic related to physical threat and hostility. High levels of PE (particularly high intensity pleasure) were also related to reduced accuracy on the Stroop across emotional domains. High intensity pleasure, as assessed by the TMCQ, reflects pleasure and positive affect related to situations involving high stimulus intensity and is likely related to activity level and sensation-seeking, in contrast to low intensity pleasure, which reflects pleasure derived from activities with low stimulus intensity. These findings are consistent with an emerging literature linking aspects of high PE with risk for externalizing disorders (e.g., Degnan, Hane, Henderson, Moas, Reeb-Sutherland, & Fox, 2011; Stifter, Putnam, & Jahromi, 2008), and should be explored further in future research.

5.1.1 Summary

Overall, there was significant evidence linking individual differences in child temperament with markers of cognitive vulnerability for psychopathology. The strongest support for temperament-cognition associations was for attentional biases to emotional stimuli. It is possible that given the age of the children in this study, that reliable individual differences in attributional style and schematic processing about the self had not yet developed (i.e., that these biases may emerge later in development). Attentional biases, in contrast, may be relatively early emerging markers of vulnerability that over time promote the development of higher-order cognitive biases. It

should also be noted that different patterns of temperament-cognition associations emerged for mother- and father-reports of child temperament. This particularly important given that most of the existing literature employs only maternal reports of temperament.

5.2 Parental History and Cognitive Vulnerability

There has been some research demonstrating links between parental history of depression and individual differences in child cognitive vulnerability. Children of depressed mothers, for example, demonstrate more negative attributional styles, more negative self-schemas, more negative interpretations of ambiguous stimuli and greater attention biases toward negative and away from positive stimuli than children of mothers without depression (Dearing & Gotlib, 2009; Garber & Robinson, 1997; Kujawa et al. 2011; Jaenicke et al., 1987; Joormann et al., 2007). Consistent with these findings there was some evidence in this study of associations between parental history of depression and child cognitive vulnerability for depression. In contrast to existing literature, however, which tends to focus primarily on maternal depression, this study found significant support for associations between paternal depression history and individual differences in child cognition, and relatively little support for associations between maternal depression and child cognition. Specifically, children of fathers with a history of either Major Depressive Disorder or Dysthymic Disorder demonstrated more negative schematic processing. Fathers demonstrating a higher risk for depression (as assessed via onset and recurrence variables) also had children with higher SRET negative processing scores than fathers classified as lower risk. There was also some evidence of associations between parental depression history and children's attentional interference from negative stimuli on the auditory Stroop. Correlation analyses indicated that children with at least one parent with a history of depression demonstrated more errors on negatively-valenced (sad and threat) Stroop trials than children with parents without a history of depression. It should be noted, however, that these relations were weak and were not significant in follow-up regression analyses.

To date, there exists little research examining parental history of anxiety and markers of cognitive vulnerability in children. In contrast to the findings reported for parental history of depression, this study did not find any support for associations between parental history of anxiety disorders and child cognitive vulnerability related to anxiety.

Given that this study used a community sample, there were relatively few parents with current diagnoses of either depression or anxiety. Parental lifetime history of internalizing disorders is considered a robust indicator of familial risk. It is possible, however, that stronger associations between parental psychopathology and child cognitive vulnerability may have been observed if current diagnostic status or severity of current symptoms had been used instead of lifetime history. Alternatively, it is also possible that stronger associations between parental history and markers of cognitive vulnerability in children may emerge later in development. Consistent with this hypothesis, much of the existing literature demonstrating associations between parental history of depression and cognitive vulnerability used samples of older children and adolescents (e.g., Dearing & Gotlib, 2009; Joormann et al., 2007)

5.3 Other Findings

Although not the primary purpose of the current study, the multi-trait/multi-method design also afforded an opportunity to explore a number of other theoretically important relationships, including associations between child temperament and current internalizing symptoms, relations between individual differences in cognitive vulnerability and internalizing symptoms, and the coherence between measures of cognition.

5.3.1 Child Temperament and Internalizing Symptoms

Individual differences in child temperament have been linked with current symptoms of depression and anxiety in children and adolescents (e.g., Biederman et al.., 2001; Chorpita et al., 2000; Fox et al., 2010; Muris et al., 2001). After controlling for symptoms of anxiety, laboratory-assessed child temperament demonstrated few significant associations with measures of child symptoms of depression. After controlling for symptoms of anxiety, parent-reports of child temperament, however, demonstrated a number of interesting relations with both child-reported and parent-reported child symptoms of depression. Results are generally consistent with models linking heightened NE and diminished PE with risk for depression. Paternal reports of child low intensity pleasures, for example, were negatively related with both child-reports and mother-reports of child symptoms of depression, and parent ratings of child sadness were related to parent ratings of child depression. There were also associations between parental ratings of child

depression and parent-reports of child anger, suggesting that multiple facets of NE were associated with parental reports of child depression.

There was a trend-level positive association between paternal ratings of child depression and laboratory-assessed BI, after controlling for paternal ratings of child anxiety. Although not specifically predicted by temperament models of depression vulnerability, this finding is consistent with research indicating that BI may present risk for both depression and anxiety (e.g., Kochanska, 1991; Olino et al., 2008; Rosenbaum et al., 1988, 2000). One interpretation of this finding is that it provides evidence against the specificity of the relations between BI and anxiety. Alternatively, such a finding may represent high levels of comorbidity of depression and anxiety or the finding that anxiety can often precede, and serve as a risk factor for depression (Mineka, Watson, & Clark, 1998; Moffit, Caspi, Harrington, Milne, Melchoir, Goldberg, & Poulton, 2007). Such findings highlight a need for research using a temperament framework examining multiple traits in order to clarify issues of specificity and comorbidity. The baseline data provided by the current study provides an opportunity to address these questions in longitudinal follow-up.

In contrast to symptoms of depression, which showed few associations with laboratory-assessed temperament, child self-reported symptoms of anxiety demonstrated a number of predicted associations with laboratory-assessed temperament. Children rated as higher in NE, as well as BI and fear, self-reported higher levels of anxiety than children rated as lower in NE, BI, or fear in laboratory tasks. Similar findings were observed for parent-report measures of child temperament. Both child self-reports and parent-reports of child anxiety demonstrated a number of associations with parental ratings of various facets of NE. Taken together, the findings support models suggesting that heightened NE in general, and heightened fear or BI specifically, are related to symptoms of anxiety.

One interesting finding is that laboratory-assessed PE (as assessed by the composite score) was positively associated with child-reported symptoms of anxiety. Although there were no predictions regarding PE-anxiety associations, the finding is consistent with prior research demonstrating a predictive association between measures of PE and symptoms of anxiety (as assessed by the Revised Children's Manifest Anxiety Scale) in children under 10-years of age (Lonigan, Hooe, David, & Kistner, 1999). Again, issues of specificity in predictive associations

between temperament and internalizing symptoms will be important to consider in longitudinal follow-up.

5.3.2 Cognitive Vulnerability and Internalizing Symptoms

Consistent with previous research (e.g., Gladstone & Kaslow, 1998; Neshat-Doost et al., 1998), child symptoms of depression were associated with a more negative and less positive pattern of schematic processing related to the self, as well as a depressogenic attributional style. Children reporting more symptoms of depression also self-reported more negative automatic thoughts across all domains assessed by the Children's Automatic Thoughts Sclae. In contrast to predictions, as well as previous research using the Children's Automatic Thoughts Scale (Schniering & Rapee, 2002; Schniering & Rapee, 2004a), there was no evidence of a specific association between symptoms of depression and automatic thoughts pertaining to personal failure. In fact, parental ratings of child depression were specifically related to child reports of negative automatic thoughts related to social threat. There was also no evidence of an association between depression and emotion-related attentional biases.

