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Biological and Contextual Predictors of the Stability of Behavioural Inhibition in Early Childhood

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BIOLOGICAL AND CONTEXTUAL PREDICTORS OF THE STABILITY OF BEHAVIOURAL INHIBITION IN EARLY CHILDHOOD

(Thesis format: Monograph)

by

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Abstract

Persistently elevated behavioural inhibition (BI) in children confers increased risk for anxiety disorders. However, little research has jointly examined exogenous and endogenous factors that may moderate BI stability in early childhood. To explore whether parent (i.e., parental overinvolvement, parent anxiety) and child (i.e., 5-HTTLPR and BDNF val66met genotype, positive emotionality) factors influenced the stability of early BI, a community sample of 371 preschoolers and their caregivers completed observational measures of child temperament, observational and questionnaire measures of parenting, and parent interviews for anxiety disorder history. Child BI at age 3 interacted with children's 5-HTTLPR variants to predict age 5 BI; children with at least one copy of the short allele exhibited less stability of BI, indexed via associations between age 3 and age 5 BI. Findings are consistent with previous work indicating the 5-HTTLPR short variant increases plasticity to contextual influences, thereby serving to decrease BI stability in early childhood.

Keywords: behavioural inhibition; child temperament; positive emotionality; parenting; 5-HTTLPR; BDNF; differential susceptibility; anxiety

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Introduction

Children show tremendous individual differences in emotional reactivity and self-regulation (Rothbart & Derryberry, 1981; Rothbart, Ahadi, & Evans, 2000). Such differences fall under the rubric of *temperament*, and have been associated with an array of positive and negative outcomes across development in domains such as mental health, physical health, and psychosocial functioning (e.g., Anzman-Frasca, Stifter, & Birch, 2012; Clauss & Blackford, 2012; Gest, 1997; Rothbart, Ahadi, & Evans, 2000; Rothbart, 1989). In particular, there has been great interest on the part of developmental psychopathologists in the temperamental trait behavioural inhibition (BI), the tendency to exhibit heightened fear responses and reticence when confronted with novelty (e.g., Garcia-Coll, Kagan, & Reznick, 1984; Kagan, Reznick, Clark, Snidman, & Garcia-Coll, 1984). This "fearful reactivity" (Lahat, Hong, & Fox, 2011, p. 248) can be expressed in response to either unfamiliar social or non-social situations, or both (e.g., Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kochanska, 1991; Rubin, Hastings, Stewart, Henderson, & Chen, 1997). The current study investigated exogenous and endogenous factors that may influence the stability of behavioural inhibition in early childhood.

The study of BI and its stability has practical relevance given its implications for children's socioemotional functioning and mental health outcomes. More specifically, children with high BI are more cooperative, have better attitudes toward school, and greater school competence, but also have poorer quality social relationships (e.g., Chen, Huichang, Li, & Wang, 2009; Gest, 1997; Graham & Coplan, 2012; Hirshfeld-Becker et al., 2007; Izzard, Schultz, Fine, Youngstrom, & Ackerman, 1999; Roswell & Coplan, 2013). In addition, BI has been widely implicated in vulnerability to numerous types of anxiety and related disorders (e.g., Lahat, Hong, & Fox, 2011; Oppenheimer, Hankin, Young, & Smolen, 2013), including social anxiety disorder

(e.g., Gladstone et al., 2005; Rotge et al., 2011), panic disorder (Rosenbaum, Biederman, Hirshfeld, Bolduc, & Chaloff, 1991), and obsessive-compulsive disorder (Coles et al., 2006). Particularly strong evidence exists linking BI to social anxiety disorders (e.g., Biederman et al., 2001; Hayward et al., 1998; Hirshfeld-Becker et al., 2008). In their recent meta-analysis, Clauss and Blackford (2012) found a greater than sevenfold increase in the risk for developing social anxiety disorder among individuals high in BI. This increased risk for social anxiety has been observed across studies using different methods, including retrospective studies in which participants recalled their own childhood levels of BI (e.g., Gladstone et al., 2006; Hayward et al., 1998; Rotge et al., 2011) as well as longitudinal studies collecting observational (e.g., Biederman et al., 2001; Hirshfeld-Becker et al., 2007) and parent-reported (e.g., Muris et al., 2011) BI.

However, the influence of BI on anxiety disorders risk may vary as a function of its stability; in particular, relative to children who exhibit high BI at a single time point, longitudinal studies show that youth with persistently high BI show a robust increase in risk for anxiety disorders in general (e.g., Hirshfeld, et al., 1992; Vreeke, Muris, Mayer, Huijding, & Rapee, 2013), and social anxiety disorder in particular (e.g., Chronis-Tuscano et al., 2009). For example, Chronis-Tuscano et al. (2009) observed that stable maternally reported BI in 126 children across infancy and early childhood was associated with an almost four times increased risk for a diagnosis of social anxiety disorder in adolescence. Additionally, in their longitudinal study of 238 children observed from birth to ninth grade, Essex et al. (2010) found that persistently high BI, assessed using self- and informant-reports (i.e., mothers', teachers', and children's reports), was related to increased risk for social anxiety disorder by adolescence. Thus, persistently elevated BI appears to confer especially heightened risk for negative outcomes.

Stability of Behavioural Inhibition

Given that the very concept of temperament posits some degree of cross-situational consistency of traits, it is expected that BI would show stability over time (e.g., Kagan, 1997; Degnan & Fox, 2007). Temperament and personality traits, including BI, are conceptualized as "endogenous basic tendencies" (McCrae et al., 2000, p. 175) with at least a partial biological basis (e.g., Kagan, 1997; Whittle, Allen, Lubman, & Yücel, 2006) that exhibit both stability and change over time. Consistent with this, estimates of the stability of BI vary yet suggest at least moderate stability (e.g., Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Johnson et al., under review; Natsuaki et al., 2013; Rubin, Burgess, & Hastings, 2002; Kagan, Reznick, & Snidman, 1988; Kerr, Lambert, Stattin, & Klackenberg-Larsson, 1994; Scarpa, Raine, Venables, & Mednick, 1995). Initially, Kagan and Moss (1962) reported high stability when assessing the broad trait of fearfulness in the sample of toddlers they followed through adulthood, although in subsequent studies, Kagan and colleagues reported moderate stability of BI when assessing smaller samples of children selected for extreme BI (e.g., Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984; Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988). For example, Kagan, Reznick, and Snidman (1988) reported significant correlations between BI assessed observationally at the ages of 14 months and 20 months ($r = .52$, $p < .01$) and at the ages of 14 months and 32 months ($r = .44$, $p < .01$) in a sample of 100 children; however, BI at ages 14 and 20 was unrelated to BI at age 4. In 205 individuals followed longitudinally from childhood to early adulthood, Gest (1997) found interviewer-rated BI to show strong evidence for BI stability in both childhood (median $r = .55$) and early adulthood (median $r = .59$). In contrast, Scarpa et al. (1995) found much lower stability of BI in 1, 795 Mauritian children assessed for BI at the ages of 3, 8, and 11 years ($rs = .10 – .21$), using observational measures and informant reports.

Thus, although there is little research examining this specific question, extant work indicates that some children remain stably high or low in BI while others show change (e.g., Degnan & Fox, 2007). As previously reviewed, given that stably elevated BI is implicated in anxiety risk, further understanding of variables moderating the relationship between early and later BI could facilitate targeted, and thus cost-effective, prevention and intervention strategies.

Studies have implicated an array of endogenous and exogenous factors in the stability of BI, reviewed as follows. Only some of this work has used longitudinal methods examining stability; nevertheless, as factors associated with BI at one time point may also influence its stability, studies using both cross-sectional and longitudinal designs will be reviewed here. Work examining constructs related to BI (e.g., shyness, social reticence), as well as BI's predictive validity for conceptually related constructs, will also be discussed in the following sections.

Exogenous Factors Influencing BI and its Stability

Parenting. Much attention has been given to the influence of parenting on children's BI, with most results indicating that early care is an important consolidating influence (e.g., Hane, Cheah, Rubin, & Fox, 2008; Rubin, Bugess, & Hastings, 2002). For example, Rubin, Burgess, and Hastings (2002) found that observationally assessed maternal intrusive control and derisive comments moderated the relationship between children's BI at 2 years of age and their social reticence at 4 years of age, such that when mothers exhibited intrusive control and/or derisive comments, children who were high in BI at age 2 were high in social reticence at age 4. In another study, Hane et al. (2008) found that observed maternal negativity, characterized by hostility and negative control, moderated the relationship between children's reticence at age 4 and social withdrawal at age 7; children who were high in reticence at age 4 and who were

exposed to high levels of maternal negativity tended to exhibit high levels of social withdrawal at age 7. Rubin et al. (1997), moreover, found that toddlers who were consistently inhibited across non-social, adult-social, and peer-social contexts had mothers who were high in observed oversolicitousness, a parenting style characterized by controlling, unresponsive, yet physically affectionate, care.

Parental overprotection, defined as parenting behaviours that shelter children from stress, constrain children's autonomy, and include excessive parental comfort and affection (e.g., Hutt, Buss, & Kiel, 2013; Kiel & Buss, 2010), has also been implicated in BI and its stability. Kiel and Buss (2012) found that observed overprotective parenting mediated the relationship between observed fearful temperament at age 2 and maternally reported shyness/inhibition at age 3. In addition, recent research suggests that interviewer-rated and parent-reported measures of parental overprotection may moderate the stability of BI assessed observationally at ages 3 and 6 (Johnson et al., under review). Furthermore, parental overcontrol, a construct that shares features with overprotective parenting (i.e., inappropriate and excessively "protective, directive, and controlling behaviours"; Lewis-Morrarty et al., 2012, p. 1365), may increase the risk for anxiety associated with BI. Lewis-Morrarty et al. (2012) investigated the relationship between stable, elevated BI, parental overcontrol, and social anxiety; they used observational and parent-reported measures of BI throughout infancy and childhood, observational measures of maternal overcontrol at age 7, and self- and parent-reported social anxiety symptoms in adolescence. Stable, elevated BI in childhood was significantly associated with greater social anxiety in adolescence only when mothers were also high in overcontrol, suggesting that stable childhood BI may lead to greatest anxiety risk in the presence of overprotective parenting styles (Lewis-Morrarty et al.).

Taken together, this literature suggests that parental behaviour that is overly involved, excessively controlling, or protective may consolidate children's BI over time. Multiple mechanisms could drive the influence of parental overinvolvement on BI stability. One such pathway may involve the extent to which parents fail to encourage their children's exploration of and engagement with novelty. Given that BI is characterized by fearfulness and reticence when confronted with novelty, parenting that facilitates exposure to, rather than protects children from, unfamiliar stimuli may serve to reduce BI over time. Thus, lower levels of parental overinvolvement might increase children's exposure to novelty, thereby enhancing the occasions children have to learn coping strategies for confronting novel, anxiety-provoking situations, and, consequently, leading to lower child BI (e.g., Muris et al., 2011). Such an explanation would be consistent with behavioural models of anxiety that focus on the role of behavioural avoidance in maintaining anxiety (e.g., Abramowitz, Deacon, & Whiteside, 2010). Conversely, it would also be consistent with the principle of "steeling," which proposes that mild stress exposure promotes child resilience (e.g., Rutter, 2012); both animal and human research has found that exposure to mild stressors can decrease negative outcomes resulting from later stress (e.g., Liu, 2015; Lyons, Parker, Katz, & Schatzberg, 2009; Rutter, 2012). Collectively, this literature proposes that conquering mild stressors may facilitate new learning and coping skills, as well as a sense of psychological mastery, thereby leading to resilience and use of adaptive strategies when confronted with consequent stress (e.g., Wu et al., 2013); the absence of such mild stressors, as in the case of high levels of parental overinvolvement, may therefore lead to stably high BI. In addition to the behavioural impact of parental overinvolvement on children's BI over time, it is also possible that there is a biological link between overinvolved parenting and BI stability, such that parental overinvolvement may signify parental genetic risk for BI or anxiety and the

presence of active gene-environment correlations (e.g., Knafo & Jaffee, 2013). In summary, parenting may consolidate children's BI through various pathways.

Although features of overinvolved parenting and related constructs have been associated with both child anxiety and BI stability, most of the relevant literature has focused on the *mediating* role of such parenting behaviours; to my knowledge, only one study has investigated the influence of overprotective parenting behaviours on moderating BI stability (Johnson et al., under review). However, given the potentially vast and cost-effective implications for parenting interventions, replication and extension of this research is imperative. As the majority of parenting styles investigated in the current BI literature seem to capture aspects of overinvolved parenting, parental overinvolvement may be the overarching construct that serves to consolidate BI in early childhood. Thus, longitudinal research specifically examining the role of parental overinvolvement on BI stability in children may be particularly useful.

Parental internalizing disorder. Associations between parental anxiety and depression (i.e., internalizing disorders) and childhood BI have been examined cross-sectionally. For example, Rosenbaum et al. (2000) observed that young children (between the ages of 2 and 6) of parents with both panic disorder and major depression displayed elevated rates of BI compared to children of parents without anxiety disorders or major depression. They also found that children of parents with only panic disorder or major depression displayed moderate levels of BI that were not discernable from BI levels in children whose parents had neither of these disorders, or from children whose parents had both of these disorders (Rosenbaum et al., 2000). More recently, Moehler et al. (2007) found that self-reported maternal depressive symptoms assessed at 6 weeks, 4 months, and 14 months post-delivery were associated with observationally-assessed child BI at 14 months. In addition, Kochanska (1991) found that toddlers whose

mothers suffered from unipolar depression exhibited higher BI compared to toddlers whose mothers were not depressed or whose mothers suffered from bipolar depression; these effects were especially pronounced when unipolar depressed mothers had experienced symptoms in the previous four months and had a history of a severe disorder. However, extensive longitudinal research on the potential influence of parental internalizing disorder on the stability of children's BI is lacking. In particular, links between BI and anxiety (e.g., Hirshfeld-Becker et al., 2007; Lewis-Morrarty et al., 2012) suggest there may be a moderating role of parent anxiety disorder in children's BI stability.

Parental internalizing disorder, specifically parent anxiety, may influence the stability of child BI through various mechanisms. Certainly, parental internalizing disorder could be related to child BI through genetic pathways. Anxiety and depression, as well as withdrawn and inhibited behaviour, show moderate genetic influence (e.g., Franić, Middeldorp, Dolan, Ligthart, & Boomsma, 2010; Garcia et al., 2013; Lamb et al., 2010; Robinson, Kagan, Reznick, & Corley, 1992; Rubin et al., 2013); given the relationship between internalizing symptoms and BI, it is possible that some of the genes influencing parental internalizing disorders might also exert an influence on child BI (e.g., Rogers, Shelton, Shelledy, Garcia, & Kalin, 2008), implicating common genetic influences on both phenotypes. However, it is also clear that parents' internalizing disorder is associated with distinct patterns of parenting (e.g., Degnan & Fox, 2007). Mothers with diagnosed anxiety, for example, have been shown to grant less autonomy and engage in catastrophizing when parenting (Moore, Whaley, & Sigman, 2004; Whaley, Pinto, & Sigman, 1999; Woodruff-Borden, Morrow, Bourland, & Cambron, 2002); these high-risk parenting behaviours may subsequently influence the stability of child BI. In contrast, maternal depression is more strongly associated with other negative parenting, especially a lack of

maternal sensitivity (e.g., Campbell et al., 2004; Moehler et al., 2007). Given that maternal anxiety is related more closely to parenting styles implicated in past work on BI (i.e., parental overinvolvement), models incorporating both parental anxiety and parental overinvolvement are necessary to detect unique effects on the stability of child BI.