The primary prediction regarding cognitive vulnerability for anxiety was that anxious symptoms would be related to attentional biases toward threatening information. Parental reports of child anxiety were unrelated to threat-related attentional biases on either the Stroop or the dot-probe. Consistent with predictions, however, child self-reported anxiety was positively related to attentional biases to threat on the dot-probe. Examination of the Revised Children's Manifest Anxiety Scale subscale scores, in relation to the threat facilitation and threat interference scores revealed an interesting finding. Specifically, threat facilitation scores were positively correlated with physical symptoms of anxiety, while threat interference scores were correlated with difficulties with concentration related to anxiety. Attentional orienting is a relatively automatic process and should while disengagement is a controlled process. This pattern of results indicates that children demonstrating higher physiological arousal related to anxiety demonstrated specific biases to orient towards threat, while those demonstrating difficulties regulating anxiety had difficulties disengaging attention from threatening information. These results again highlight the importance of exploring the possibility that different components of attention provide unique (and potentially interacting) contributions to the development of anxiety.

Although not specifically predicted, children with higher rates of anxious symptoms also demonstrated a more negative attributional style, and child self-reported symptoms of anxiety were related to a more negative self-schema, after controlling for self-reported symptoms of depression. These patterns of cognition are typically thought to predict symptoms of depression. It is possible that these measures also predict anxiety vulnerability.

5.4 Strengths and Limitations

The primary strength of the current study is the multi-trait/multi-method design. Consistent with previous research there was little agreement between parent reports and laboratory measures of child temperament. Laboratory-assessed PE was unrelated to parent-reports of PE. Similar results were observed for lower-order facets of NE, and correlations between parent and laboratory measures of child fearfulness were weak to moderate. Although there was some agreement between mothers' and fathers' reports of child temperament, correlations were moderate at best. Also consistent with previous research, there was little agreement between parent-reports and child-reports of child symptoms of depression and anxiety. The general lack of agreement between measures of major study variables supports the use of multiple measures and the inclusion of multiple informants in studies of the role of temperament in conferring vulnerability for psychopathology.

The majority of existing research focuses on maternal reports of child temperament and internalizing disorders. The inclusion of paternal reports, therefore, is an important strength of this study. Father's reports of child temperament and internalizing psychopathology as well as paternal history of depression and anxiety were collected for the majority of families in this study, and many of the significant temperament-cognition associations were found only for paternal ratings of child temperament. Similarly, the current study found some evidence of links between parental history of depression and child cognitive vulnerability for depression, but in contrast to previous research which highlights an important role for maternal depression in conferring vulnerability, associations were strongest for paternal history of depression. These findings suggest that efforts should be made to include data from both parents whenever possible in future studies.

This study also addresses a number of other limitations of existing research. The use of a relatively young community sample provides an opportunity to explore associations between temperament and cognition in a sample of children in the absence of already existing psychopathology. The relatively young sample also adds significantly to the literature by examining cognitive vulnerability much earlier than is typically the case in existing research and provides a good baseline for the longitudinal study of the development of cognitive vulnerability. The use of a community sample also reduces some of the challenges associated with research using high-risk samples. Offspring studies, for example, may confound the effects of child temperament with unique characteristics of parent-child interactions.

There are, however, also a number of limitations and directions for future research. This study provides some initial support for the hypothesis that longitudinal relations between individual differences in child temperament may be mediated by the development of cognitive biases. The data presented in this paper, however, are cross-sectional and correlational. Longitudinal follow-up will be required to test this hypothesis more fully. Many of the correlations presented in this paper were also weak to moderate and should be interpreted with caution until longitudinal follow-up can explore the stability of associations more fully. This is particularly important to note given that corrections for multiple comparisons were not used.

Although the use of a community sample is a strength in the sense that it removes many of the confounds of high risk samples and samples of children who already have depression or anxiety, it also presents a limitation for exploring associations between current symptoms of depression and anxiety and either individual differences in child temperament or cognitive biases, as there is little variability in current symptoms. Over time, these hypotheses can be explored more fully in longitudinal follow-up.

In addition to testing hypotheses regarding the role of cognitive vulnerability in mediating relations between temperament and internalizing psychopathology, longitudinal follow-up should also explore the stability of cognitive vulnerability across development as well as the stability of temperament-cognition associations. These data will be particularly important in understanding the role of temperament in the development of cognitive vulnerability as well as in understanding how cognitive vulnerability develops and confers vulnerability to internalizing disorders. An assessment of other potentially mediating factors, such as life stressors, pubertal

status, parenting factors, and peer relations, can also be included in follow-up assessments to examine the role that these factors play in the development of depression and anxiety.

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Table 1

Affective Coding Variables: Means, Standard Deviations, and Zero-Order Correlations

	1 PE	2 NE	3 Sadness	4 Anger	5 Fear	6 Interest	7 Sociability
2	.17*						
3	-.03	.57***					
4	.33***	.57***	.11				
5	.00	.65***	.06	-.0			
6	.64***	.06	-.0	.35***	-.18*		
7	68***	.25***	.11	.43***	-.05	.67***	
	M = 2.65 *SD* = 1.29	*M* = 0.43 *SD* = 0.17	*M* = 0.37 *SD* =0.24	*M* = 0.40 *SD* = 0.29	*M* = 0.50 *SD* = 0.34	*M* = 1.97 *SD* = 0.42	*M* = 1.87 *SD* = 0.72

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 2

Factor Loadings for Behavioural Inhibition Micro-Coding

Variable	**Factor 1**	**Factor 2**	**Factor 3**
ENO Child Touches Skull	-.21	**.61**	-.25
ENO Latency to Touch Skull	.18	**-.57**	.28
ENO Child Touches Cloth	-.05	**.74**	-.03
ENO Latency to Touch Cloth	-.02	**-.75**	.10
ENO Child Touches Mask	-.17	**.66**	.15
ENO Latency to Touch Mask	.09	**-.67**	-.12
ENO Child Touches Box	-.05	**.72**	.19
ENO Latency to Touch Box	-.02	**-.67**	-.07
ENO Child Touches Spider	-.09	**.68**	.10
ENO Latency to Touch Spider	.08	**-.64**	-.09
ENO Number of Objects Touched	-.18	**.93**	.22
ENO Number of Epochs Playing with Box	-.07	**.60**	-.10
ENO Number of Epochs Playing with Skull	-.09	**.43**	-.16
ENO Number of Epochs Playing with Spider	.00	**.45**	-.01
OF Phase 1 Child Approaches Carrier	**-.81**	.08	-.07
OF Phase 1 Latency to Approach Carrier	**.84**	-.06	.08
OF Phase 1 Tentativeness to Approach Carrier	**.85**	-.11	.09
OF Phase 1 Child Touches Carrier	**-.86**	.10	-.03
OF Phase 1 Latency to Touch Carrier	**.88**	-.14	.02
OF Phase 1 Tentativeness to Touch Carrier	**.87**	-.15	.10
OF Phase 1 Child Looks Inside	**-.84**	.07	-.05
OF Phase 1 Latency to Look Inside	**.84**	-.09	.02
OF Phase 1 Tentativeness to Look Inside	**.83**	-.08	.05
OF Phase 1 Child Touches Animal	**-.78**	.15	-.01
OF Phase 1 Latency to Touch Animal	**.76**	-.18	.03
OF Phase 1 Tentativeness to Touch Animal	**.76**	-.19	.06
OF Phase 1 Child Demonstrates Fear Response	**.69**	-08	-.08
OF Phase 1 Latency to First Fear Response	**-.75**	.07	-.10
OF Phase 1 Child Makes Verbalization	**-.34**	.21	.16
OF Latency to First Verbalization	**.33**	-.23	-.14
OF Phase 1 Withdrawal Attempt	**.48**	.12	-.14
OF Phase 1 Latency to Withdrawal Attempt	**-.46**	-.11	.08
ENO Child Touches Tunnel/Tent	-.12	.22	**.75**
ENO Latency to Touch Tunnel/Tent	.10	-.10	**-.76**
ENO Number of Epochs Playing with Tunnel/Tent	-.10	-.24	**.62**
SA Attempts to Engage Stranger in Play	.15	-.05	**.52**
SA Latency to Engage Stranger in Play	-.13	.03	**-.51**
SA Intensity of Peak Approach	.04	.07	**.33**

Table 3

Temperament in Middle Childhood Questionnaire Scales: Means, Standard Deviations, and Zero-Order Correlations

	1 Maternal High Intensity Pleasure	2 Paternal High Intensity Pleasure	3 Maternal Low Intensity Pleasure	4 Paternal Low Intensity Pleasure	5 Maternal Anger/ Frustration	6 Paternal Anger/ Frustration	7 Maternal Sadness	8 Paternal Sadness	9 Maternal Fear	10 Paternal Fear	11 Maternal Shyness	12 Paternal Shyness
2	.62***											
3	-.11	-.17*										
4	-.22**	-.15*	.40***									
5	-.30***	.19*	-.16*	-.27***								
6	.04	.27***	-.07	-.06	.46***							
7	-.05	-.04	.01	-.10	.53***	.38***						
8	-.14	.05	-.04	-.04	.28***	.68***	.53***					
9	-.29***	-.27***	-.03	.01	.26***	.13	.45***	.25**				
10	-.24**	-.29***	.01	.06	.07	.24**	.19**	.39***	.49***			
11	-.22**	-.16*	-.00	-.04	.22**	.09	.35***	.14	.32***	.10		
12	-.17*	-.20**	.07	.04	.03	.06	.18*	.25**	.19*	.22**	.66***	
	M = 3.54 *SD* = 0.58 α = 0.81	*M* = 3.52 *SD* = 0.52 α = 0.79	*M* = 3.87 *SD* =0.44 α = 0.61	*M* = 3.71 *SD* = 0.44 α = 0.60	*M* = 2.96 *SD* = 0.70 α = 0.81	*M* = 2.96 *SD* = 0.66 α = 0.82	*M* = 2.64 *SD* = 0.52 α = 0.77	*M* = 0.63 *SD* = 0.52 α = 0.77	*M* = 2.61 *SD* = 0.63 α = 0.72	*M* = 2.62 *SD* = 0.64 α = 0.74	*M* = 2.64 *SD* = 0.83 α = 0.85	*M* = 2.67 *SD* = 0.76 α = 0.83

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4

Prevalence of Parental Depressive and Anxiety Disorders (Based on Clinical Interview Data)

	Mothers (n = 203)		Fathers (n = 196)	
	Lifetime n (%)	**Current n (%)**	**Lifetime n (%)**	**Current n (%)**
Any Mood Disorder	70 (34.48%)	9 (4.43%)	38 (19.39%)	8 (4.08%)
Any Depressive Disorder	66 (32.51%)	8 (3.94%)	35 (17.86%)	7 (3.57%)
MDD or DD	54 (26.60%)	7 (3.45%)	31 (15.82%)	7 (3.57%)
MDD	53 (26.11%)	4 (1.97%)	28 (14.29%)	3 (1.53%)
DD	4 (1.97%)	4 (1.97%)	4 (2.04%)	3 (1.53%)
Early Onset	18 (8.87%)		13 (6.63%)	
Late Onset	36 (17.73%)		18 (9.18%)	
Single Episode	23 (11.33%)		12 (6.12%)	
Recurrent/ Chronic	31 (15.27%)		17 (8.67%)	
Any Anxiety Disorder	52 (25.62%)	24 (11.82%)	25 (12.76%)	10 (5.10%)
Panic Disorder	16 (7.88%)	5 (2.46%)	7 (3.57%)	2 (1.02%)
Agoraphobia	4 (1.97%)	1 (0.49%)	1 (0.51%)	1 (0.51%)
Social Phobia	12 (5.19%)	4 (1.97%)	13 (6.63%)	5 (2.55%)
Specific Phobia	13 (6.40%)	8 (3.94%)	3 (1.53%)	3 (1.53%)
OCD	2 (0.99%)	0 (0%)	1 (0.51%)	0 (0%)
PTSD	8 (3.94%)	2 (0.99%)	1 (0.51%)	0 (0%)
GAD		2 (0.99%)		1 (0.51%)
ANOS	5 (2.46%)	4 (1.97%)	3 (1.50%)	1 (0.51%)

Table 5

Zero –Order Correlations between Laboratory-Assessed and Parent-Reports of Child Temperament

	Lab NE	Lab Sad	Lab Anger	Lab Fear	Lab PE (composite)	BI F1	BI F2
Maternal High Intensity Pleasure	-.04	.01	.16*	-.21**	.11	.03	.18*
Paternal High Intensity Pleasure	.01	.12	.08	-.15*	.05	.05	.20*
Maternal Low Intensity Pleasure	.01	.01	-.04	.05	.02	.07	.04
Paternal Low Intensity Pleasure	-.09	-.10	-.10	.03	-.01	-.04	-.03
Maternal Anger/ Frustration	.13	.04	.12	.07	.03	.11	.13
Paternal Anger/ Frustration	.15	.14	.10	.04	.06	.08	.20*
Maternal Sadness	.18*	.18**	.03	.12	.00	.11	-.04
Paternal Sadness	.26**	.22**	.11	.14	.03	.12	.04
Maternal Fear	.18*	.09	-.09	.28***	-.12t	.24**	-.03
Paternal Fear	.21**	.04	-.05	.33***	.00	.20*	-.02
Maternal – Shyness	.06	.11	-.16*	.15*	-.45***	.03	-.20*
Paternal Shyness	.09	.06	-.14	.21**	-.45***	.12	-.25**

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$

BI F1 = Behavioural Inhibition Micro-coding Factor 1 (BI); BI F2 = Behavioural Inhibition Micro-Coding Factor 2 (Exploration); BI F3 = Behavioural Inhibition Micro-Coding Factor 3 (Surgency)

Table 6

Partial Correlations between Child Internalizing Symptoms and Measures of Child Cognitive Vulnerability and Temperament