Endogenous Factors Influencing BI and its Stability

Genes. In addition to exogenous factors, endogenous child variables have been associated with BI and its stability in childhood and adolescence. Specific genetic variants, for example, have been implicated in BI or related behaviours (e.g., Garcia et al., 2013; Lamb et al., 2010; Rubin et al., 2013; Rogers, Shelton, Shelledy, Garcia, & Kalin, 2008), particularly within high-risk environments (e.g., high-risk parenting contexts; e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011). One such gene is the serotonin transporter (5-HTT) gene, particularly the promoter region (5-HTTLPR; e.g., Fox et al., 2005; Lanzenberger et al., 2007; Ohara, Nagai, Suzuki, Ochiai, & Ohara, 1998; Schinka, Busch, & Robichaux-Keene, 2004). For example, in one longitudinal study, Fox et al. (2005) observed children's BI at age 14 and 84 months and found that, when controlling for baseline BI, elevated BI at age 84 months was associated with low social support as reported by the children's mothers, as well as the presence of the 5-HTT short allele.

Recently, attention has been given to the 5-HTTLPR gene in the context of the differential susceptibility hypothesis (Belsky & Pluess, 2012, 2013; Belsky, Jonassain, Pluess, Stanton, Brummett, & Williams, 2009; Pluess & Belsky, 2009). Differential susceptibility posits that certain genes lead individuals to show heightened responsivity to experience, such that they exhibit especially negative outcomes in the presence of adverse environmental influences and especially positive outcomes in the presence of positive, supportive environments (e.g., Belsky &

Pluess, 2009, 2013). For example, 5-HTTLPR has been found to moderate the influence of current life events on neuroticism; when compared to individuals with two copies of the 5-HTTLPR long (L) allele, individuals with two copies of the 5-HTTLPR short (S) allele exhibited greater neuroticism in the presence of more negative life events but exhibited less neuroticism in the presence of more positive life events (Pluess, Belsky, Way, & Taylor, 2010). Other studies have found genetic susceptibility to family support, such that youth with the S allele tended to have greater depressive symptoms in the presence of poor family support and tended to have the fewest depressive symptoms in the presence of high family support (e.g., Dalton Hammen, Najman, & Brennan, 2014; Li, Berk, & Lee, 2013) relative to those without this allele. Given the emerging literature implicating 5-HTTLPR in differential susceptibility (e.g., Dalton et al., 2014), and the associations between 5-HTTLPR and BI (e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011), research investigating the potential role of 5-HTTLPR in moderating BI stability over time may be relevant in mitigating risk for internalizing disorders.

In addition to 5-HTTLPR, brain-derived neurotrophic factor (BDNF) and the gene that codes for it, have been widely implicated in plasticity (e.g., Castrén & Rantamäki, 2009; Thoenen, 1995). Of specific importance to the present study is the finding that a single-nucleotide polymorphism (SNP) at nucleotide 196 (rs6265) on the BDNF gene, which leads the amino acid methionine (met) to replace valine (val) at codon 66, results in a reduction of available BDNF (e.g., Chen et al., 2004; Egan et al., 2003). Hayden et al. (2010) recently found evidence suggesting support for a role of BDNF in differential susceptibility hypotheses with respect to temperament. In their large community sample (N = 413), the presence of the BDNF met allele in young children increased vulnerability to both positive and negative environmental influences such that children with at least one copy of the met allele displayed increased negative

emotionality (NE) when exposed to parental relationship discord or a parent with a history of a depressive disorder but displayed decreased NE when these negative environmental influences were not evident. Little research, however, has investigated the potential influence of BDNF on other aspects of temperament, including BI.

In light of differential susceptibility hypotheses and its notion of plasticity, it is possible that 5-HTTLPR or BDNF may moderate the stability of BI in early childhood. More specifically, the presence of either the 5-HTTLPR S allele or BDNF met allele may leave children more susceptible to both positive and negative environmental influences. Consequently, these children may exhibit less stable BI over time compared to children with neither of these alleles.

Positive emotionality. Rothbart and Bates (2006) proposed that fearful temperament might differentially impact an individual's socio-emotional adjustment in accordance with other temperament traits also present within the individual (e.g., tendency toward dysregulation). Given that temperament traits co-occur within an individual and are thought to operate interactively to shape behaviour (Rothbart & Bates), it is surprising that BI has almost exclusively been examined in isolation. Greater understanding of interactions between temperament traits could increase knowledge of factors shaping child risk and resilience, with both theoretical and practical implications.

Of particular relevance to the current study is the proposed interaction between positive emotionality (PE) and BI. PE, by definition, involves approach-related and exploratory behaviours, as well as interest and engagement with the environment (e.g., Clark & Watson, 1999; Laptook, Klein, Olino, Dyson, & Carlson, 2010). Given the roles of both PE and BI in children's engagement with environmental stimuli, these two temperament traits might interact to influence BI stability in early childhood, with high PE serving as a buffer against high BI.

Specifically, interactions might be found for children initially high in both BI and PE if, for example, their heightened levels of PE facilitated exposure and adaptation to novelty, thereby decreasing their inhibited behaviour over time. Like low levels of parental overinvolvement, high PE might encourage exposure to novelty and thus, provide children initially high in both BI and PE with opportunities to learn coping strategies for managing their novelty-induced fearfulness. As a result, children high in both BI and PE might be expected to show a reduction in their BI levels over time, while children high in BI but low in PE might remain more stably inhibited over time.

Previous literature suggests that high PE (and related constructs) may serve to buffer the effects of vulnerabilities to negative outcomes (e.g., Clark, 2005; Park, Belsky, Putnam, & Crnic, 1997; Tugade & Fredrickson, 2004; Hart & Behrens, 2013; Miller, 2003; see Davis & Suveg, 2014 for a comprehensive review). For instance, in young boys with elevated shyness, elevated activity levels have been associated with a decreased relationship between shyness and internalizing problems (Karevold, Coplan, Stollmiller, & Mathieson, 2011). High PE in adolescents has been found to buffer the influence of parental risk factors on adolescent substance use (Wills, Sandy, Yaeger, & Shinar, 2001); in adults, high positive affect has been found to buffer negative affect reactivity to stress (Wichers et al., 2007). Low PE has also been found to moderate the relationship between risk factors and negative mental health outcomes (e.g., Hart & Behrens, 2013). For example, low PE has been found to interact with high NE and low constraint/inhibition to predict an internalizing form of posttraumatic stress response (Miller, 2003). However, despite extensive literature on the stability of BI and PE independently and the potential utility of findings on temperament trait interactions (e.g., Rothbart & Bates, 2006),

minimal research has explored whether these child temperament traits interact to affect BI stability.

Indeed, only one study to my knowledge has investigated whether BI and PE interact to specifically influence BI stability (Johnson et al., under review). In this work, the role of PE was examined as a predictor of BI stability assessed at ages 3 and 6. In accordance with the buffering hypothesis of high PE, Johnson et al. (under review) observed that lower levels of child PE predicted increased stability of child BI at age 6 when children were also high in BI at age 3. Additional longitudinal research investigating the possibility that high PE might act as a protective factor for inhibited children, leading to lowered stability of BI for these children, is clearly lacking in the BI literature.

Objectives of Current Study

The current study aimed to build on previous research when investigating moderators of the stability of BI, examining a broader range of biological and contextual factors thought to influence the stability of BI in early childhood, and using both a multimethod approach and a community sample of a larger size than most previously studied. Much literature has considered the influence of parenting on children's BI; thus, I included both observational measures and parents' self-reports. Based on previous research (e.g., Johnson et al., under review; Kiel & Buss, 2012; Lewis-Morrarty et al., 2012), I predicted that parental overinvolvement, as operationalized by observed parental intrusiveness and low self- and informant-reported parental autonomy-granting, would moderate the relationship between BI at baseline and follow-up. Children with elevated levels of both BI and parental overinvolvement at baseline were hypothesized to show greater stability of BI. In an extension of the cross-sectional research on parental internalizing disorder and BI, I also aimed to longitudinally investigate the potential moderating role of

parental anxiety on BI stability. I predicted that parental anxiety would interact with child BI such that children high in BI at age 3 would remain high in BI at age 5 in the presence of a parental anxiety disorder diagnosis.

In addition to parent variables, child variables were also explored as predictors of BI stability. Due to the deficit of literature exploring the potential moderating role of genetics, I aimed to investigate potential interactions between proposed "plasticity genes" and other variables that might moderate the stability of BI in young children. It was predicted that the presence of the 5-HTTLPR S allele and the BDNF met allele, both previously associated with plasticity (e.g., Cirillo, Hughes, Ridding, Thomas, & Semmler, 2012; Hayden et al., 2010; Pluess, Belsky, Way, & Taylor, 2010), would be associated with lower stability of BI between the ages of 3 and 5 years, due to their tendency to heighten children's responsivity to a broad array of influences likely to both increase and decrease BI. I, moreover, intended to explore potential trait-by-trait interactions, looking at interactions between BI and PE. Consistent with literature implying a buffering effect of PE (Clark, 2005; Johnson et al., under review; Mackrell et al., 2014; Tugade & Fredrickson, 2004; Wichers et al., 2007), I hypothesized that PE would moderate the stability of BI such that elevated levels of both BI and PE at baseline might lead to lower BI at follow-up, thereby reflecting less stable BI.

Due to the difficulties associated with assessing temperament and related constructs in infancy (e.g., Hubert, Wachs, Peters-Martin, & Gandour, 1982) and considering that early childhood is a developmental period during which there is support for both increased stability in temperament and plasticity (e.g., Caspi et al., 2003; Van den Akker, Deković, Prinzie, & Asscher, 2010), I initially assessed children at age 3 and then again at age 5. Moreover, my study's emphasis on parental factors also led me to concentrate on early childhood, as parents are the

main source of children's socialization during early childhood and have a crucial influence on children's development during this age range (e.g., Root & Stifter, 2010); research indicates effects of preschool parenting on adolescent development (e.g., Essex, Klein, Slattery, Goldsmith, & Kalin, 2010;). In addition, I relied on laboratory measures to assess BI, which are viewed as the "gold standard" for assessing BI (Kagan, 2003). Furthermore, given that much of the current BI literature has focused on discrete groups of children with extreme levels of BI (e.g., Kagan et al., 1988), which potentially inflates estimates of BI stability, the present study used continuous measures of BI, looking at children across the range of BI scores.

Method

Data for this study were collected in two waves. The first wave was collected over a span of two years and was comprised of a 2-hour laboratory visit (during which child DNA, child temperament data, and observed parenting data were collected), a 2.5-hour home visit carried out within two weeks of the laboratory visit (during which observed parenting data were collected), and a questionnaire battery that was completed by parents. The second wave was initiated roughly 30 months after the first laboratory visit and was comprised of a 2-hour laboratory visit (during which child temperamental data and observed parenting data were collected) and a telephone or face-to-face interview (during which the psychiatric history of biological caregivers was assessed).

Baseline Assessment

Participants. Participants were an unselected community sample of 409 families from southwestern Ontario who participated in a larger study of biological and contextual factors influencing child temperament and risk for psychopathology. Participants were recruited through a university's developmental research participant pool and through advertisements

placed in local daycares, preschools, recreational facilities, and on websites. A screening procedure administered by trained study personnel at the recruitment phase was used to exclude children with significant medical or psychological impairments. The Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997) was administered to children to screen for significant cognitive impairment and English proficiency; participants scored within the average range (M = 111.94, SD = 14.32). Written consent for the child was acquired from the child's primary caregiver; written consent from parents for their own participation was also attained. Monetary compensation was provided.

Children (201 boys; 49.1%) were a mean age of 3.43 years (SD = 0.30) and most had a mother as their primary caregiver (N = 380; 93.0%). The mean age of mothers was 33.25 years (SD = 4.62) and the mean age of fathers was 35.01 years (SD = 4.89). Of the families for whom we have the following demographic data, approximately one-quarter of children spent no time in care outside of the house (e.g., daycare, preschool; N = 105; 26.0%). Most mothers (N = 259; 71.6%) and fathers (N = 350; 94.0%) worked outside of the home. Most mothers (N = 366; 93.7%) and fathers (N = 316; 82.0%) had at least some post-secondary education.

Of the families for whom we had data on ethnicity (N = 405; 99.0%), 91.6% identified themselves as Caucasian (N = 371), 1.5% identified as Asian (N = 6), and 6.9% identified as other race (N = 28). The majority of parents were married (N = 330; 81.7%) or living together (N = 24; 5.9%); 1.5% of participants did not provide this information (N = 6). Almost all of the participating children for whom we have data lived with their biological mothers (N = 398; 98.3%) and biological fathers (N = 354; 87.4%). Approximately half of the families reported a family income between $40,000 and $100,000 CAD ($N$ = 207; 50.4%); 29.8% reported a family income of over $100,000 CAD ($N$ = 122); 10.7% reported an income between $20,000 and

$40,000 CAD (*N* = 44); 3.9% reported an income of less than $20,000 CAD (*N* = 16); and 5.1% (*N* = 21) did not report a family income.

Laboratory assessment of temperament and parenting. Children participated in 12 standardized laboratory tasks taken from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995) with a female experimenter. Tasks were designed to elicit a wide array of temperamental characteristics and were videotaped for coding purposes. Carryover effects were minimized by ensuring that no tasks meant to elicit comparable affective reactions occurred successively; children were also given a short opportunity to play in between each task to return to a baseline state. The complete assessment spanned a total of 1.5 to 2 hours.

Of the 12 Lab-TAB tasks, PE was coded in all tasks and BI was coded in three tasks (risk room, stranger approach, and jumping spider). These three tasks were selected based on previous research using similar tasks to assess behaviours relevant to the trait of BI. Such procedures are consistent with past research using observational measures of temperament (e.g., Durbin, Klein, Hayden, Buckley, & Moerk, 2005; Mackrell et al., 2014; Olino, Klein, Dyson, Rose, & Durbin, 2010), which suggest BI is a specific response to novel situations whereas PE is not context-specific (e.g., Laptook, et al., 2008; Laptook, Klein, Olino, Dyson, & Carlson, 2010). A parent was present in the main experimental area with his/her child for all episodes except stranger approach, box empty, and a portion of pop-up snakes (see below); he or she was instructed to work on questionnaires at a desk in the back corner of the room while avoiding interaction with the child. A description of each episode is provided below.

Risk room. The child and experimenter entered a room containing novel and ambiguous stimuli, including, a small staircase, a mattress, a balance beam, a Halloween mask, a cloth

tunnel, and a large, black cardboard box. The experimenter left for five minutes after instructing the child to play with the stimuli "however you like". When the experimenter returned, she asked the child to interact with each stimulus in the room.

Tower of patience. The child and experimenter took turns building a tower with large blocks. During each of her turns, the experimenter adhered to a schedule of increasingly lengthy delays before placing her block on the tower.

Puzzle with parent (teaching task). Based on the Teaching Tasks battery (Egeland, Weinfield, Hiester, Lawrence, Pierce, & Chippendale, 1995), the child and parent were seated at a table in the centre of the experimental room and given a difficult block puzzle to work on together for five minutes while the experimenter left them alone. Child and parent collaborated on the puzzle, which had six different solutions, until the experimenter returned. To enhance motivation to complete the puzzle, the dyad was told to place the pictures of their completed puzzles on one corner of their table so they could show the experimenter how many they were able to solve by the end of the episode. This task was coded for parenting behaviour (as described subsequently).

Stranger approach. The child was left alone in the experimental area under the premise that the experimenter needed to get a toy for further play. While the child was alone, an unfamiliar male research assistant entered the room and spoke to the child while slowly moving closer, following a standardized script and timed intervals. After asking the child four standardized questions, the stranger left and the main experimenter returned. The same stranger then returned, greeted the experimenter and child, and was introduced to the child as the experimenter's friend.

Car go. The child and experimenter played with two remote controlled cars for several minutes. The experimenter and child raced their cars, with the experimenter allowing the child to win every time.

Transparent box. The child selected a toy, which the experimenter locked in a transparent box. The child was then left to work to open the box with a set of keys that were, unbeknownst to the child, inoperable. After a few minutes, the experimenter returned with the correct key, and helped the child access the toy.

Pop-up snakes. The experimenter showed the child what appeared to be a can of potato chips, actually containing coiled spring snakes. The experimenter demonstrated the trick, and encouraged the child to surprise his or her parent with the snakes.

Jumping spider. The child and experimenter were seated at a table in the centre of the room when a research assistant brought in a terrarium with a fuzzy, fake, black spider and placed it on the table. The experimenter showed the spider to the child and asked the child to touch the spider; when the child's hand was close to the spider, the experimenter manipulated the spider using an attached wire, making it appear to jump. This was repeated for a total of four trials, with the experimenter coaxing the child to touch the spider each time. At the end of the fourth trial, the experimenter showed the child that the spider was a toy.

Snack delay. The child was instructed to wait for the experimenter to ring a bell before eating a bite of a snack. The experimenter adhered to a schedule of varied delays before ringing the bell.

Impossibly perfect green circles. The child was repeatedly asked to draw the perfect green circle on a large piece of paper. After each drawing, the experimenter mildly criticized each circle. After two minutes of criticism, the experimenter praised the child's circles.

Popping bubbles. The child and experimenter played with a bubble-shooting toy for several minutes, during which time, the experimenter was enthusiastic and encouraging.

Box empty. The child was given a gift-wrapped box, under the pretense that an appealing toy was inside. After a brief interval in which the child was left alone to discover that the box was empty, the experimenter returned with several small toys for the child to keep, explaining that she had forgotten to place the toys inside.

BI coding. Video-recordings of the laboratory tasks were coded by trained graduate and undergraduate raters (see Appendix A for the coding manual). Raters were trained to an intraclass correlation of .80 with a master coder. Once this standard was reached, periodic reliability checks were conducted on 15-20% of all recordings (e.g., three recordings out of every 15 recordings were coded for reliability for stranger approach). Coders periodically met as a group to review recordings and prevent observer drift.

BI micro-coding. Episodes were divided into 20-to-30-second intervals called "epochs", using a system based on that developed by Goldsmith et al. (1995). In each epoch, fearful affect was coded such that the maximum intensity display was rated on a 3-point scale. As described in the next section, specific behaviours were coded in each individual epoch to evaluate the presence and intensity of conventional BI behavioural responses. The peak intensity of each behaviour was coded for all epochs.

Risk room was divided into two phases for coding purposes. The first phase, which was divided into 30-second epochs, began when the child entered the room and ended when the experimenter returned. Latencies to touch each specific object were recorded, as well as the latency to the child's first fear response and to the child's first verbalization. In each epoch, bodily fear, tentative play, time spent playing, references parent (i.e., child looks to parent),

proximity to parent, fearful or wary questions or comments, and amount of time talking were all coded. The second phase of this episode began when the experimenter returned to the room and ended when the child and experimenter exited the room. In this phase, latencies to comply with the experimenter's requests were recorded. This phase was divided into 20-second epochs for micro coding. All the same behaviours were coded as in the first phase, with the exception of time spent playing and amount of time talking. In addition, noncompliance and references experimenter (i.e., child looks to experimenter) were coded.

In stranger approach, bodily fear and vocal fear were coded during each epoch using codes highly similar to those used to code risk room. In addition to these behaviours, stilling/freezing was coded as the duration, in seconds, that a child exhibited a marked decrease in activity that exceeded two seconds and involved little or no movement. Approach, avoidance, gaze aversion, and verbal/nonverbal interaction were also coded; however, they were coded only for epochs in which the stranger was present. The latency from the time the experimenter said she would leave the room to the child's first fear response was also recorded, as was the latency from the time the stranger entered the room to the child's first vocalization.

Jumping spider was divided into four trials for coding purposes; each trial began when the experimenter told the child to "go ahead and pet the spider". Latency to the first definite fear response was coded. In each trial, intensity of fear expression, intensity of bodily fear, intensity of vocal distress, intensity of bodily fear, approach, withdrawal, gaze aversion, and startle were coded. At the end of the episode, the presence or absence of play with spider was coded based on the child's play with the spider when given the opportunity to do so after the last trial. Verbalizations were also coded as present if the child vocalized during the episode.

Reliability for each task was high (risk room ICC = .92; stranger approach ICC = .87; jumping spider ICC = .91). Item analysis was used to create a BI scale, after standardizing and reverse-coding items as necessary. The final BI scale consisted of an average of z-scored codes (α = .79, N = 39; ICC = .71, N = 32) from risk room, stranger approach, and jumping spider.

PE coding. Positive affect was coded during each episode, with each relevant display of facial, vocal, and bodily positive affect coded on a three-point intensity scale (see Appendix B for the coding manual). Ratings for the affective displays in each modality (e.g., facial) were summed within each episode, the totals for the 12 episodes were then summed, and the three modalities were aggregated to create a score for positive affect reflecting facial, vocal, and bodily indicators to create a PE scale (α = .88, N = 108; ICC = .67; N = 18).

Parenting coding. Video-recordings of the laboratory visits (i.e., puzzle with parent) were coded by trained undergraduate and graduate raters who were trained in the same manner as the BI coders. Parenting variables were coded such that a global rating for each variable was given based on the parent-child interactions throughout the entire episode (see Appendix C for the coding manual). Ratings scales were developed from the Teaching Tasks coding manual (Weinfield, Egeland, & Ogawa, 1998) and Qualitative Ratings for Parent-Child Interactions (Cox & Crnic, 2003). Seven scales concentrated on parent behaviour, eight scales concentrated on child behaviour, and two scales were more dyadic. For purposes of the current study, the parent intrusiveness scale was used. Parent intrusiveness was coded on a 7-point scale ranging from 1 (*none*) to 7 (*very high*). Reliability for the teaching task was high (ICC = .90; N = 61).

Genetic data. At the initial laboratory visit, buccal cell samples were collected from all 409 participants by softly rubbing the inside of the child's cheek with a cotton swab (Epicentre, Madison, WI, USA), and was extracted by Qiagen DNA MicroKit® (Mississauga, ON, Canada).

DNA was extracted following manufacturer's protocols. All children were genotyped for the serotonin transporter promoter (5-HTTLPR s/l) and BDNF val66met gene variants using allele-specific TaqMan polymerase chain reaction (Sheikh et al., 2010). For 5-HTTLPR, allele frequencies were as follows: l/l = 127 (31%); s/l = 193 (48%); and s/s = 85 (21%). This genotype distribution is consistent with Hardy-Weinberg equilibrium (X^2 (1) = .54, p =.46). For BDNF val66met allele frequencies were: val/val = 258 (63%), val/met = 134 (33%), and met/met = 17 (4%), also consistent with Hardy-Weinberg equilibrium (X^2 (1) = .01, p =.94). Given the previous literature on plasticity (e.g., Dalton Hammen, Najman, & Brennan, 2014; Hayden et al., 2010; Li, Berk, & Lee, 2013; Pluess, Belsky, Way, & Taylor, 2010), children with a copy of the S allele were considered to possess the 5-HTTLPR "plasticity" allele; children with a copy of the met allele were considered to possess the BDNF "plasticity allele.

Home assessment of parenting. Observed parenting data was also collected during a home visit that occurred within two weeks of the laboratory visit. Two semi-structured parenting tasks were conducted during this home visit, called the three bag and prohibition tasks.

Three bag task. This task was established from a task developed by the National Institute of Child Health and Human Development (1997), modified by Ipsa and colleagues (Ipsa et al., 2004). The primary caregiver and their child were directed to play together with three bags of toys. The first bag held a book, the second bag held a set of toy kitchen items, and the third bag held a farmhouse play set. The pair was instructed to play with the toys in order and to put away one set of toys before proceeding to the next set. This free play paradigm continued for approximately 10 minutes.

Prohibition task. This task was intended to elicit negative parenting behaviours. The primary caregiver and the child were given two boxes of toys, the first of which contained toys

that would be fun or exciting for children in this age group (e.g., a toy electronic guitar), and the second of which contained unexciting and age-inappropriate toys that were missing pieces or batteries (e.g., a plastic cone and pieces for Mr. Potato head without the head). To begin with, the primary caregiver was instructed to prevent his or her child from playing with the appealing toys, thus forcing the caregiver to engage the child in play with the unappealing toys. After three minutes, the primary caregiver was told that they could allow their child to play with the toys in either box, and after six minutes of play, the caregiver was directed to have the child put away the toys. The child then received five minutes to tidy up. The experimenter provided the primary caregiver with printed instruction cards to increase the child's perception that these orders were coming from the caregiver instead of the experimenter.

Parenting coding. Video-recordings of the home parenting tasks were again coded by trained graduate and undergraduate raters using a very similar coding system to that used for coding the laboratory parenting task. The parent intrusiveness scale was used for purposes of this study. Reliability for both home parenting tasks was high (three bag ICC = .86; N = 61; prohibition ICC = .87; N = 61).

Parent questionnaires. Parents completed a battery of questionnaires, which included self- and informant-report measures of parenting and parental psychopathology, child temperament and psychopathology, and demographic information. The following questionnaire measures are relevant to the current study.

Parenting Styles and Dimensions Questionnaire. Primary and secondary caregivers independently completed self and informant versions of an abbreviated (32 item) version of the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson, Mandleco, Olsen, & Hart, 2001). The PSDQ is intended to assess self- and spouse-reported parenting behaviours for

parents of preadolescent children based on a 5-point Likert scale response format ranging from 1 (*never*) to 5 (*always*). It is divided into three parenting domains (authoritative, authoritarian, and permissive), which are additionally divided into sub-dimensions (connection, autonomy-granting, regulation, verbal hostility, physical coercion, non-reasoning/punitive, and indulgence). For purposes of the present study, the PSDQ autonomy-granting scale was used, as low autonomy-granting was conceptualized as an index of parental overinvolvement. The PSDQ has good internal consistency (Robinson, Mandleco, Olsen, & Hart, 2001). In this sample, internal consistency of the autonomy-granting scale, indexed by coefficient alpha, indicated good reliability ($\alpha = .71$ for self- and informant-reports). Of relevance to the current study, primary caregivers' self-reported PSDQ data and secondary caregivers' informant-reported PSDQ data (assessing the primary caregivers' parenting) were used. As self- and informant-reported autonomy-granting scores for the primary caregiver PSDQ were significantly and positively correlated ($r = .33$, $p < .01$), a PSDQ autonomy-granting composite was calculated such that PSDQ self-reported and informant-reported autonomy-granting scores for the primary caregiver were summed and averaged. In cases where participants did not have one of these scores, the available score was used in analyses; thus, 405 participants had a final PSDQ autonomy-granting score.

For the sake of parsimony, the PSDQ autonomy-granting composite and the observer ratings of intrusiveness will be referred to as questionnaire-reported overinvolvement and observed overinvolvement, respectively. The final PSDQ autonomy-granting composite was reverse-coded such that higher scores indicated higher levels of parental overinvolvement.

Follow-up Assessment

Participants. Follow-up participants were 371 of the initial 409 families, an attrition rate

of 9.5%. Participants that dropped out of the study were not significantly different from those that completed the follow-up on most study variables. However, children that did not participate in the follow-up assessment had significantly lower baseline PPVT scores compared to children that participated in both assessments (M = 107.68 versus 112.44; $t(397) = 1.97$ $p = .049$), although both were in the normal range of scores. The follow-up visit occurred an average of 29.63 months (SD = 1.55) following the baseline laboratory assessment, when children were an average of 5.93 years old (SD = 0.31).

Laboratory assessment of temperament. Children participated in 12 standardized laboratory tasks taken from an adapted version of the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995), which were similar to the initial laboratory tasks but designed to be age-appropriate for somewhat older children. Similar to the baseline assessment, BI was assessed in three tasks: exploring new objects, stranger approach, and object fear; as these were the only episodes used in the current study, the remainder of the tasks are not described further here.

Exploring new objects. The child and experimenter entered a room containing various novel and ambiguous stimuli, which included a tunnel, a remote-controlled spider, a skull and cloth, a box with a toy heart inside, and a box with "worms" inside. The experimenter left for a total time of five minutes after giving the child permission to play with the objects in the room. When the experimenter returned, she asked the child to interact with each stimulus in the room.

Stranger approach. The child was left alone in the experimental area with a toy. While the child was alone, an unfamiliar male research assistant entered the room. Following a standardized script and timed intervals, he asked the child friendly questions and asked to play with the toy together.

Object fear. The experimenter instructed the child to investigate "something scary" in a pet carrier, leaving the child alone in the room. After one minute, the experimenter returned and asked the child about the item in the animal carrier. If the child had not explored the carrier, the experimenter asked the child to look and to put his or her hands into the carrier with the experimenter present. The episode concluded with the child discovering or being shown that the carrier contained a stuffed animal hidden by shredded newspaper.

BI coding. At the age 5 follow-up, affective and behavioural micro-coding procedures were very similar to those used for the initial age 3 baseline tasks (see Appendix D for the coding manual). Video-recordings of the follow-up laboratory visits were again coded by trained undergraduate and graduate raters; these raters were trained in the same manner as those who coded the laboratory tasks from the initial baseline laboratory visit. Interrater reliability for each BI task was high (exploring new objects ICC = 86.3, N= 55; stranger approach ICC = 85.7, N = 47; object fear ICC = 77.8, N = 52). The final BI scale consisted of an average of z-scored codes (α = .88, N = 67; ICC = .98, N = 24) from exploring new objects, stranger approach, and object fear.