	Mother CBCL Depression	Father CBCL Depression	DSRS Total Score	Mother CBCL Anxiety	Father CBCL Anxiety	RCMAS Total Score
SRET Pos. Adj. Endorsed	-.04	.01	-.22**	.06	-.05	.08
SRET Neg. Adj. Endorsed	-.02	.20*	.25**	.06	.03	.18*
SRET Pos. Processing	-.02	-.03	-.15 □	-.02	-.10	.02
SRET Neg. Processing	-.02	.09	.04	-.04	.01	.18*
ES Positive Errors	.10	-.10	.02	-.04	.09	.16*
ES Sad Errors	.23**	.06	.06	-.15*	-.02	.16*
ES Threat Errors	.16*	.01	-.03	-.04	.08	.19**
ES Positive Interference	.08	.11	.07	-.09	-.17*	.00
ES Sad Interference	-.04	-.03	.10	-.09	-.11	-.11
ES Threat Interference	.03	-.02	.05	-.08	-.06	-.07
DP Positive Bias	-.08	.03	.09	.03	-.02	.06
DP Positive Facilitation	-.12	-.02	-.02	.02	-.02	.12+
DP Positive Interference	.07	.04	.10	-.03	-.03	-.06
DP Sad Bias	-.04	-.03	.05	-.14+	.01	-.04
DP Sad Facilitation	-.08	-.04	-.04	.01	.00	.09
DP Sad Interference	.13 □	.01	.12	-.17*	.03	-.15*
DP Threat Bias	.03	.09	.13 □	.01	.04	.14*
DP Threat Facilitation	-.10	.01	.08	.10	.09	.09
DP Threat Interference	.13 □	.12	.06	-.10	-.06	.08
CATS Total	.01	.14 □	31***	.08	.00	.44***
CASQ PC	-.07	.00	-.28***	.04	-.14+	.03
CASQ NC	.15*	.18*	.32***	.09	.08	.14*
Laboratory NE	.11	.11	-.07	.04	.04	.18*
Laboratory Sadness	.09	.06	.03	.07	.10	.08
Laboratory Anger	.08	.06	.00	-.06	-.02	-.01
Laboratory Fear	.04	.07	-.14 □	.06	.01	.24**
Laboratory PE (composite)	.04	.09	-.07	-.07	-.13	.20*
BI (Factor 1)	.05	.15 □	.00	.05	.00	.17*
Exploration (Factor 2)	-.04	.11	.17*	.07	-.04	-.03
Maternal Rated Sadness	.43***	.32***	-.07	..05	.03	.17*
Paternal Rated Sadness	.21**	.30***	-.06	.10	.15 □	.15 □
Maternal Rated Anger	.26**	.11	.12	.00	.22**	.09
Paternal Rated Anger	.20**	.25**	-.03	.08	.18**	.10
Maternal Rated Fear	.13	.08	.02	.22**	.07	.07
Paternal Rated Fear	.09	.06	-.07	.11	.22**	.17*
Maternal Rated LIP	-.06	-.08	-.12	.09	-.08	.02
Paternal Rated LIP	-.16*	-.04	-.14 □	.06	-.10	.01
Maternal Rated HIP	.17*	-.04	.13 □	-.20*	.08	-.01
Paternal Rated HIP	.07	-.02	.06	-.07	.00	.06

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; □ $p < .10$

SRET = Self-Referent Encoding Task; ES = Emotional Stroop; DP = Dot-Probe; CATS = Children's Automatic Thoughts Scale; CASQ-R PC = Children's Attributional Style Questionnaire-Revised Positive Composite; CASQ-R NC = Children's Attributional Style Questionnaire-Revised Negative Composite; LIP = low intensity pleasure; HIP = high intensity pleasure

Table 7

Zero-Order Correlations between Measures of Child Temperament and Cognitive Vulnerability

	Lab NE	Lab Sad	Lab Anger	Lab Fear	Lab PE	BI	Mat. Sad	Pat. Sad	Mat. Anger	Pat. Anger	Mat. Fear	Pat. Fear	Mat. LIP	Pat. LIP	Mat. HIP	Pat. HIP
SRET PAE	-.04	-.13	.06	-.03	.10	-.06	-.04	-.05	-.05	-.03	-.03	-.02	.02	.07	.05	.03
SRET NAE	.11	.10	.05	.06	.12	.12	.12	.10	.09	.09	.10	.07	-.09	-.14	.13	.09
SRET PPS	-.03	-.13	.08	-.03	.07	-.08	-.04	-.05	-.07	-.05	-.03	-.04	.03	.07	.00	.02
SRET NPS	.01	.02	.01	.00	.12	.02	.00	.08	-.10	.05	-.01	.08	.08	.07	-.02	.02
ES Pos. Errors	.06	.09	.11	-.06	.17*	.08	.04	-.03	.07	.00	-.04	-.04	-.02	-.14	.22**	.26***
ES Sad Errors	.00	.07	.07	-.10	.15*	.06	.15*	.10	.11*	.11	.05	-.08	-.06	-.28***	.22**	.22**
ES Thr. Errors	.06	.04	.11	-.10	.10	.10	.07	.03	.08	.12	-.04	.02	-.03	-.26***	.17*	.17*
ES Pos. Int.	.00	.04	.07	-.09	.10	-.01	-.02	-.05	-.06	-.02	-.06	-.07	.00	.05	.03	-.03
ES Sad Int.	-.07	.02	-.03	-.09	.08	.04	-.15*	-.08	-.12	-.05	-.18	-.06	.03	.06	.09	.13
ES Thr. Int.	-.08	.00	-.09	-.05	.09	.01	-.10	-.07	-.11	-.94	-.05	.06	.09	.02	.02	-.10
DP Pos. Bias	.00	.01	-.04	.03	.02	.00	-.16*	-.07	-.15*	-.13	-.09	-.04	.01	.05	-.06	.02
DP Pos. Fac.	.00	.06	.01	-.04	.07	-.08	-.06	-.03	-.13	-.09	-.05	-.16*	-.09	-.05	-.07	.07
DP Pos. Int.	-.04	-.12	-.08	.08	-.05	.08	-.15*	-.08	-.07	-.08	-.07	.10	.12	.10	-.02	-.07
DP Sad Bias	-.03	-.02	.02	-.05	-.09	-.07	.09	.07	.05	.05	-.07	-.05	-.04	-.03	-.01	.07
DP Sad Fac.	.10	.02	.13	.03	-.03	-.08	.06	.10	-.03	.06	-.03	-.13	-.18*	-.06	-.08	.07
DP Sad Int.	-.12	-.03	-.10	-.10	-.08	-.02	.06	.01	.10	.01	-.05	.07	.17	.02	.09	.01
DP Thr. Bias	-.09	-.05	.03	-.13	.06	-.05	.03	.09	.12	.05	-.06	-.03	-.06	-.08	.11	.05
DP Thr. Fac.	.01	.07	.08	-.10	.07	-.11	.05	.10	.03	.07	-.04	-.19*	-.18*	-.16*	.04	.10
DP Thr. Int.	-.15*	-.15*	-.07	-.07	-.02	.04	-.02	.00	.12	-.02	-.03	.15*	.11	.07	.12	-.04
CATS Total	.05	.13	.04	-.03	.15*	.01	.07	.10	.14	.21**	-.11	-.04	-.07	-.11	.21**	.14
CASQ-R PC	-.08	-.12	-.05	.00	-.08	.07	.03	-.08	-.17*	-.20**	.14*	.11	.08	.22**	-.17*	-.19*
CASQ-R NC	.10	.05	.04	.08	.03	.13	.18*	.10	.26***	.11	.02	.04	-.10	-.21**	.27***	.13

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; $p < .10$

SRET PAE = SRET positive adjectives endorsed; SRET NAE = negative adjectives endorsed; SRET PPS = positive processing score; SRET NPS = negative processing sore; ES Pos. Errors = Emotional Stroop positive errors; ES Sad Errors = Emotional Stroop sad errors; ES Thr. Errors = Emotional Stroop threat errors; ES Pos. Int. = Emotional Stroop positive interference score; ES Sad Int. = Emotional Stroop sad interference score; ES Thr. Int. = Emotional Stroop threat interference score; DP Pos. Bias = Dot-probe positive bias score; DP Pos. Fac. = Dot-Probe positive facilitation score; DP Pos. Int. = Dot-Probe positive interference score; DP Sad Bias = Dot-Prove sad bias score; DP Sad Fac. = Dot-Probe sad facilitation score; DP Sad Int. = Dot-Probe sad interference score; DP Thr. Bias = Dot-Probe threat bias score; DP Thr. Fac. = Dot-Probe threat facilitation score; DP Thr. Int. = Dot-Probe threat interference score

Table 8

Hierarchical Multiple Regressions for Predictors of Child Attributional Style (PE and NE)

Regression 1 (DV: CASQ-R Negative Composite Score)				Regression 2 (DV: CASQ-R Positive Composite Score)			
	ΔR^2	**β**	**pr**		**ΔR^2**	**B**	**pr**
Step 1	06**						
(1, 177)							
PPVT		-.24**	-.24				
Step 2	.20***			**Step 1**	.11***		
(4, 174)				**(3, 175)**			
PPVT		-.20**	-.23				
DSRS		.35***	.38	DSRS		-.32***	-.32
Mat. CBCL Depression		.17*	.18	Mat. CBCL Depression		-.06	-.06
Pat. CBCL Depression		.13	.13	Pat. CBCL Depression		.00	.00
Step 3	.00			**Step 2**	.03*		
(6, 172)				**(3, 196)**			
PPVT		-.20**	-.23				
DSRS		.35***	.37	DSRS		-.30***	-.30
Mat. CBCL Depression		.14	.13	Mat. CBCL Depression		-.01	-.01
Pat. CBCL Depression		.10	.11	Pat. CBCL Depression		.02	.01
Mat. TMCQ Sadness		.07	.06	Pat. TMCQ Sadness		-.06	-.06
Mat. TMCQ LIP		-.03	-.04	Pat. TMCQ LIP		.17*	.18

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; □ $p < .10$

$\Delta R^2 = R^2$ Change; β = Beta; pr = partial correlation

Mat. = maternal reports; Pat. = paternal reports; LIP = low intensity pleasure

Table 9

Hierarchical Multiple Regressions for Predictors of Child Negative Automatic Thoughts (PE and NE)

Regression 1 (DV: CATS Physical Threat)	ΔR^2	β	pr	Regression 2 (DV: CATS Hostility)	ΔR^2	B	pr	Regression 3 (DV: CATS Total)	ΔR^2	β	pr	Regression 4 (DV: CATS Total)	ΔR^2	β	pr
Step 1 (3, 174)	.13***			**Step 1 (3, 174)**	.16***			**Step 1 (3, 176)**	.21***			**Step 1 (3, 176)**	.21***		
DSRS		.35**	.34	DSRS		.34***	.33	DSRS		.43***	.43	DSRS		.43***	.43
Mat.CBCL Depression		.00	.00	Mat.CBCL Depression		-.13	-.12	Mat.CBCL Depression		.00	.00	Mat.CBCL Depression		.00	.00
Pat. CBCL Depression		.04	.04	Pat. CBCL Depression		.17*	.16	Pat. CBCL Depression		.09	.10	Pat. CBCL Depression		.09	.10
Step 2 (5, 172)	.03*			**Step 2 (5, 172)**	.03*			**Step 2 (5, 174)**	.02			**Step 2 (5, 174)**	.03*		
DSRS		.34*	.34	DSRS		.34***	.34	DSRS		.41***	.41	DSRS		.43***	.44
Mat.CBCL Depression		.00	.00	Mat.CBCL Depression		-.13	-.12	Mat.CBCL Depression		-.02	-.02	Mat.CBCL Depression		-.03	-.03
Pat. CBCL Depression		.04	.04	Pat. CBCL Depression		.17*	.16	Pat. CBCL Depression		.08	.09	Pat. CBCL Depression		.04	.04
Lab NE		.02	.02	Lab NE		.01	.01	Mat. Anger		.07	.07	Pat. Anger		.18*	.18
Lab PE (composite)		.17*	.07	Lab PE (composite)		.17*	.17	Mat. HIP		.11	.12	Pat. HIP		.04	.04

NOTE: * p < .05; ** p < .01; *** p < .001; □ p < .10

Mat. = maternal reports; Pat. = paternal reports; HIP = high intensity pleasure

Table 10

Hierarchical Multiple Regressions for Predictors of Child Stroop Errors (Laboratory Assessed NE and PE)

Regression 1 (DV: Stroop Positive Errors)	ΔR^2	β	pr	Regression 2 (DV: Stroop Sad Errors)	ΔR^2	β	pr
Step 1	.01			**Step 1**	.03		
(3, 168)				**(3, 168)**			
DSRS		.05	.04	DSRS		.10	.10
Mat.CBCL Depression		.06	.05	Mat.CBCL Depression		.14	.13
Pat. CBCL Depression		-.10	-.09	Pat. CBCL Depression		-.03	-.02
Step 2	.02			**Step 2**	.02		
(5, 166)				**(5, 166)**			
DSRS		.05	.05	DSRS		.10	.10
Mat.CBCL Depression		.06	.05	Mat.CBCL Depression		.14	.13
Pat. CBCL Depression		-.11	-.10	Pat. CBCL Depression		-.02	-.02
Lab NE		.03	.03	Lab NE		-.06	-.06
Lab PE (composite)		.14 □	.14	Lab PE (composite)		.15*	.15

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; □ $p < .10$

Mat. = maternal report; Pat. = paternal report; Lab = laboratory-assessed

Table 11 (a)

Hierarchical Multiple Regressions for Predictors of Child Stroop Errors (Maternal Reports of NE & PE)

Regression 1 (DV: Stroop Sad Errors)				Regression 2 (DV: Stroop Threat Errors)			
	ΔR^2	**B**	**pr**		**ΔR^2**	**B**	**pr**
Step 1	.02			**Step 1**	.01		
(3, 168)				**(3, 168)**			
DSRS		.10	.10	DSRS		-.01	-.01
Mat.CBCL Depression		.11	.10	Mat.CBCL Depression		.09	.09
Pat. CBCL Depression		-.01	.01	Pat. CBCL Depression		.02	.02
Step 2	.06*			**Step 2**	.03		
(5, 166)				**(5, 166)**			
DSRS		.06	.06	DSRS		-.05	-.05
Mat.CBCL Depression		.02	.02	Mat.CBCL Depression		.06	.05
Pat. CBCL Depression		-.07	-.06	Pat. CBCL Depression		-.01	-.01
Mat. TMCQ Sad		.17 □	.13	Mat. TMCQ Sad		.04	.03
Mat TMCQ Anger		.05	.04	Mat TMCQ Anger		.06	.05
Mat. TMCQ LIP		-.07	-.07	Mat. TMCQ LIP		-.04	-.03
Mat. TMCQ HIP		.18*	.18	Mat. TMCQ HIP		.14 □	.13

Table 11 (b)

Hierarchical Multiple Regressions for Predictors of Child Stroop Errors (Paternal Reports of NE & PE)

Regression 1 (DV: Stroop Sad Errors)				Regression 2 (DV: Stroop Threat Errors)			
	ΔR^2	**B**	**pr**		**ΔR^2**	**β**	**pr**
Step 1	.02			**Step 1**	.10		
(3, 168)				**(3, 168)**			
DSRS		.10	.10	DSRS		-.01	-.01
Mat.CBCL Depression		.11	.10	Mat.CBCL Depression		.09	.09
Pat. CBCL Depression		-.01	-.01	Pat. CBCL Depression		.02	.02
Step 2	.10**			**Step 2**	.09**		
(5, 166)				**(5, 166)**			
DSRS		.04	.04	DSRS		-.07	-.07
Mat.CBCL Depression		.05	.05	Mat.CBCL Depression		.04	.04
Pat. CBCL Depression		-.02	-.01	Pat. CBCL Depression		.03	.03
Pat. TMCQ Sad		.11	.08	Pat. TMCQ Sad		-.08	-.06
Pat. TMCQ Anger		-.05	-.04	Pat TMCQ Anger		.10	.07
Pat. TMCQ LIP		-.24**	-.24	Pat. TMCQ LIP		-.24**	-.24
Pat. TMCQ HIP		.18*	.18	Pat. TMCQ HIP		.11	.11

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; □ $p < .10$

Mat. = maternal report; Pat. = paternal report; LIP = low intensity pleasure; HIP = high intensity pleasure

Table 12

Hierarchical Multiple Regressions for Predictors of Child Dot-Probe Performance (NE and PE)