Diagnostic interviews with parents. In order to assess parental internalizing disorder, the full Structured Clinical Interview for *DSM-IV* (SCID; First, Spitzer, Gibbon, & Williams, 1996) was conducted with all biological parents when possible. The SCID is one of the most extensively used diagnostic interviews, and has demonstrated interrater reliability and procedural validity (First et al., 1996). Ph.D. candidates in the Clinical Psychology program administered the SCID after training by a Ph.D.-level psychologist, the principal investigator on the larger study. The interviewers were not involved in data collection and did not have access to data on the children. In cases where a second biological parent was unavailable to complete the SCID, a

family history interview was conducted with the primary biological caregiver when possible (Andreasen, Endicott, Spitzer, and & Winokur, 1977); data for 11 biological fathers was gathered through family history interviews. Interrater reliability for the SCID was calculated based on 33 audiotaped interviews (21 mothers and 12 fathers) and was high for diagnoses used in this study (Lifetime Anxiety Disorder, Kappa = 1.00).

For purposes of the current study, a composite variable for maternal anxiety was computed based on all maternal anxiety disorder variables covered by the SCID; maternal history of any anxiety disorder was coded as 1 and maternal history of no anxiety disorders was coded as 0. A composite variable for paternal anxiety was computed in the same way. Given the risk conferred for child anxiety when either parent has a history of anxiety (e.g., Franić, Middeldorp, Dolan, Ligthart, & Boomsma, 2010; Garcia et al., 2013), a final parental anxiety variable was computed to capture this familial risk; in the case where either a mother or father had a history of any anxiety disorder, parental anxiety was coded as 1 and when neither mother nor father had such a history, as 0.

Results

Means, standard deviations, and bivariate correlations between demographic and other study variables are presented in Table 1. Age 3 and age 6 BI were significantly positively correlated, albeit only modestly so; this correlation was fairly similar to laboratory-based studies of BI found across comparable follow-up intervals (e.g., Broberg, Lamb, & Hwang, 1990; Scarpa, Raine, Venables, & Mednick, 1995) although smaller than correlations reported in other studies, especially studies involving children selected for extreme BI scores (e.g., Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984; Kagan, Reznick, & Snidman, 1988). Age 3 and age 6 BI were significantly and positively correlated with child sex, such that girls exhibited

Table 1

Correlations between study variables.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1. Age 3 BI	-												
2. Age 5 BI	.28**	-											
3. Age 3 PE	-.12*	-.08	-										
4. 5-HTTLPR	.11*	-.01	-.10*	-									
5. BDNF	-.06	.03	.03	-.02	-								
6. Age 3 Observed Parental Overinvolvement	-.05	-.03	-.07	-.02	.06	-							
7. Age 3 Questionnaire-reported Parental Overinvolvement	-.05	.02	.004	-.01	.02	.09	-						
8. Parental AD	.05	.05	-.03	.06	-.05	-.03	.002	-					
9. Family Income	.05	-.10*	.10	.04	.05	-.17**	-.02	-.07	-				
10. Child Sex	.15**	.18**	.00	.07	-.01	-.11*	.03	-.01	-.02	-			
11. Child Age	-.17**	-.10*	.18**	-.06	.05	-.11*	.01	-.03	.06	.06	-		
12. Child Race	-.06	-.09	.08	-.03	-.10*	-.09	-.04	-.04	.07	-.06	-.06	-	
13. PPVT Score	-.05	-.01	.12*	.04	-.08	-.28**	-.14**	.01	.11*	.07	.05	-.02	-
N	409	394	409	405	409	409	405	409	389	409	409	409	399
Mean	0.0036	0.0068	0.00	0.69	0.37	2.79	-17.83	0.27	3.73	0.51	3.43	0.93	112.00
Standard Deviation	13.00	0.44	0.74	0.46	0.48	0.94	2.79	0.44	1.14	0.50	0.30	0.25	14.05

* $p < .05$, ** $p < .01$.

Note: 5-HTTLPR and BDNF: presence of "plasticity" allele = 1, absence of "plasticity" allele = 0; Age 3 Questionnaire-reported Parental Overinvolvement reflected by composite variable; Child Sex: female = 1, male = 0; Child Age presented in years at age 3 assessment; Child Race: Caucasian = 1, any other race = 0; AD = Anxiety Disorder; Parental AD: disorder present = 1, disorder absent

= 0; Family Income: 1 = < $20,000, 2 = $20,000 - $40,000, 3 = $40,001 - $70,000, 4 = $70,001 - $100,000, 5 = > $100,000; PPVT = Peabody Picture Vocabulary Test.

higher BI than boys; this association is consistent with some past work (e.g., Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Hane, Cheah, Rubin, & Fox, 2008). BI at both time points was significantly and negatively correlated with child age at baseline, albeit showing very modest associations. Age 3 BI also showed a significant, albeit small, negative correlation with age 3 PE. In addition, age 3 PE was significantly and positively correlated with children's PPVT scores and child age at baseline. Again, these correlations were small. 5-HTTLPR showed a small, significant positive correlation with age 3 BI and a small, significant negative correlation with age 3 PE, such that children with at least one copy of the S allele exhibited higher age 3 BI and lower age 3 PE. Consistent with literature on BDNF allelelic frequencies (e.g., Shimizu, Hashimoto, & Iyo, 2004; Verhagen et al., 2010), BDNF yielded a small, significant negative correlation with child race, such that children who were not Caucasian tended to have at least one copy of the met allele.

Additionally, observed parental overinvolvement at baseline was significantly and negatively correlated with child sex and child age at baseline; parents displayed more overinvolvement with younger children, and with boys. Observed overinvolvement showed a small, significant negative correlation such that higher observed overinvolvement was associated with lower PPVT scores; in contrast, questionnaire-reported overinvolvement showed a small, significant positive correlation such that higher questionnaire-reported overinvolvement was associated with higher PPVT scores. Moreover, family income showed a small, significant positive correlation with children's PPVT scores. Family income also showed small, albeit significant, negative correlations with age 3 BI and observed parental overinvolvement. There were no significant correlations between parental anxiety and any other relevant study variables.

Multiple regression was used to investigate whether putative influences on the stability of child BI interacted with age 3 BI to predict age 5 BI, following standard procedures for testing interactions in multiple regression (Aiken & West, 1991). Because I had many variables in the current study, I organized analyses based on the two approaches to assessing parental overinvolvement, observational and questionnaire, to reduce the number of terms in models. Thus, two models were run predicting age 5 BI, each including age 3 BI, either observed or questionnaire-reported overinvolvement, parental anxiety, 5-HTTLPR, BDNF, and age 3 PE. Prior to running the regression analyses, continuous variables were standardized and dichotomous variables were dummy-coded. Given research showing sex differences in BI (e.g., Doey, Coplan, & Kingsbury, 2014; Fox, Henderson, Marshall, Nichols, & Ghera, 2005) and the significant correlations between child sex and age 3 BI, age 5 BI, and observed parental overinvolvement in this data, child sex was treated as a covariate in all models. As child age at baseline was also significantly correlated with all temperament variables and observed parental overinvolvement, I initially included it as a covariate in all models; however, as there were no significant main effects of child age and including it as a covariate did not change the overall findings, it was dropped from final models. Given the genetic variables included in my analyses, I ran models excluding all non-Caucasian participants to control for population stratification. However, results were virtually identical with the inclusion of non-Caucasian participants in models; thus, models including all participants are presented here.

To make final models more parsimonious, all nonsignificant interaction terms in preliminary model tests were dropped. In cases of significant interactions, tests of simple slopes and regions of significance were used to understand the nature of the interaction. To test regions of significance, Hayes and Matthes' (2009) guidelines for the Johnson-Neyman technique

(Johnson & Fay, 1950) were used. This method uses the asymptotic variances, covariances, and other regression parameters to determine the value(s) of the focal predictor variable at which groups at varying levels of the moderator (i.e., the two levels of a dichotomous moderator variable; low, moderate, high levels of a continuous moderator variable) are significantly different ($p < .05$) in terms of the outcome variable. Partial correlations (*pr*) are provided as measures of effect size in my analyses.

In the final version of this first model (i.e., after having dropped nonsignificant interactions), age 3 BI, observed parental overinvolvement, parental anxiety, 5-HTTLPR, BDNF, age 3 PE, and child sex were entered in the first step, followed by the product of age 3 BI and 5-HTTLPR. The main effects of age 3 BI and child sex were significant in this model (see Table 2). However, the main effect of age 3 BI was qualified by a significant interaction between age 3 BI and 5-HTTLPR. This interaction is depicted in Figure 1. While tests of simple slopes indicated that the relationship between BI at ages 3 and 5 was significant both in the absence of an S allele ($\beta = 0.50$, $p < .0001$, $pr = .23$) and in the presence of an S allele ($\beta = 0.20$, $p < .001$, $pr = .18$), the association between age 3 and age 5 BI was strongest in children without a copy of the S allele, consistent with models of differential susceptibility. Next, tests of regions of significance were conducted. The plots suggested that the impact of 5-HTTLPR genotype was more salient at relatively higher levels of age 3 child BI, rather than when BI was low. Tests of regions of significance (Hayes & Matthes, 2009) indicated that significant differences in age 5 BI as a function of 5-HTTLPR genotype were evident above a value of 0.28, slightly higher than average age 3 BI. Thus, the presence or absence of the S allele seemed to influence BI stability only when children exhibited moderate to high BI at age 3; in the context of lower age 3 BI, BI stability was not affected by children's 5-HTTLPR genotype.

Table 2

Children's age 3 behavioural inhibition (BI) and child and parent factors as predictors of children's age 5 BI in the observed parental overinvolvement model.

	Overall Model				Change Statistic			
	Df	R^2	*F*	*Cohens* f^2	*Df*	ΔR^2	ΔF	β
Step 1	7, 382	.10	6.24***	.11				
Age 3 BI								0.26***
Observed Parental Overinvolvement								-0.01
Parental Anxiety								0.04
5-HTTLPR								-0.05
BDNF								0.04
Age 3 PE								-0.05
Child Sex								0.14**
Step 2	8, 381	.12	6.30***	.14	1, 381	.01	6.12*	
Age 3 BI								0.50***
Observed Parental Overinvolvement								-0.01
Parental Anxiety								0.04
5-HTTLPR								-0.07
BDNF								0.03
Age 3 PE								-0.05
Child Sex								0.13*
Age 3 BI X 5-HTTLPR								-0.27*

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

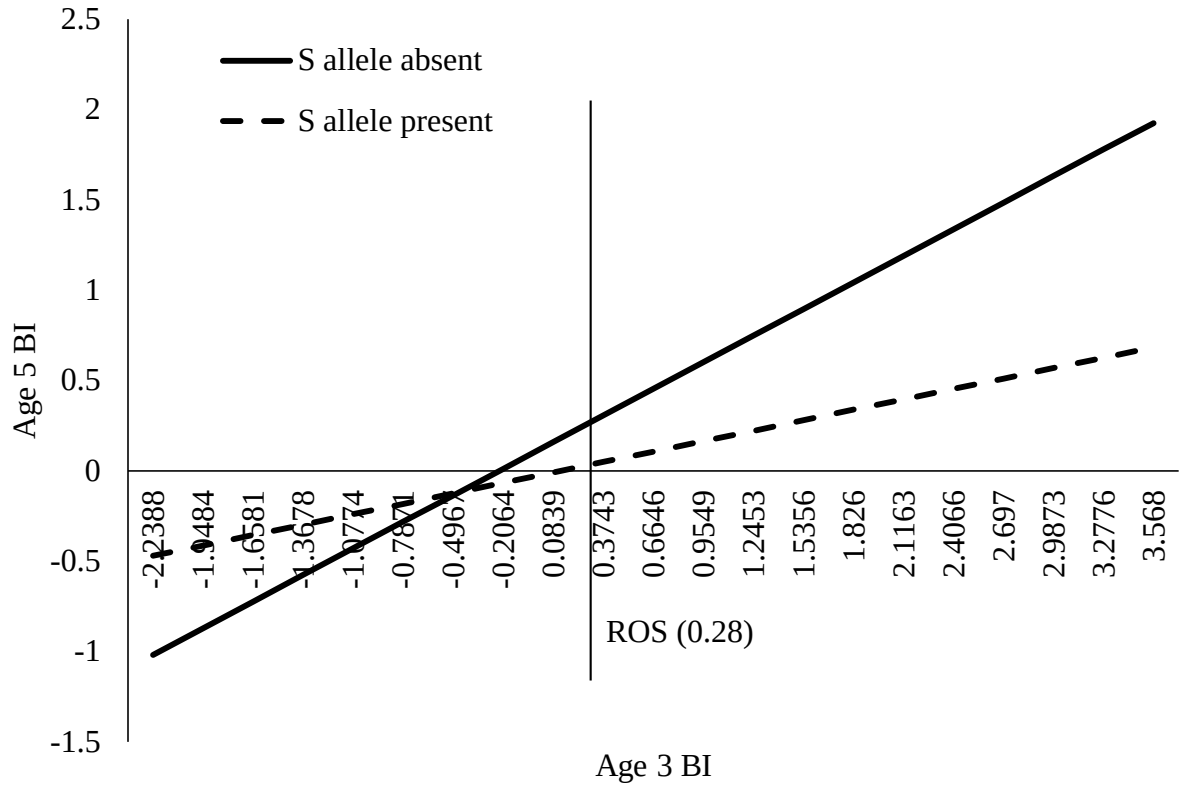

Figure 1. Interaction between age 3 BI and 5-HTTLPR genotype predicting age 5 BI in the observed parental overinvolvement model. The value x = 0.28, derived using the Johnson-Neyman technique (Johnson & Fay, 1950), indicates the value of age 3 BI above which significant differences in age 5 BI emerge for children with and without a copy of the S allele. ROS = region of significance.

In the final version of the second model (i.e., after having dropped nonsignificant interactions), age 3 BI, questionnaire-reported parental overinvolvement, parental anxiety, 5-HTTLPR, BDNF, age 3 PE, and child sex were entered in the first step, followed by the product of age 3 BI and 5-HTTLPR. As in the first model, the main effects of age 3 BI and child sex were significant in this model (see Table 3). Again, the main effect of age 3 BI was qualified by a significant interaction between age 3 BI and 5-HTTLPR. This interaction is illustrated in Figure 2. Consistent with my hypothesis and the observed parenting model, the relationship between age 3 and age 5 BI was strongest in children without a copy of the S allele, with tests of simple slopes indicating that the relationship between BI at ages 3 and 5 was significant both in the absence of an S allele ($\beta = 0.50$, $p < .0001$, $pr = .23$) and in the presence of an S allele ($\beta = 0.20$, $p < .001$, $pr = .18$.). Again, the plots suggested that the impact of 5-HTTLPR genotype was more salient at relatively higher levels of age 3 child BI, rather than when BI was low. Tests of regions of significance (Hayes & Matthes, 2009) indicated that significant differences in age 5 BI as a function of 5-HTTLPR genotype were evident above a value of 0.33, slightly higher than average age 3 BI. Therefore, the presence or absence of the S allele seemed to influence BI stability only when children exhibited moderate to high BI at age 3. When children exhibited lower BI at age 3, BI stability was not influenced by children's 5-HTTLPR genotype[1].

Given that maternal and paternal anxiety disorders were collapsed into one parental anxiety variable for purposes of making models more parsimonious, it is worth noting that the overall findings presented above remained even when models were run with maternal and paternal anxiety separately. In models investigating maternal anxiety only, the interaction

[1] Although I had no a priori hypothesis for a three-way interaction between age 3 BI, 5-HTTLPR genotype, and child sex, an exploratory analysis including this interaction term was conducted in light of the significant main effect of child sex in the two models. Results indicated no significant three-way interaction between these terms in the observed overinvolvement model ($p = .92$) or questionnaire-reported overinvolvement model ($p = .91$).

Table 3

Children's age 3 behavioural inhibition (BI) and child and parent factors as predictors of children's age 5 BI in the questionnaire-reported parental overinvolvement model.

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	Overall Model				Change Statistic			
	Df	R^2	*F*	*Cohens* f^2	*Df*	ΔR^2	ΔF	β
Step 1	7, 380	.10	6.33***	.11				
Age 3 BI								0.26***
Questionnaire Parental Overinvolvement								0.03
Parental Anxiety								0.04
5-HTTLPR								-0.05
BDNF								0.04
Age 3 PE								-0.05
Child Sex								0.15**
Step 2	8, 379	.12	6.37***	.14	1, 379	.01	6.03*	
Age 3 BI								0.50***
Questionnaire Parental Overinvolvement								0.03
Parental Anxiety								0.04
5-HTTLPR								-0.06
BDNF								0.03
Age 3 PE								-0.04
Child Sex								0.13**
Age 3 BI X 5-HTTLPR								-0.27*

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

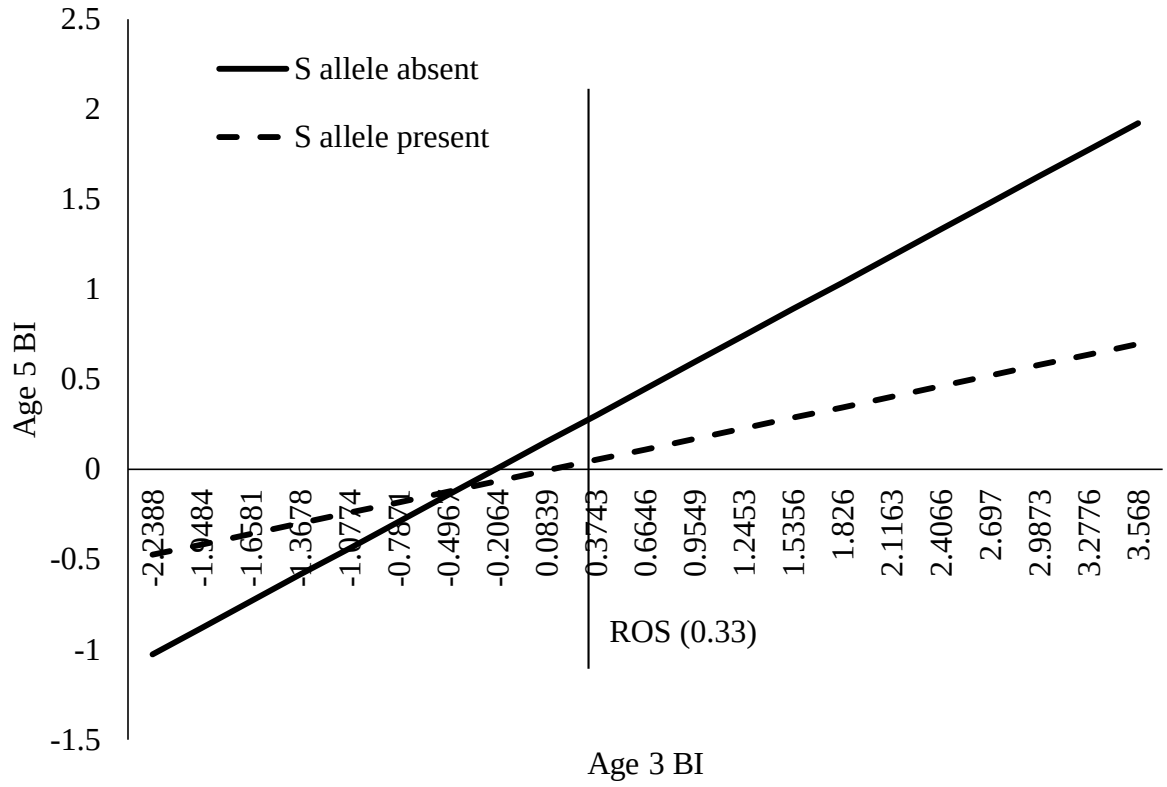

Figure 2. Interaction between age 3 BI and 5-HTTLPR genotype predicting age 5 BI in the questionnaire-reported parental overinvolvement model. Questionnaire-reported parental overinvolvement is indexed by the self- and informant-reported PSDQ composite The value x = 0.33, derived using the Johnson-Neyman technique (Johnson & Fay, 1950), indicates the value of age 3 BI above which significant differences in age 5 BI emerge for children with and without a copy of the S allele. ROS = region of significance.

between age 3 BI and 5-HTTLPR remained significant ($p < .05$) for both observed and questionnaire models. The same pattern was found in models considering paternal anxiety only, with the interaction between age 3 BI and 5-HTTLPR showing a strong trend ($p = .07$ and $p = .06$ for observed and questionnaire models, respectively). Moreover, the main effect of child sex remained significant in both maternal anxiety and paternal anxiety models across both observed and questionnaire measures of parental overinvolvement ($p < .05$ for all models). Neither maternal nor paternal anxiety significantly interacted with age 3 BI to predict age 5 BI[23].

Discussion

The present study sought to explore putative influences on the stability of BI in early childhood, drawing upon past work and focusing on parenting, parent anxiety, child temperament, and genetic factors (e.g., Davis & Suveg, 2014; Degnan & Fox, 2007; Fox et al., 2005; Hayden et al., 2010; Moore, Whaley, & Sigman, 2004; Kiel & Buss, 2012; Pluess, Belsky, Way, & Taylor, 2010; Rosenbaum et al., 2000; Rubin, Burgess, & Hastings, 2002). While some work has explored mediating influences on the stability of BI, far less is known about moderators of stability, an important contribution of this work. I extended previous work by including conceptually related factors (e.g., parental overinvolvement and parental anxiety) in the same model, and used a longitudinal design involving a relatively large sample size. Findings indicated that, of these proposed moderators of BI stability, 5-HTTLPR genotype was the only variable to significantly moderate the stability of BI between age 3 and age 5, such that the relationship between BI at ages 3 and 5 was stronger in children without a copy of the S allele. While speculative, this finding is consistent with past work on the 5-HTTLPR genetic variants in

[2] $p = .89$ and $p = .86$ for the interaction between age 3 BI and maternal anxiety in the observed and questionnaire-reported overinvolvement models, respectively.
[3] $p = .88$ and $p = .90$ for the interaction between age 3 BI and paternal anxiety in the observed and questionnaire-reported overinvolvement models, respectively.

differential susceptibility, in that it suggests the S allele renders children more responsive to influences that lead to phenotypic variability over time.

Despite numerous studies investigating the influence of 5-HTTLPR on internalizing disorders and temperament in both children and adults (e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011; Chen et al., 2014; Fox et al., 2005; Liu et al., 2013; Miu, Vulturar, Chiş, Ungureanu, & Gross, 2013; Verhagen et al., 2009), no research has specifically considered the impact of 5-HTTLPR genotype on BI stability. This deficit in the literature is surprising given the increasing support for the role of the S allele in differential susceptibility hypotheses (e.g., Belsky & Pluess, 2012, 2013; Dalton, Hammen, Najman, & Brennan, 2014; Li, Berk, & Lee, 2013; Pluess, Belsky, Way, & Taylor, 2010). The 5-HTTLPR S allele has previously been found to influence plasticity, such that individuals with at least one copy of the S allele have shown increased vulnerability to both positive and negative environmental influences (e.g., Belsky & Pluess, 2009; Dalton et al., 2014). Given this finding, I hypothesized that children with at least one copy of the S allele would be more susceptible to factors influencing BI and thus, would display less stable BI over time compared to children without a copy of the S allele. In accordance with this hypothesis, lower BI stability between ages 3 and 5 was found for children with a copy of the S allele.

However, it is interesting to note that the influence of 5-HTTLPR genotype on associations between age 3 and age 5 BI was only significant for children with moderate to high levels of BI at age 3. When children were low in age 3 BI, the presence or absence of the S allele did not influence BI stability, suggesting that when it comes to inhibited temperament, children with a copy of the S allele and low BI may exhibit less plasticity compared to children with a copy of the S allele and higher BI. Although the reasons for this effect are unclear, of

children with an S allele, those with low BI may not respond to exposure to novelty as do children with moderate to high BI, if their low fearfulness and reticence when confronted with novelty is already adaptive. Alternatively, it is possible that the threshold of environmental exposure necessary to influence BI stability in early childhood varies, such that the exposure to adversity required to become more inhibited over time may be greater than the exposure to supportive environments required for children to become less inhibited. Thus, children in the current study with the 5-HTTLPR "plasticity" allele and low age 3 BI may not have demonstrated this plasticity with respect to BI stability since most children were not dealing with extreme negative circumstances; perhaps if children's exposure to adverse circumstances had reached a greater threshold, these children with low BI and a copy of the S allele would have demonstrated the same plasticity in their BI levels between ages 3 and 5 as did children with moderate to high BI and a copy of the S allele. It is also possible that children with an S allele who are low in BI show evidence of plasticity, but for a different behavioural outcome than BI.

Although the significant moderating effect of 5-HTTLPR genotype on BI stability in the current study is intriguing, specifically in light of the differential susceptibility hypothesis, replication of this finding is crucial. While some research shows evidence for 5-HTTLPR- and 5-HTT-environment interactions in predicting children's BI at one time point, (e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011; Fox et al., 2005), to my knowledge, no studies have investigated the moderating role of 5-HTTLPR on BI stability. In one study, Fox et al. (2005) found evidence for a gene-environment (GXE) interaction in predicting BI such that children with a copy of the S allele and low mother-reported social support were at heightened risk for high BI at age 84 months although children with a copy of the S allele and high social support were not at increased BI risk at 84 months. In another study, Burkhouse et al. (2011) found

evidence for a 5-HTTLPR GXE interaction in predicting BI during middle childhood, such that higher child-reported maternal overprotection was related to higher child-reported BI only for children with two copies of the S allele (or other lower-expressing L_g allele). However, neither study investigated longitudinally assessed BI and the effect of 5-HTTLPR genotype on BI stability in early childhood. Thus, future longitudinal research on BI stability and its moderation by 5-HTTLPR genotype is essential.

I did not test three-way interactions in the current data set to better understand the factors that might be driving the 5-HTTLPR-age 3 BI interaction. Consequently, future studies should investigate influences that contribute to BI stability, and the lack thereof, for children with a copy of the S allele. Given longitudinal research on parenting and BI (e.g., Kiel & Buss, 2012), as well as cross-sectional research on parenting, BI, and 5-HTTLPR genotype (e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011), parenting styles (e.g., overprotection, intrusiveness) might be a logical starting point. For example, although we did not find interactions with parenting in the current study, overprotective parenting has been found to moderate observed BI between ages 3 and 6 (Johnson et al., under review) and mediate BI-related traits between ages 2 and 3 (Kiel & Buss, 2012). In light of the current findings, it is possible that overprotective parenting may lead to stably high BI only for children with a copy of the S allele. Such a hypothesis would be consistent with the cross-sectional research of Burkhouse et al. (2011), in which an interaction between maternal overprotection and 5-HTTLPR genotype predicted BI in middle childhood. Similar interactions involving 5-HTTLPR and other parenting styles, such as intrusiveness or solicitousness, may also be found with respect to predicting BI stability. Although the current study did include measures of parenting, as well as 5-HTTLPR genotype

and longitudinally assessed BI, I did not have adequate power to explore three-way interactions between age 3 BI, 5-HTTLPR genotype, and parental overinvolvement in my models.

Three-way interactions between child BI, 5-HTTLPR, and parental psychopathology may also be useful to investigate in the framework of differential susceptibility hypotheses, particularly given cross-sectional studies on child BI and parental internalizing disorders (e.g., Kochanska, 1991; Moehler, 2007; Rosenbaum et al., 2000). It is possible that having a parent with an anxiety disorder may impact BI stability only for children with a copy of the S allele, who may already be more genetically vulnerable to environmental influences. Parents with internalizing disorders have been found to engage in specific negative parenting styles (e.g., Campbell et al., 2004; Degnan & Fox, 2007; Moore, Whaley, & Sigman, 1999; Moehler et al., 2007); exposure to these negative parenting styles and parents' symptoms of psychopathology may consolidate elevated BI in children with enhanced sensitivity to contextual factors. While parental anxiety disorder was assessed in the present study, lack of power due to sample size once again prevented me from investigating these three-way interactions. Future longitudinal research using larger sample sizes will be critical in exploring such three-way interactions, thereby allowing a greater understanding of differential susceptibility in the context of BI stability in young children.

This increased vulnerability to environmental factors in children with a copy of the S allele is particularly important in the context of prevention and early intervention for children already at temperamental risk for internalizing disorders due to elevated levels of BI. Stably elevated BI has been robustly implicated in risk for anxiety (e.g., Chronis-Tuscano et al., 2009, Hirshfeld et al., 1992); therefore, prevention strategies targeting children with high BI who are most likely to remain high in BI over time may be especially cost-effective. As children without

a copy of the S allele exhibited more stable BI between the ages of 3 and 5 in the present study, focusing intensive prevention and early intervention programs on children with high BI who are also lacking a copy of the 5-HTTLPR S allele may be beneficial in reducing their levels of BI, and consequently, their risk for anxiety disorders. Conversely, children with high BI and a copy of the S allele may be more receptive to intervention given their increased sensitivity to context; thus, it may be more economical to focus less-intensive, less time-consuming interventions on these children, thereby maximizing distribution of resources.

Given the significant interaction between age 3 BI and 5-HTTLPR genotype in the current study, several concerns regarding GXE interaction studies are important to note. First, a significant interaction in a GXE study indicates the presence of a statistical interaction; however, a statistical interaction can also occur when a GXE correlation is operating (e.g., Dick et al., 2015; Riley, 2008). Such GXE correlations may be passive (i.e., no explicit influence of the genotype on the environmental factor studied); they may also be active or evocative (i.e., explicit influence of the genotype on the environmental factor; e.g., Dick et al., 2015; Riley, 2008). Complex traits, moreover, are likely to be influenced by multiple genes and multiple environmental factors, such that GXE and gene-gene (GXG) interactions are at play (e.g., Dick et al., 2015; Riley, 2008); we did not test such complex models in the current study due to limited power. Another issue with GXE studies relates to measurement, particularly the scale on which the environmental variables is assessed; transforming the scale can create or eliminate significant GXE interaction effects (e.g., Dick et al., 2015; Riley, 2008; Schlomer, et al., 2015). Other statistical concerns include the appropriate selection of model, the inclusion of covariates and their interactions with study variables to control for confounds, sample size, and the power necessary to detect various types of interactions (for a review, see Dick et al., 2015). As allelic

frequencies vary across ethnicities, interactions between ethnicity and environment that result from stratification may be misinterpreted as GXE interactions (e.g., Dick et al., 2015). Publication bias is an additional challenge affecting the GXE literature (e.g., Dick et al., 2015). In view of these GXE study concerns, therefore, caution must be exercised when interpreting significant GXE interactions and replication becomes especially important.