Regression 1 (DV: DP Postive Bias Score)	ΔR^2	β	pr	Regression 2 (DV: DP Positive Interference Score)	ΔR^2	β	pr	Regression 3 (DV: DP Sad Facilitation Score)	ΔR^2	β	pr
Step 1 (3,169)	.02			**Step 1 (3, 169)**	.00			**Step 1 (3, 169)**	.01		
DSRS		.10	.10	DSRS		.10	.10	DSRS		.10	.10
Mat.CBCL Depression		-.11	-.10	Mat.CBCL Depression		-.01	-.01	Mat.CBCL Depression		-.01	-.01
Pat. CBCL Depression		.06	.06	Pat. CBCL Depression		.04	.04	Pat. CBCL Depression		-.06	-.06
Step 2 (6,166)	.04 $^{\square}$			**Step 2 (6, 166)**	.07 **			**Step 2 (6, 166)**	.06 **		
DSRS		.12	.12	DSRS		.01	.01	DSRS		.09	.09
Mat.CBCL Depression		-.02	-.02	Mat.CBCL Depression		.09	.08	Mat.CBCL Depression		-.06	-.06
Pat. CBCL Depression		.11	.10	Pat. CBCL Depression		.12	.11	Pat. CBCL Depression		-.12	-.11
TMCQ Mat. Sad		-.12	-.10	TMCQ Mat. Sad		-.25 **	-.20	TMCQ Mat. Sad		.18 $^{\square}$	.15
TMCQ Mat. Anger		-.15	-.13	TMCQ Mat. Anger		.01	.01	TMCQ Mat. Anger		-.08	-.07
TMCQ Mat. LIP		.02	.02	TMCQ Mat. LIP		.18 *	.17	TMCQ Mat. LIP		-.27 *	-.22

NOTE: * $p < .05$; ** $p < .01$; *** $p < .001$; $^{\square}$ $p < .10$

Mat. = maternal report; Pat. = paternal report; LIP = low intensity pleasure; DP = Dot-Probe

Table 13

Hierarchical Multiple Regressions for Predictors of Child Dot-Probe Performance (Fear and BI)

Regression 1 (DV: DP Threat Interference Score)	ΔR^2	β	pr	Regression 2 (DV: DP Threat Facilitation Score)	ΔR^2	β	pr	Regression 3 (DV: DP Positive Facilitation Score)	ΔR^2	β	pr
Step 1 (3,169)	.02			**Step 1 (3, 169)**	.02			**Step 1 (3, 169)**	.03		
RCMAS		.14 ^{t}	.14	RCMAS		.11	.11	RCMAS		.16*	.16
Mat.CBCL Anxiety		-.06	-.06	Mat.CBCL Anxiety		.03	.03	Mat.CBCL Anxiety		-.03	-.03
Pat. CBCL Anxiety		.01	.01	Pat. CBCL Anxiety		.08	.07	Pat. CBCL Anxiety		-.04	-.03
Step 2 (6,166)	.02			**Step 2 (6, 166)**	.08**			**Step 2 (6, 166)**	.03		
RCMAS		.12	.12	RCMAS		.14 ^{t}	.14	RCMAS		.18*	.18
Mat.CBCL Anxiety		-.07	-.07	Mat.CBCL Anxiety		.06	.06	Mat.CBCL Anxiety		-.02	-.02
Pat. CBCL Anxiety		-.02	-.02	Pat. CBCL Anxiety		.11	.11	Pat. CBCL Anxiety		.01	.01
TMCQ Pat. Fear		.14 ^{t}	.14	TMCQ Pat. Fear		-.24**	-.23	TMCQ Pat. Fear		-.19*	-.19
				TMCQ Pat. LIP		-.09	-.08				
				TMCQ Mat. LIP		-.10	-.10				

NOTE: * p < .05; ** p < .01; *** p < .001; $^{\square}$ p < .

Mat. = maternal report; Pat. = paternal report; LIP = low intensity pleasure; HIP = high intensity pleasure; DP = Dot-Probe

Table 14

Zero-Order Correlations between Parental Depression and Child Cognitive Vulnerability

	Either Parent Lifetime History of MDD or DD	Mother Lifetime History of MDD or DD	Mother Depression Onset	Mother Depression Course	Father Lifetime History of MDD or DD	Father Depression Onset	Father Depression Course
SRET Positive Adjectives Endorsed	.00	-.07	-.05	-.04	.08	.11	.14*
SRET Negative Adjectives Endorsed	-.01	-.03	-.06	-.08	.08	.05	.04
SRET Positive Processing Score	.03	.01	.08	.03	-.01	.00	.00
SRET Negative Processing Score	.07	-.07	-.5	-.06	.23**	.18*	.16*
Stroop Positive Errors	.06	.05	.03	-.02	.10	.09	.09
Stroop Sad Errors	.16*	.11	.08	.07	.05	.06	.05
Stroop Threat Errors	.09	.06	.00	-.01	.15*	.13 t	.14 t
Stroop Positive Interference	-.02	-.06	-.04	-.05	-.04	-.08	-.05
Stroop Sad Interference	.05	.02	.03	.02	.00	.00	-.04
Stroop Threat Interference	.12 t	.14*	.10	.08	.01	.01	.02
Dot-Probe Positive Bias	-.01	.02	.00	.02	-.03	.01	-.03
Dot-Probe Positive Facilitation	.02	.05	.02	.04	-.10	-.06	-.11
Dot-Probe Positive Interference	-.05	-.03	-.01	-.02	.03	.01	.05
Dot-Probe Sad Bias	.02	.07	-.04	-.01	-.10	-.09	-.13 t
Dot-Probe Sad Facilitation	.01	.06	.00	.00	-.12 t	-.13 t	-.13 t
Dot-Probe Sad Interference	.03	.04	-.04	.00	.02	.04	-.01
Dot-Probe Threat Bias	.09	.05	.02	.08	.14 t	.17*	.18*
Dot-Probe Threat Facilitation	.07	.07	.02	.03	.06	.09	.09
Dot-Probe Threat Interference	.03	.00	.01	.07	.08	.11	.12 t
CASQ-R Positive Composite	.02	-.03	.01	.01	.07	.09	.07
CASQ-R Negative Composite	.07	.04	.03	.05	.00	.03	.03
CATS Total	-.07	-12t	-.09	-.08	.00	.02	.01

NOTE: □ $p < .10$ * $p < .05$; ** $p < .01$; *** $p < .001$

Table 15

Zero-Order Correlations between Parental Anxiety and Child Cognitive Vulnerability

	Either Parent Lifetime History of Anxiety Disorder	Mother Lifetime History of Anxiety Disorder	Father Lifetime History of Anxiety Disorder
SRET # Positive Adjectives Endorsed	-.01	-.05	.09
SRET # Negative Adjectives Endorsed	.09	.06	.05
SRET Positive Processing Score	.08	-.01	.15*
SRET Negative Processing Score	.01	-.02	.05
Stroop Positive Errors	.00	.02	.05
Stroop Sad Errors	.07	.07	.07
Stroop Threat Errors	.12	.06	.11
Stroop Positive Interference	.00	-.07	.05
Stroop Sad Interference	-.09	-.02	-.12
Stroop Threat Interference	-.07	-.01	-.11
Dot-Probe Positive Bias	-.02	-.02	-.03
Dot-Probe Positive Facilitation	-.02	.07	-.10
Dot-Probe Positive Interference	.02	-.07	.08
Dot-Probe Sad Bias	-.08	-.05	-.03
Dot-Probe Sad Facilitation	-.05	-.07	-.03
Dot-Probe Sad Interference	-.03	.03	.01
Dot-Probe Threat Bias	-.04	-.03	-.03
Dot-Probe Threat Facilitation	.02	.04	.03
Dot-Probe Threat Interference	-.09	-.08	-.02
CASQ-R Positive Composite	.07	.13 t	-.02
CASQ-R Negative Composite	-.07	-.06	-.02
CATS Total	.04	.04	.09
CATS Physical Threat	.06	.01	.11
CATS Social Threat	.06	.07	.06
CATS Personal Failure	.01	-.03	.12 t
CATS Hostility	.02	.07	.01

Appendix A

Auditory Emotional Stroop Stimuli (Matched for Word Frequency)