The lack of significant interactions between age 3 BI and all other proposed moderating variables in the present study is interesting given the current BI literature. In particular, the absence of a moderating effect of parental overinvolvement on children's BI stability warrants discussion. In contrast to previous research suggesting that certain negative parenting styles (e.g., overprotection, negativity, solicitousness) serve to consolidate high BI and BI-related traits in early childhood (e.g., Degnan, Henderson, Fox, & Rubin, 2008; Hane, Cheah, Rubin, & Fox, 2008; Johnson et al., under review; Kiel & Buss, 2012; Rubin, Burgess, & Hastings, 2002), I found no influence of parental overinvolvement on BI stability. Several factors may explain this discrepancy. First, my participants were from the community, which limited the extent to which more extremely negative parenting styles were evident. It is possible, moreover, that video-recording parenting-child interactions to observationally assess parental overinvolvement may have led parents to display socially desirable behaviour and inhibit negative parenting responses, particularly in the artificial setting of the laboratory; the specific tasks used to assess parenting in this study were also not purposely designed to elicit parental overinvolvement. In addition, the construct of parental overinvolvement explored in my study was not identical to negative parenting constructs investigated in other studies; while my measures of overinvolved parenting were intended to capture aspects of negative parenting implicated in previous BI research (e.g., overprotection, solicitousness, intrusiveness), it is possible that my operational definition

overlooked a facet of high-risk parenting behaviours reflected in other studies. Furthermore, it is possible that high-risk parenting styles may consolidate high child BI only for a certain subset of children, for example, children with a copy of the S allele who may possess increased biological sensitivity to environmental influences. As previously noted, I did not have adequate power to explore such three-way interactions between parenting, 5-HTTLPR genotype, and age 3 BI in the present study; thus, future research investigating these potential interactions is crucial.

With respect to the lack of association between parental anxiety and BI stability in the current study, it is again important to note that a non-clinical sample was used. Thus, the majority of parents did not have an anxiety disorder, which limited my power to detect interactions between parental anxiety and age 3 BI. Additionally, the parental anxiety measure used in analyses took into consideration the lifetime diagnosis of any anxiety disorder in parents, in contrast to a current diagnosis. The vast majority of parents were not experiencing an anxiety disorder at the time of the study and may not have experienced an anxiety disorder during their children's lifetime, thereby minimizing children's exposure to anxiety-related parenting and its potential impact on BI. Had I recruited a clinical sample with a portion of parents currently experiencing an anxiety disorder as a comparison point, it is possible that moderating effects of parental anxiety on the relationship between age 3 and age 5 BI would have been found.

It is also interesting to note the lack of moderation of PE on BI stability in the current study. Previous studies have supported the idea that high PE and PE-related constructs may buffer against the impact of other vulnerabilities to negative consequences (e.g., Davis & Suveg, 2014; Karevold, Coplan, Stollmiller, & Mathieson, 2011; Mackrell et al., 2014; Wichers et al., 2007). However, only one study to my knowledge has specifically examined the role of PE in moderating BI stability (Johnson et al., under review), finding that PE at age 3 interacted with BI

at age 3 to predict age 6 BI, such that children with low PE and high BI demonstrated more stably elevated BI at age 6. One factor leading to the discrepancy between study findings may pertain to the construct of PE. Although both studies assessed PE observationally across a similar battery of laboratory tasks, the previous study included interest as well as positive affect in its overall measure of PE; in order to reduce conceptual overlap with the construct of BI, interest was not included in the PE measure used in the current study. However, it is possible that interest may be a key facet of PE when it comes to high PE buffering against high BI; high interest, as well as high positive affect, may be necessary to facilitate inhibited children's engagement with the environment and their approach and exploratory behaviours. Thus, future research is needed to differentiate the specific facets of PE that may be important in mitigating risk for stably elevated BI in children.

The lack of significant interaction between BDNF genotype and age 3 BI in the current study is not particularly surprising. Although a body of literature supports the role of BDNF in plasticity (e.g., Castrén & Rantamäki, 2009; Thoenen, 1995) and some research implicates BDNF in temperament (Hayden et al., 2010) and anxiety-related traits (e.g., Frustaci, Pozzi, Gianfagna, Manzoli, & Boccia, 2008; Suzuki et al., 2011), there is a dearth of research on BDNF and BI specifically. Some recent research supports the notion that the BDNF met allele confers increased plasticity to environmental influences in accordance with differential susceptibility hypotheses (e.g., Hayden et al., 2010; Suzuki et al., 2011). For example, Suzuki et al. (2011), found that children with the met allele showed higher harm avoidance and lower self-directedness in the context of negative parental rearing, but showed lower harm avoidance and higher self-directedness in the context of positive parental rearing, compared to children without a met allele. Hayden et al. (2010) also found that children with the met allele demonstrated

increased sensitivity to contextual factors when considering the temperament trait of NE. However, no studies to my knowledge have explicitly explored BDNF and BI in humans, thus, it is possible that BI stability is influenced primarily by 5-HTTLPR or other genes. It is also worth noting that of the research on other temperament traits and BDNF, one study found evidence for a gene-gene interaction between 5-HTTLPR and BDNF in predicting anxiety-related traits, suggesting that combinations of genes may interact to influence anxiety-related traits (Arias et al., 2012). Similar gene-gene interactions may be found with respect to BI stability. Future research is needed to explore potential interactions between BDNF and other genes, as well as environmental factors, in moderating BI stability.

Strengths and Limitations

The current study has various strengths. For instance, observational measures of child temperament were used at both baseline and follow-up assessments. In addition, observational, as well as self- and informant-reported, measures of parental overinvolvement were used, capturing a greater range of overinvolved parenting behaviours than those assessed in most studies. The present study also used a relatively large sample size (with a respectable retention rate of 90.5%) and a longitudinal design that allowed two years between baseline and follow-up assessments, thereby permitting a strict test of BI stability. However, several limitations are important to note. First, the current sample size, while larger than most observational studies of BI stability, did not permit adequate power for exploring three-way interactions between age 3 BI, genetic, and environmental factors; such three-way interactions are likely critical to understanding factors consolidating BI over time. Second, participants were recruited from the community and comprised a non-clinical sample; as previously noted, this may have limited the ability to detect a moderating effect of parental anxiety on BI stability. Third, at each assessment

age, BI was observationally assessed in only three laboratory tasks, two of which involved novel non-social situations and one of which involved a novel social situation; thus, it is possible that differences in the type of novel situation (i.e., social versus non-social) may have disproportionately influenced estimates of children's BI. As some research suggests differences in BI and its stability across social versus non-social tasks (e.g., Burkhouse, Gibb, Coles, Knopik, & McGeary, 2011; Kochanska, 1991; Kochanska & Radke-Yarrow, 1992; Rubin, Hastings, Stewart, Henderson, & Chen, 1997), it will be important to address these contextual concerns in future studies. Fourth, the sample was comprised primarily of Caucasian participants from middle-class families, restricting the generalizability of this research to other cultures and socioeconomic classes. Finally, it is important to note that significant interactions, especially GXE interactions, often do not replicate.

In summary, the findings of the current study suggest the stability of BI in early childhood may be shaped partly by 5-HTTLPR, such that differential susceptibility may be at play. Given the relationship between genetic and environmental influences, investigation of contextual factors that may potentially interact with 5-HTTLPR genotype to moderate BI stability is crucial. Nevertheless, these findings may be relevant in the development and implementation of targeted prevention strategies for children at increased risk for negative outcomes (e.g., anxiety disorders), due to elevated BI in early childhood.

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Appendix A: Age 3 behavioural inhibition tasks coding manual and record forms

1. Risk Room

Phase I (child alone):

Start time: Begin coding as soon as the child enters the room.
Stop time: Stop coding when the experimenter returns.

A. **Time of first definite fear response:** note the time (including secs) of the first DEFINITE fear response (definite = either a 1 or higher is coded for fearful affect or distress vocalization OR a 2 or higher is coded for postural/bodily fear).

B. Watch entire episode through once to record the time at which each object was first touched.
Objects touched: record start time for the beginning of the episode, and the counter time when the object is first intentionally touched. Objects must be intentionally (not accidentally) touched, which can include exploration, rather than obvious playing.

C. Verbalizations
Time of first verbalization: record the counter time at which the child makes his/her first verbalization, which can take any tone of affect or content.

D. *Phase I scoring:*
Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch

0 = no facial region shows codeable fear movement
1 = fear expression is ambiguous or is of low intensity; fear is evident in only one facial region (i.e., brows raised in distress)
2 = fear expression is definitely present in at least 1 facial region (i.e., brows raised and drawn together, upper eyelids raised)
3 = fear expression is definitely present in both facial regions (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Bodily Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness
1 = child's body reflects low intensity fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.; diminished activity level)
2 = child's body reflects moderate intensity fear or weariness or the display lasts a majority of the epoch (e.g. slight defensive body posture; fearful tension)
3 = child's body reflects high intensity fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Tentative play: rate the peak intensity of hesitancy the child exhibits during the epoch; hesitancy is reflected by both wariness and physical cautiousness. Take into account the level of boldness

vs. inhibition in the child's play, particularly the manner of their approach towards objects and the quality of their play with the objects

0 = no hesitancy; child readily engages in play with objects with no pauses to examine objects, AND expresses no wariness when in contact with objects -- child plays boldly

1 = slight hesitancy; child examines object or pauses briefly (i.e., 2-5 secs) before playing with it, but then does not express wariness while in contact with the object

2 = moderate hesitancy, as indicated by any of the following: child pauses 6 or more secs before playing with an object, or expresses wariness while in contact with the object, or clearly avoids an object

3 = extreme hesitancy; child does not explore or touch objects at all, but may look at or point to objects

References parent: the peak/max degree to which child references parent before engaging with a toy

0 = child does NOT comment to or glance toward the parent before engaging

1 = child looks to, or directs comment or question to parent before engaging with a toy

2 = child asks for permission or seeks reassurance from parent before engaging with a toy

Proximity to parent: Closest physical proximity of the child relative to the parent; this rating should reflect solely the child's physical distance from their mother, regardless of why the child is close to their mother.

0 = greater than one foot/arm's length from parent

1 = within one foot/arm's length from parent

2 = clinging to parent (clutching parent's body, sitting in parent's lap, burying head in parent's body).

Fearful/Wary Questions/Comments: any comments or questions that indicate fear (taking into account both tone of voice and content) , such as: "I don't like this", "That is scary".

0 = child did not make an utterance of this kind during the epoch

1 = child makes a low intensity fear or wariness verbalization

2 = child makes a moderate/high intensity fear or wariness verbalization

Amount of time talking: the overall amount/duration of verbalizations made by the child

0 = child does not speak

1 = child makes a brief utterance (e.g., "ooh"/"Ah", incomplete sentences)

2 = child makes an extended/complete utterance (e.g., child states a full sentence)

Time spent playing: degree to which the child engaged in purposeful manipulation, exploration, or symbolic interaction (e.g., talking to an object) with the objects

0 = child did not play with any toys during the epoch

1 = child played with toys for less than half of the epoch

2 = child played with toys for more than half of the epoch

3 = child played with the toys for the entire epoch

Sad affect: code the highest intensity sad affect that occurs during the epoch
0 = NO facial region shows codeable sadness movement
1 = droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows; or, expression is fleeting
2 = definitely downturned mouth or definite raising of inner corners of eyebrows
3 = both definitely downturned mouth *and* definite raising of inner corners of eyebrows

Phase II (child & experimenter)

Start time: when experimenter returns
Stop time: after experimenter and child leave the room

A. Time to comply: note the time, in seconds, at which the experimenter first asks the child to participate in an activity (time when request is completed), then note the time in seconds at which the child touches the object. If child fails to touch the object, record the time of next request.

B. Phase 2 Scoring:

NOTE: do NOT code an epoch if less than 10 seconds in length.

Noncompliance: rate the peak intensity of noncompliant/oppositional behavior; include responses to the experimenter's requests to stand in a certain position, as well as to touch objects
0 = child complies readily with experimenter's requests, with NO signs of opposition
1 = child requires prompting (2 or more requests) from the experimenter to engage in the requested activity, or exhibits mild opposition through facial, postural, or verbal signs (i.e., ignores, shuffles feet, or says "no" in a neutral tone of voice); child eventually complies
2 = child requires prompting (2 or more requests) to engage in the requested activity, AND exhibits moderate opposition through facial, postural, or verbal signs (i.e., child grimaces strongly, crosses arms defiantly, or says "no" or some other verbalization in an angry or whining tone of voice); child eventually complies with the request, but compliance may not be complete.
3 = child requires prompting (more than 2 requests) to engage in the requested activity, AND exhibits strong opposition through facial, postural, or verbal signs (i.e., child runs away, shakes head violently, refuses verbally to comply with task, or may engage in other activities); child eventually complies with the request, but compliance may not be complete
4 = child exhibits strong signs of opposition, AND does NOT comply with the request

References experimenter: the peak/max degree to which child references experimenter before complying with the request; should clearly reflect wariness/fear, rather than merely noncompliance

0 = child does NOT comment to or glance toward the experimenter in a timid manner before complying

1 = child questions the experimenter regarding the request before complying, or clearly looks again at the experimenter before complying (even though it is obvious they understand the request); child obviously seems timid about or is reluctant to engage in the requested behavior

Fearful/Wary Questions/Comments: note the peak intensity of any comments or questions that indicate fear (taking into account both tone of voice and content), such as: "I don't like this", "That is scary".

0 = child did not make an utterance of this kind during the epoch

1 = child makes a low intensity fear or wariness verbalization

2 = child makes a moderate/high intensity fear or wariness verbalization

Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch

0 = no facial region shows codeable fear movement

1 = fear expression is ambiguous or is of low intensity; fear is evident in only one facial region (i.e., brows raised in distress)

2 = fear expression is definitely present in at least 1 facial region (i.e., brows raised and drawn together, upper eyelids raised)

3 = fear expression is definitely present in both facial regions (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Bodily Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness

1 = child's body reflects low intensity fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.; diminished activity level)

2 = child's body reflects moderate intensity fear or weariness intensity or the display lasts a majority of the epoch (e.g. slight defensive body posture; fearful tension)

3 = child's body reflects high intensity fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Tentative play: rate the peak intensity of hesitancy the child exhibits during the epoch; hesitancy is reflected by both wariness and physical cautiousness. Take into account the level of boldness vs. inhibition in the child's play, particularly the manner of their approach towards objects and the quality of their play with the objects

0 = no hesitancy; child readily engages in play with objects with no pauses to

examine objects, AND expresses no wariness when in contact with objects -- child plays boldly

1 = slight hesitancy; child examines object or pauses briefly (i.e., 2-5 secs) before playing with it, but then does not express wariness while in contact with the object

2 = moderate hesitancy, as indicated by any of the following: child pauses 6 or more secs before playing with an object, expresses wariness while in contact with the object, or clearly avoids an object

3 = extreme hesitancy; child does not explore or touch objects at all, but may look at or point to objects

References parent: the peak/max degree to which child references parent before engaging with a toy

0 = child does NOT comment to or glance toward the parent before engaging

1 = child looks to, or directs comment or question to parent before engaging with a toy

2 = child asks for permission or seeks reassurance from parent before engaging with a toy

Proximity to parent: the CLOSEST physical proximity of the child relative to the parent; this rating should reflect solely the child's physical distance from their mother, regardless of why the child is close to their mother.

0 = greater than one foot/arm's length from parent

1 = within one foot/arm's length from parent

2 = clinging to parent (clutching parent's body, sitting in parent's lap, burying head in parent's body)

Sad affect: code the highest intensity sad affect that occurs during the epoch

0 = NO facial region shows codeable sadness movement

1 = droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows; or, expression is fleeting

2 = definitely downturned mouth or definite raising of inner corners of eyebrows

3 = both definitely downturned mouth *and* definite raising of inner corners of eyebrows

Risk Room Episode #1

ID

Coder Initials:

Date ___ / ___ / ___ (M / D / Y)

Child's Sex ○ Male ○ Female

Start time: ___ : ___ : ___ (H : M : S)

End time: ___ : ___ : ___

Time of first definite fear response ___ : ___ : ___

Objects touched

Object touched	**counter time** (hour:minute:sec)		
Tunnel	___ : ___ : ___		
Stairs	___ : ___ : ___		
Mattress	___ : ___ : ___		
Balance Beam	___ : ___ : ___		
Scary Box	___ : ___ : ___		
Mask	___ : ___ : ___		
Total # touched:	___		

Verbalizations **time at first verbalization** ___ : ___ : ___

Latency to Comply	Time Asked	Time Touched
Tunnel	___ : ___ : ___	___ : ___ : ___
Balance Beam	___ : ___ : ___	___ : ___ : ___
Stairs	___ : ___ : ___	___ : ___ : ___
Box	___ : ___ : ___	___ : ___ : ___
Mask	___ : ___ : ___	___ : ___ : ___

Risk Room Episode #1

ID

Phase I scoring:

Epochs: 30 secs Start time: : : End time: : :

Time (min/sec)													
Fearful affect													
Bodily fear													
Tentative play													
References parent													
Proximity to parent													
Fearful/wary comments/questions													
Amount of time talking													
Time spent playing													
Sad facial affect													

Phase II scoring:

Epochs: 20 secs Start time: : : End time: : :

Time (min/sec)													
Noncompliance													
References Experimenter													
Fearful/wary comments/questions													
Fearful Affect													
Bodily Fear													
Tentative Play													
References Parent													
Proximity to Parent													
Sad Affect													

4. STRANGER APPROACH
Start time: begin coding when the experimenter and child enter the room
Stop time: end coding when the child leaves the room

A. Time of first fear response: Note the time (including secs) from the time when the experimenter leaves the room to the first actual moment of a definite fear response (the first epoch is which a 1 or higher is coded for fearful affect or distress vocalizations, or a 2 or higher is coded for postural fear).

B. Time of first vocalization: Note the time (including secs) from time when the stranger enters the room to the first vocalization, which can take any tone of affect or content.

C.

Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch

0 = no facial region shows codeable fear movement
1 = fear expression is ambiguous or is of low intensity; fear is evident in only one facial region (i.e., brows raised in distress)
2 = fear expression is definitely present in at least 1 facial region (i.e., brows raised and drawn together, upper eyelids raised)
3 = fear expression is definitely present in both facial regions (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Postural Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness
1 = child's body reflects low intensity fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.; diminished activity level)
2 = child's body reflects moderate intensity fear or weariness intensity or the display lasts a majority of the epoch (e.g. slight defensive body posture; fearful tension)
3 = child's body reflects high intensity fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Still/Freezing: total duration of Still/Freezing (in seconds). Duration of freezing is defined as a marked decrease in activity (>2 secs) with little or no movement, with or without any indication of muscular tension.

Distress vocalizations: rate the peak intensity of distress vocalizations that occur during the epoch

0 = NO distress vocalizations
1 = mild distress vocalizations that are ambiguous in nature
2 = distress vocalizations that indicate some fear or sadness, either through the

content or intonation, (e.g., "Who are you?", "Where's my mommy?", or nervous laughter)

3 = vocalizations that indicate clearly fearful or sad overtones, either through content or intonation (e.g., "don't come closer", "I want my mommy")

Approach: rate the peak intensity of approach behaviors (any behavior initiated by the child to decrease the distance between himself and the stranger). If the child continues to face toward the stranger in subsequent epochs, s/he should continue to be coded a 1. Similarly, if the child stays within 3 feet of the stranger during subsequent epochs, s/he should continue to be coded a 3.

0 = NO approach behaviors

1 = child's body faces toward the stranger, or child goes hesitantly toward the door after the knock

2 = child takes 1or 2 hesitant steps toward the stranger, or goes boldly toward the door after the knock

3 = child takes 1 or 2 non-hesitant steps toward the stranger, or initiates some action to get within close proximity to the stranger (i.e., walks right up to the stranger)

NA > code for epochs when the stranger is absent

Avoidance: rate the peak intensity of avoidance behaviors (behaviors initiated by the child to maintain or increase the distance between himself and the stranger). If the child is coded a 1 for one epoch, then continues to be turned away during the following epochs, s/he should continue to be coded a 1. Code similarly for 3 codes - if the child continues to stay at the far corner of the room, continue to code the child a 3.

0 = child exhibits NO avoidance -- child stands in place or approaches the stranger

1 = low avoidance -- child's body faces away from the stranger

2 = moderate avoidance -- child takes 1 or 2 steps away from the stranger

3 = high avoidance -- child takes more than 2 steps away from the stranger, possibly going to the far corner of the room, or moving to the parent or experimenter (when present)

NA > coded for epochs when the stranger is absent

Gaze aversion: rate the peak intensity of gaze aversion that occurs during the epoch

0 = NO gaze aversion

1 = child glances down or away from the stranger in a deliberate attempt to avoid eye contact (i.e.,only darting glances toward stranger)

2 = child makes NO eye contact with the stranger at all during the epoch

NA > coded for epochs when the stranger is absent

Verbal/nonverbal interaction: the peak quality of the child's verbal responses to the stranger

0 = child does NOT respond to questions or initiate conversation with stranger

1 = child makes neutral or eager responses to questions, either verbally or nonverbally (i.e., nodding in response to a question), but does NOT initiate conversation with stranger

2 =child initiates conversation with stranger, or elaborates on a response
NA > coded for epochs when the stranger is absent

Angry affect: rate the peak intensity of angry facial affect that occurs during the epoch
0 = NO facial region show codeable facial anger movement
1 = anger expression is ambiguous or of low intensity; expression is present only in 1 facial region (i.e., furrowed brows, narrowed eyes, or tense/squarish mouth)
2 = anger expression is definitely present in 1 facial region (i.e., furrowed brows, or tense/squarish mouth)
3 = anger expression is definitely present in both facial regerions (i.e., furrowed brows, narrowed eyes, and angular/tense mouth)

Sad affect: code the highest intensity sad affect that occurs during the epoch
0 = NO facial region shows codeable sadness movement
1 = droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows; or, expression is fleeting
2 = definitely downturned mouth or definite raising of inner corners of eyebrows
3 = both definitely downturned mouth *and* definite raising of inner corners of eyebrows

Coder Initials: ☐☐

Stranger Approach
Episode #4

ID ☐☐☐☐

Child's Sex ○ Male ○ Female

Date ☐☐ / ☐☐ / ☐☐☐☐
M D Y

Start time: ☐☐ : ☐☐ : ☐☐
H M S

Time when E says that she will leave the room: ☐☐ : ☐☐ : ☐☐

Time when S enters room: ☐☐ : ☐☐ : ☐☐

End time: ☐☐ : ☐☐ : ☐☐

Time of first definite fear response ☐☐ : ☐☐ : ☐☐

Time of first vocalization ☐☐ : ☐☐ : ☐☐

Epochs are 20 secs in duration

Time (min/sec)												
Fearful affect												
Postural fear												
Still/Freezing												
Vocal Fear												
Approach												
Avoidance												
Gaze Aversion												
Verbal/nonverbal interaction												
Angry affect												
Sad affect												

8. Jumping Spider

This episode is divided into four trials. Each trial begins as the experimenter begins to say "go ahead and pet the spider" or otherwise asks or explicitly prompts child to pet the spider. If child does not take his/her hand out of the cage before experimenter makes spider jump a second, third or fourth time, trials begin when experimenter makes spider jump. "After effects" are noted when the experimenter begins to request that child touch the spider, and lasts until child begins to operate the spider alone.

Variables to be scored:

a. Latency to fear response
b. Intensity of fear expression
c. Intensity of vocal distress
d. Intensity of bodily fear
e. Approach
f. Withdrawal
g. Gaze Aversion
h. Startle
i. Plays with spider
j. Verbalizations

a. **Time of fear response**: **Time of first definite fear response:** note the time (including secs) of the first DEFINITE fear response (definite = either a 1 or higher is coded for fearful affect or distress vocalization OR a 2 or higher is coded for bodily fear). Code as "9999" if no fear response occurs.

b. **Intensity of fear expression**: Peak intensity of fear or fear blends is noted in each epoch using affect descriptions and rated on the following scale:

0 = No facial region show codeable fear movement.
1 = Only one facial region shows codeable movement, identifying a low intensity fear, or expression is ambiguous.
2 = Only 2 facial regions show codeable movement, or expression in one region (e.g., brows) is definite.
3 = An appearance change occurs in all 3 facial regions, or coder otherwise has impression of strong facial fear.

c. **Intensity of vocal distress***: Peak intensity of vocal distress is noted in each epoch and rated on the following scale:
0 = No distress vocalizations.
1 = Mild vocalizations that may be difficult to identify as hedonically fearful.
2 = Vocalizations that indicate some fear. For example, nervous laughter or fearful interjections such as "oh".
3 = Scream or loud, fearful interjection. For example, "no!" or "whoa!"
*note that some vocalizations in the episode will not be fear related.

d. **Intensity of bodily fear**: Peak intensity of bodily fear (changes in body position or body movement) is noted in each epoch and rated on the following scale:
   0 = Very low bodily fear, no sign of bodily fear.
   1 = Low bodily fear. Decreased activity; an apparent or sudden decrease in the activity level of child. For example, child sitting still for a few seconds after petting spider.
   2 = Medium bodily fear. Bodily tensing: visible tensing of muscles such as drawing back of shoulders, tensing chords in neck.

e. **Approach**: Presence of approach behaviors is noted in each epoch and rated on the following scale:
   0 = Touches spider with no hesitation.
   1 = Hesitates for one or two seconds before touching spider.
   2 = Hesitates for three to five seconds before touching spider.
   3 = Does not touch spider.

f. **Withdrawal**: Peak intensity of withdrawal behaviors is noted in each epoch and rated on the following scale:
   0 = Very low withdrawal, child sits in place or makes minute movements away from spider.
   1 = Low withdrawal, child pulls back in chair slowly, or makes some movement from spider.
   2 = Medium withdrawal, child turns/twists away from spider and/or pulls back from spider.
   3 = High withdrawal, child moves away from table and/or jumps away from spider.

g. **Gaze Aversion**: Peak intensity of gaze avoidance is noted in each epoch and rated on the following scale:
   0 = No aversion
   1 = Briefly averts gaze.
   2 = Averts gaze for two to three seconds or focuses on object other than spider for two or three seconds.
   3 = Averts gaze for nearly all of the time between experimenter's requests to pet spider, or focuses on object other than spider for most of time between experimenter's request.

h. **Startle**: Presence of startle response is noted during each epoch. (1 = present, 0 = not present)

i. **Play with spider**: It is noted whether or not child plays with spider when given the opportunity to do so at end of 4^{th} trial. (e.g., moves the spider or touches it) (yes = 1; no = 0)

j. **Verbalizations**: It is noted whether or not child vocalizes during episode (check box if child verbalizes).

BI: Jumping Spider

Subject # _____
Coder: _____
Date: _____

Start time: _____

Time of first fear response: T1_____ T2_____ T3 _____ T4 _____

Scoring Intervals

Trial Number	1	2	3	4	After Effects
Time (begin/end)					
Peak Intensity of fear expression (0 -3)					
Peak Intensity of vocal distress (0-3)					
Peak intensity of bodily fear (0-2)					
Approach (0-3)					
Peak intensity of withdrawal (0-3)					
Gaze Aversion (0-3)					
Startle 1 = yes; 0 = no					
Spider jumped 1 = yes; 0 = no					

Child plays with spider when given the opportunity: YES NO

Verbalizations: note whether child verbalizes or not during episode: YES NO

Appendix B: Age 3 positive emotionality tasks coding manual and record forms

GENERAL CODING GUIDELINES & CONVENTIONS FOR ALL EPISODES

1. You will almost always need to watch an episode more than once to make valid ratings of all behaviors.

2. Behavior exhibited from the time the child enters the room until when they leave should be considered in making ratings. Hence, the start and stop times recorded on the coding sheets should be closely tied to the counter times when the child initially enters and exits the room, respectively.

3. If you are coding episodes that someone else has already coded for reliability, be sure to use the first coder's start and stop times so that you are considering the same sample of behavior in making your ratings.

4. Rate whether a behavior is present, not changes from baseline. For example, if a subject consistently has a mildly positive facial expression, this should be counted in your ratings—don't wait for the child to express a larger smile to code facial PA as present.

5. Codes are designed so that typical/usual behavior during a task is reflected by a midrange score (e.g., 2 on a 0-4 scale). Higher scores should be assigned to children who exhibit more/above average levels of a behavior; lower scores are assigned to children who exhibit less/below average levels of a behavior.

POSITIVE & NEGATIVE AFFECT CODING GUIDELINES & CONVENTIONS FOR ALL EPISODES

1. To code positive and negative affect displayed during the task, note each instance of potentially relevant facial, vocal, and bodily behavior as it occurs, pausing the video to consider behaviors. Relevance is determined largely by reviewing the list of affect exemplars in the coding manual, so familiarizing yourself with the list prior to coding is important.

2. Once you have determined that a behavior is relevant, decide whether it is a low, moderate, or high instance of affect by picking the most closely related exemplar from

the list. Note this instance by placing a mark in the appropriate column on the coding sheet.

3. If a facial affect expression is displayed for longer than 5 seconds, consider it as having occurred a second time. Count these additional behaviors by marking on the sheet as necessary. Intensity can be adjusted as needed (e.g., a high intensity smile that is sustained for 7 seconds but fades in intensity to a moderate level would be counted as one high and one moderate instance of facial PA).

4. For bodily and vocal affect, if a relevant behavior occurs for longer than 10 seconds, count it as having occurred again.

5. Children occasionally exhibit "blends" of affect (e.g., eyes appearing sad while the mouth simultaneously expresses anger). In such instances, both affective expressions can be counted as present. There is no need to force a choice between types of expressions when both are present.

6. Consider simultaneous displays of facial, verbal, and bodily behavior as discrete behaviors (i.e., consider them independently) in assigning intensity ratings. For example, a child who smiles and says "Cool!" at the same time may give the overall impression of high intensity pleasure; however, both the smile and the vocalization must reflect high intensity PA considered individually to each be coded as high intensity PA.