Neutral		Depressive (Sad)		Positive (Happy)		Threat	
Word	**Frequency**	**Word**	**Frequency**	**Word**	**Frequency**	**Word**	**Frequency**
bird [5]	284	sad [4]	99	love [5]	113	fire [3]	281
book [4]	249	bad [5]	142	happy [4]	229	dark [5]	254
heavy [4]	177	left out [1]	*	like [4]	172	afraid [4]	171
fresh [1]	133	alone [1,4]	146	glad [4]	160	noise [3]	130
magic [3]	64	sorry [3]	71	proud [4]	78	spider [3]	67
leaf [2]	60	apart [1]	51	brave [4]	58	blood [5]	58
donkey [5]	61	no friends [1]	*	prize [2]	51	police [5]	49
pen [4]	39	cry [4]	77	share [4]	43	gun [3]	39
shiny [1]	37	unliked [1]	*	smile [4]	32	danger [5]	39
robin [5]	35	lonely [1,4]	38	perfect [4]	41	scared [4]	32
bath [2]	22	weak [5]	20	joke [5]	24	bang [5]	25
movie [4]	18	hated [1]	13	success [4]	13	ghost [5]	13

* word frequency not available
[1] Martin, Cole, Clausen, Logan, & Strosher (2003)
[2] Mathews et al. (1989)
[3] Neshat-Doost et al. (2000)
[4] Perez-Edgar & Fox (2003)
[5] Taghavi et al. (2003)

Appendix B

Dot-Probe Stimuli Taken from International Affective Picture System (IAPS)

Valence	IAPS #
Neutral	7404, 7496, 7510, 1675, 1947, 7504, 2575, 7044, 7285, 7595, 7590, 7037, 2305, 1670, 2635, 7211, 7182, 7058, 2594, 2515, 7190, 2446, 2206, 7043, 2441, 2191, 2518, 2020, 7130, 7500, 5471, 7009, 6150, 7710, 2200, 7547, 7170, 7002, 7140, 7090, 2104, 2980, 7038, 2221, 2102, 7034, 5500, 7056, 5530, 5390, 7224, 7030, 7233, 7205, 7705, 7041, 7040, 7217,7080, 2190, 7234, 7010, 7100, 5731, 7000, 7235, 7150, 7050, 7025, 7052, 7950, 7490, 7060, 5740
Depressive	9421, 2800, 9520, 9530, 9340, 2900, 2141, 9415, 2700, 2205, 9341, 9342, 2276, 2312
Positive	8490, 8510, 5450, 5480, 7430, 7330, 5910, 1920, 2650, 7250, 8620, 7400, 2070, 1710, 8260
Threatening	2810, 6300, 1930, 3530, 6210, 3500, 1300, 9480, 1120, 9050, 1201, 6370, 2120

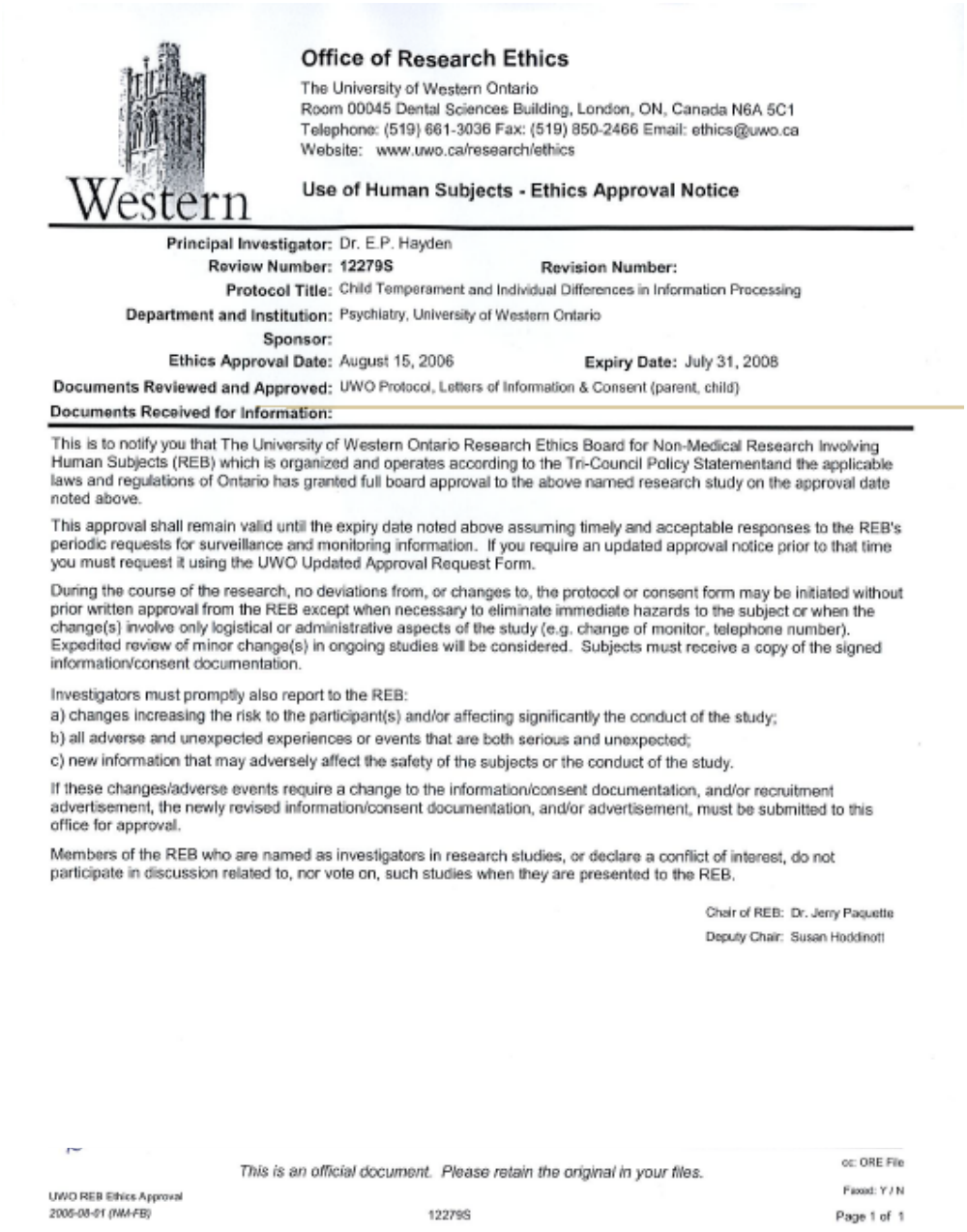
Appendix C

Stimuli for Self-Referent Encoding Task

Positive Adjectives	Negative Adjectives
Important	Bad
Strong	Mean
Fun	Wrong
Proud	Boring
Exciting	Angry
Friendly	Sad
Popular	Lonely
Brave	Foolish
Lucky	Ugly
Clever	Lazy
Smart	Stupid
Fast	Clumsy
Terrific	Ashamed
Talented	Selfish

Appendix D

Ethics Approval



Office of Research Ethics

The University of Western Ontario
Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
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Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. E.P. Hayden
Review Number: 12279S **Revision Number:**
Protocol Title: Child Temperament and Individual Differences in Information Processing
Department and Institution: Psychiatry, University of Western Ontario
Sponsor:
Ethics Approval Date: August 15, 2006 **Expiry Date:** July 31, 2008
Documents Reviewed and Approved: UWO Protocol, Letters of Information & Consent (parent, child)
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (REB) which is organized and operates according to the Tri-Council Policy Statementand the applicable laws and regulations of Ontario has granted full board approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the REB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the REB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the REB:
a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the REB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the REB.

Chair of REB: Dr. Jerry Paquette
Deputy Chair: Susan Hoddinott

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UWO REB Ethics Approval
2006-08-01 (NM-FB)

12279S

Page 1 of 1

Curriculum Vitae

Patricia L. Jordan
(Maiden Name: Wall)

I. EDUCATION

In progress	**Doctorate of Philosophy, Clinical Psychology** **University of Western Ontario**
2005	**Masters of Arts, Clinical Psychology** **University of Western Ontario**
2003	**Honors Bachelor of Science, Research Specialist in Psychology** **University of Toronto**

II. PUBLICATIONS

Hayden, E. P., Olino, T. M., Mackrell, S. V. M., **Jordan, P. L**., Dejardins, J., & Katsiroumbas, P. (under review). Cognitive vulnerability to depression during middle childhood: Rank-order stability and associations with parenting and parental depression.

Jordan, P.L. & Morton, J.B. (in press). Attention & the development of anxiety disorders: the importance of disentangling reactive and regulatory components of attention. In J. A. Burack & N. A. Fox (Eds.), *Cognitive neuroscience, development, and psychopathology.* Oxford University Press.

Jordan, P. L. & Morton, J. B**.** (2012). Perseveration and the status of 3-year-olds' knowledge in a card-sorting task: Evidence from studies involving congruent flankers. *Journal of Experimental Child Psychology, 111,* 52-64.

Durbin, C. E., Schalet, B. D., Hayden, E. P., Simpson, J., & **Jordan, P. L.** (2009). Hypomanic personality traits: a multi-method exploration of their association with normal and abnormal dimensions of personality. *Journal of Research in Personality*, 43, 898-905.

Jordan, P.L. & Morton, J.B. (2008). Flankers facilitate 3-year-olds' performance in a card-sorting task. *Developmental Psychology, 44,* 265-274.

Wall (Jordan), P.L., Botly, L.C.P., Black, C.K., & Shettleworth, S.S. (2004). The geometric module in the rat: independence of shape and feature learning in a food finding task. *Learning & Behavior, 32,* 289-298.

III. POSTER PRESENTATIONS

Kotelnikova, Y., Mackrell, S., **Jordan, P**., & Hayden, E. P. (May, 2011). Temperament traits as predictors of change in internalizing problems in middle childhood. *Poster presentation accepted for the 2011 Annual Convention of the Association for Psychological Science*, Washington, DC, USA.

Mackrell, S. V. M., **Jordan, P. L**., Sheikh, H. I., Singh, S. M., & Hayden, E. P. (March, 2011). Longitudinal associations between temperament, social adjustment and internalizing disorders

risk in middle childhood. *Poster presentation under review for the 2011 Biennial Meeting of the Society for Research in Child Development*

Jordan, P.L., Hayden, E.P., Schalet, B.D., & Durbin, C.E. (September 28, 2008). Concurrent and longitudinal associations between personality and mood and anxiety: a multi-method approach. *Poster presented at the Convention of the Society for Research in Psychopathology*, Pittsburgh, PA, USA.

Schalet, B.D., Durbin, C.E., Mendelsohn, K.A., Hayden, E.P., & **Jordan, P.L.** (September 28, 2008). Depression is associated with discrepancies between self- and observer-reports of personality traits. *Poster presented at the Convention of the Society for Research in Psychopathology*, Pittsburgh, PA, USA.

Jordan, P.L., Hayden, E.P, & Dozois, D.J.A. (October 7, 2007). Individual differences in information processing in childhood: coherence among measures and relations to child temperament. *Poster presented at the Convention of the Society for Research in Psychopathology,* Iowa City, IA, USA.

Schalet, B.D., Durbin, C.E., Mendelsohn, K.A., Hayden, E.P., & **Jordan, P.L.** (October 7, 2007). Self- and observer-reports of personality: Associations with internalizing psychopathology. *Poster presented at the Convention of the Society for Research in Psychopathology,* Iowa City, IA, USA.

Jordan, P.L., Lee, A., & Zelazo, P.D. (June 8, 2007). Attentional set-shifting in preschoolers: Changing roles of task complexity, interference, and type of shift across development. *Poster presented as the Convention of the Canadian Psychological Association,* Ottawa ON, Canada.

Jordan, P.L. & Morton, J.B. (March 31, 2007). Continuous variation in 3-year-olds' card sorting performance as a result of parametric manipulations of post-switch conflict. *Poster presented at the Biennial Meeting of the Society for Research in Child Development,* Boston MA, USA.

Wall (Jordan), P.L. & Morton, J.B. (April 2005). A bottom-up approach to improving 3-year-olds' flexibility in a card-sorting task. *Poster presented at the Biennial Meeting of the Society for Research in Child Development,* Atlanta, GA, USA.

Chiang, J.K., **Wall (Jordan), P.L.,** & Zelazo, P.D. (June 2004). Reversal learning and extra-dimensional shifting in preschool children. *Poster presented at the Convention of the Canadian Psychological Association,* St. Johns, NL, Canada.

IV. RESEARCH STUDENTSHIPS

2007-2010	**Research Studentship**, Ontario Mental Health Foundation (OMHF), $32,000
2007	**Ontario Graduate Scholarship in Science & Technology**, Ministry of Training, Colleges, and Universities, $10,000 (declined)
2007	**Student Travel Award,** Canadian Institutes of Health Research (CIHR): Institute of Human Development, Child and Youth Health, $1000
2005-2007	**Canadian Graduate Scholarship**, Natural Sciences and Engineering Research Council of Canada (NSERC), $70,000
2005	**Ontario Graduate Scholarship**, Ministry of Training, Colleges, and Universities, $15,000 (declined)

2003-2005 **Post-Graduate Scholarship**, Natural Sciences and Engineering Research Council of Canada (NSERC), $34,600

2003 **Ontario Graduate Scholarship**, Ministry of Training, Colleges, and Universities, $15,000 (declined)

2003 **Undergraduate Research Award,** Natural Sciences and Engineering Research Council of Canada (NSERC), $5,600

2002 **Undergraduate Research Award,** Natural Sciences and Engineering Research Council of Canada (NSERC), $5,600

V. OTHER SCHOLARSHIPS & AWARDS

2009 **LRPA Award for Outstanding Contribution by a Psychology Student**, London Regional Psychological Association (Awarded to the Advocacy Through Action Group)

2009 **2008 OPA Public Education Award**, Ontario Psychological Association (Awarded to The Advocacy Through Action Group for 2008 Public Lecture Series: "Finding Your Way: A series on the Psychology of Everyday Life")

2008-2009 **Western Graduate Research Scholarship**, University of Western Ontario, $8,000

2006-2007 **Thesis Research Award,** University of Western Ontario, $700

2004-2005 **Graduate Tuition Scholarship,** University of Western Ontario, approximately $6,000

2003-2004 **Graduate Tuition Scholarship,** University of Western Ontario, approximately $6,000

2003 **Ethel Treber & F. Louis Travelling Scholarship,** Victoria College, University of Toronto, $4,000

2003 **Dr. Horace O. Frosty Steer Award in Psychology,** Faculty of Arts & Sciences, University of Toronto, $2,700

2003 **The Scott Memorial Scholarship,** Victoria College, University of Toronto, $500

1999-2003 **Xerox Canada University Education Scholarship**, Association of Universities and Colleges Canada, $4,000

2002 **The Hodgins Prize,** University of Toronto, $200

2002 **The John Davidson Ketchum Memorial Scholarship in Psychology**, Faculty of Arts & Sciences, University of Toronto, $300

2002 **Anne Marjorie Beer Scholarship,** Victoria College, University of Toronto, $1,500

2001 **John Natress Watson Memorial Award,** Victoria College, University of Toronto, $1,500

1999 **Isabel L. Bader Scholarship**, Victoria College, University of Toronto, $1,500

1999 **Bloor Lands Admission Scholarship**, Victoria College, University of Toronto, $1,000