EXEMPLARS OF LOW, MODERATE, AND HIGH INTENSITY AFFECT CODES

Positive affect

Facial:

LOW = slight raising of corners of mouth – no teeth visible – no contraction of outer eye corner; or, smile is fleeting

MODERATE = corners of mouth definitely raised – teeth visible – no contraction of outer eye corner

HIGH = full smile – corners of mouth definitely raised – teeth visible – contraction of outer eye corner

Vocal:

LOW = somewhat lilting tone of voice; brief giggle or hiss

MODERATE = giggle or extended laugh; clearly exuberant tone of voice; statement with overtly positive content (e.g., "I like this!", "neat", "cool")

HIGH = full, extended laugh; screech, shriek, or whoop; statement with *both* overtly positive content and positive tone

Bodily:

LOW = perky/snappy movement; floating motion of arms or hands; ambiguous hop or skip

MODERATE = brief hop or skip with clearly positive tone; slight wiggle or contortion

HIGH = clearly jubilant motions, "dance of joy", clapping, arm shaking/quivering, knee slapping

Sadness

Facial:

LOW = droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows; or, expression is fleeting

MODERATE = definitely downturned mouth or definite raising of inner corners of eyebrows

HIGH = both definitely downturned mouth *and* definite raising of inner corners of eyebrows

Vocal:

LOW = slightly whiny or dejected tone; slight sigh

MODERATE = definite sigh; definite whiny or dejected tone; statement with possible/probable sad content

HIGH = deep sigh; crying sound; statement with obvious sad content

Bodily:

LOW = somewhat slumped posture; lifeless motion with arms, dejected gait/walk

MODERATE = definitely slumped posture; shoulders slumped; dejected kick of feet or dropping of arm

HIGH = head in hands; head slump; clearly dragging feet

Anger

Facial:

LOW = eyebrows drawn slightly down & together, mouth slightly tense or squarish; or, expression is fleeting

MODERATE = eyebrows definitely drawn down & together; mouth definitely tense or squarish

HIGH = *both* eyebrows definitely drawn down & together *and* mouth definitely tense or squarish

Vocal:

LOW = irritable or cranky tone; slight grunt

MODERATE = definite grunt, groan, or sharp exclamation; statement with possible/probable angry content

HIGH = statement with definite angry content; definite angry/irritable tone; yelling

Bodily:

LOW = slight tension in neck or shoulders; irritable foot tapping or shaking

MODERATE = definite tension in neck or shoulders; forceful movements; arm shaking

HIGH = kicking, punching or other aggressive motion; fists balled; stomping

Fear

Facial:

LOW = eyebrows slightly raised & tightened; mouth corners drawn slightly down & back

MODERATE = eyebrows definitely raised & tightened; mouth corners definitely drawn down & back

HIGH = *both* eyebrows definitely raised & tightened *and* mouth corners definitely drawn down & back

Vocal:

LOW = slightly quavering tone of voice; whispering or cautious tone

MODERATE = statement with possible fearful/wary content; frightened "ooh", "yikes", stuttering "uhhh"s

HIGH = "eek", yelp; statement with definite fearful/wary content

Bodily:

LOW = cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.; diminished activity level or stilling; nervous facial movements (other than prototypical fear facial expressions)

MODERATE = slight defensive body posture; fearful tension; slight withdrawal/move backward

HIGH = definite defensive body posture, jumping back in fear; definite retreat; definite freezing

Note: The following global ratings (i.e., interest/engagement, activity level/vigor, anticipatory PA, initiative/passivity, compliance, sociability, and impulsivity) were coded across all 12 episodes as applicable. The first episode is provided below as an example of this global rating coding system.

EPISODE 1: RISK ROOM

Interest/engagement

Normative considerations: the stimuli in this episode are novel to most children, and typically elicit a fair amount of interest. It is not uncommon for children to become somewhat bored toward the end of the 5 min first phase (if they have already played with or examined all the objects). Children often ask their mothers to name the objects and examine them in some amount of detail, both of which are good indicators of interest, in addition to time spent playing and facial expressions of interest. Some children will examine all the objects, while others will spend a majority of the episode playing with 1 or 2 objects.

0 = child exhibits only minimal interest in the stimuli, may hover near mother for a majority of the epoch or wander about the room; child may play with or examine a few objects briefly
1 = child seems interested in at least a few of the stimuli, although this interest may fade quickly or drop off near the end of the episode; child examines some objects
2 = child seems quite interested in the stimuli - plays with most of the stimuli with a fair degree of interest, examines objects, may make some pleasure comments or exhibit curiosity about the stimuli
3 = child exhibits very high interest - plays intently with several stimuli, asks many questions or makes many comments about the stimuli, examines objects in great detail; rarely shows signs of boredom; may seek out one item after another

Activity level/vigor

Normative considerations: This episode is designed to encourage a fair amount of activity from the child, including moving from one stimuli to another, crawling through the tunnel, jumping off the stairs, etc. Most children move across the entire room at some point during the episode, and most repeatedly engage in activities requiring physical effort (crawling, jumping).

0 = child moves little - is lethargic or sluggish in movement, or spends most of the episode standing or sitting in one place
1 = child exhibits some degree of activity and energy, but typically manipulates objects with little vigor and usually walks from one stimuli to another
2 = child exhibits moderate to high activity and energy - child runs across the room for at least part of the episode and typically manipulates objects with vigor; child spends a fair amount of time playing with objects that require physical effort
3 = child is extremely active - child spends nearly all of the epoch engaged in activities that require physical effort; may displace or play aggressively with stimuli, or move frenetically about the room

Anticipatory PA

Normative considerations: This episode is not designed to elicit a great deal of anticipatory positive affect. Therefore, any indication of anticipatory PA should be weighted heavily.

0 = no anticipatory PA is evident
1 = on at least 1 occasion, child smiles BEFORE engaging in an activity (i.e., before crawling through the tunnel or jumping off the stairs
2 = on several occasions, child smiles before engaging in an activity, or makes pleasure verbalizations before engaging in an activity (i.e., "Whoa!", "Look at that")
3 = child jumps up and down or wiggles in excitement before engaging in an activity

Initiative/Passivity

Normative considerations: most examples of initiative are evident during the 2nd phase of the episode (when the experimenter returns). Initiative is indicated by making suggestions to the experimenter about different ways to play with the stimuli (some behaviors may overlap with noncompliance). Passivity is also indicated by inhibited behavior during the 1st phase of the episode, as well as reliance on the mother (such as asking permission before playing with objects, asking mother how to play with certain objects, or repeatedly asking the mother to play).

0 = child exhibits NO initiative - child plays tentatively during the 1st part of the episode, and relies on mother for suggestions or encouragement
1 = child shows some initiative – may make a suggestion to the experimenter; child plays independently, but may require some encouragement from mother
2 = child shows moderate initiative - may make a few suggestions to the experimenter; child plays boldly when the experimenter is absent - plays independently without encouragement from mother
3 = child demonstrates a high degree of initiative - child is bold in play when experimenter is absent, and consistently attempts to direct the episode by suggesting new games to play or engaging in alternative (non-requested) activities when the experimenter is present

Compliance

Normative considerations: compliance is particularly evident during the 2nd phase of the episode (when the experimenter returns), although it may also come into play if the mother makes requests or prohibitions during the 1st phase. Include the experimenter's requests to stand in certain places, as well as requests to play with stimuli. DO NOT take into account apparent motivation behind noncompliance (i.e., if the child appears afraid of the mask). Prompting refers to the experimenter repeating a request for a 2nd or additional time.

0 = extremely noncompliant - child consistently fails to comply with experimenter's requests, is argumentative or oppositional
1 = somewhat noncompliant - child complies with some of the experimenter's requests, but may refuse to comply or require prompting to comply with some requests
2 = fairly compliant - child complies with all of the experimenter's requests, but may hesitate or require prompting in a few instances
3 = extremely compliant - child complies with all of the experimenter's requests without

delay, and requires no additional prompting

Sociability

Normative considerations: the 1st phase of the episode does not require any social interaction from the child, although it is common for children to address their mother at some point. The 2nd phase pulls for more social interaction, although this is still limited, as the experimenter makes brisk requests of the child, and does not initiate conversation. Evidence of engaging the experimenter in interaction should be given more weight than interaction with the mother.

0 = child does not engage the mother or the experimenter in social interaction; may make only brief eye contact with the experimenter
1 = low sociability; child does not attempt to engage the experimenter in interaction; may make some attempts to engage the mother in conversation or interaction
2 = moderate sociability; child makes some comments to the experimenter, nods to requests, and makes eye contact; child may address the mother for a fair amount of time during the 1st phase
3 = high sociability; child makes many attempts to engage the experimenter in conversation or interaction; child may greet experimenter when she returns; child may spend a significant portion of the 1st phase commenting to or interacting with the mother

Impulsivity

Normative considerations: At the high end, this variable reflects a tendency to act or respond without reflection or hesitation, and can be indicated by labile or quickly changing behavior or shifts in attention. At the extreme end, it is evident in acting without consideration for potential danger or negative consequences for one's behavior. At the low end, this variable reflects a planful and deliberate approach towards play and interaction. Keep developmental considerations in mind – young children are less capable of inhibiting dominant behavior in engaging in reflection than are older children or adults.

0 = not at all impulsive – child never behaves in an impulsive manner; does not act without reflection or hesitation; child's behavior is consistently highly controlled and deliberate
1 = some instances of impulsivity – child occasionally engages in impulsive activity, but typically his/her behavior is well-controlled or reflective
2 = moderate or high impulsivity – the child engages in impulsive activity on several occasions; lack of inhibitory control or reflection is clearly present on at least 1 occasion

Episode start time: Episode stop time: Total time (secs):

Episode:

Subj No	
Coder	
Date	

Positive affect	***Low***	***Mod***	***High***	**Overall score**
Facial PA				
Vocal PA				
Bodily PA				
Negative affect	***Low***	***Mod***	***High***	
Facial fear				
Facial sadness				
Facial anger				
Vocal fear				
Vocal sadness				
Vocal anger				
Bodily fear				
Bodily sadness				
Bodily anger				
Behavioral ratings	***Low***	***Mod***	***High***	
Interest/engagement				
Activity level/vigor				
Anticipatory PA				
Initiative vs. passivity				
Compliance				
Sociability				
Impulsivity				

Appendix C: Parent-child interaction tasks coding manual and record form

Note: This coding system is derived from the Teaching Tasks coding manual and Qualitative Ratings for Parent-Child Interactions (Weinfield, Egeland, & Ogawa, 1998; Cox & Crnic, 2003).

CODING RATING SCALES

There are seven rating scales that focus on parent behaviour. The scales are:

Parent Sensitivity/Responsivity
Parent Detachment
Parent Supportive Presence
Parent Intrusiveness
Parent Hostility
Parent Quality of Instruction
Parent Confidence
Parent Positive Affectivity
Parent Negative Affectivity

Each scale is presented here, containing an initial description of the goals of the scale and a description of each rating point.

Parent Sensitivity/Responsivity: This scale focuses on how the parent observes and responds to their child's social gestures, expressions, and signals as well as how they respond to child negative affect. The key defining characteristic of a sensitive interaction is that it is child-centered. The sensitive parent is tuned to and manifests awareness of the child's needs, moods, interests, and capabilities, and allows this awareness to guide his/her interaction. A sensitive parent provides stimulation that is appropriate to the situation. He/she provides the child with contingent vocal stimulation and acknowledges the child's interest, efforts, affect, and accomplishments. A sensitive parent can spend time just watching the child but the difference between them and a detached parent is that the sensitive parent seems to be actively taking an interest in the child's activities, as evidenced by comments and embellishments when the child loses interest. A sensitive interaction is well timed and paced to the child's responses, a function of its child-centered nature. Such an interaction appears to be "in sync". The parent paces toys and games to keep the child interested and engaged, but also allows the child to disengage and independently explore the toys. Some markers of sensitivity include: (a) acknowledging the child's affect; (b) contingent vocalizations by the parent; (c) appropriate attention focusing; (d) evidence of good timing paced to the child's interest and arousal level; (e) picking up on the child's interest in toys or games; (f) shared positive affect; (g) encouragement of child's efforts; (h) providing an appropriate level of stimulation when needed; and (i) sitting on floor or low seat, at child's level to interact.

1. **No Sensitivity.** There are almost no signs of parent sensitivity. Thus, the parent is either predominantly intrusive or detached. The parent rarely responds appropriately to the child's cues, and does not manifest awareness of the child's needs. Interactions are characteristically ill-timed or inappropriate. A parent who typically appears oblivious or punitive to the child's needs and affect would receive this score.
2. **Very Low**. This score would be given to parents who display weak or infrequent signs of sensitivity/responsiveness. While the parent is sometimes sensitive, the balance is clearly in the direction of insensitivity. The parent may give some delayed or perfunctory responses to cues from the child but the parent clearly appears more unresponsive than responsive.
3. **Low.** This rating should be given to parents who display some clear instances of sensitive responding. The parent can be characterized as sensitive to the child; however, the parent's behaviors may be mechanical in quality and ill-paced. The interaction can be characterized by a mixture of well-timed and faster paced episodes, or by a parent who is trying to be sensitive, but the interaction has signs of insensitivity. This rating may also be given to parents who are trying to interact appropriately with their child but he/she may appear not to know what to do. The parent is inconsistently sensitive and hard to categorize.
4. **Moderate**. This rating should be given to parents who are predominantly sensitive/responsive. The parent demonstrated sensitivity in most interactions but may neglect to give a fuller response or a well-timed, appropriate response. Some of the parent's responses are mixed, i.e. some are half-hearted or perfunctory, but the majority are full responses.
5. **High**. The rating should be given to parents who are exceptionally sensitive and responsive. Instances of sensitivity are rare and never striking. Interactions are characteristically well-timed and appropriate. Overall, most responses are prompt, appropriate, and effective.

Detachment/Disengagement: The detached parent appears emotionally uninvolved or disengaged and unaware of the child's needs. This parent does not react contingently to the child's vocalizations or actions, and does not provide the "scaffolding" needed for the child to explore objects in novel ways. Detached parents either miss or ignore the child's cues for help with toys and games, and their timing is out of synchrony with the child's affect and responses (although not the overwhelming barrage of stimulation that intrusive parents present). Simply allowing the child to play by him/herself is not necessarily a sure sign of detachment; this can be appropriate at times, such as when the child is playing happily or contentedly and the parent checks in with the child visually. The detached parent will remain disengaged even when the child makes a bid for interaction with the parent. The detached parent is passive and lacks the emotional involvement and alertness that characterizes a sensitive parent. He/she appears uninterested in the child. There may be a "babysitter-like" quality to the interaction in that the parent appears to be somewhat attentive to the child, but behaves in an impersonal or perfunctory manner that fails to convey an emotional connection between the parent and the child. Other parents may demonstrate a performance-orientation in that the interaction is tailored towards performing for the camera rather than reacting to and facilitating child-centered behavior.

1. **Not Detached**. This rating should be given to parents who display almost no signs of detachment or under involvement. When interacting with the child, the parent is clearly emotionally involved. These parents can be sensitive or intrusive.

2. **Minimal Detachment**. This rating should be given to parents who display minimal signs of detachment. While they are clearly emotionally involved with the child during most of the interaction, there may be brief periods of detachment.

3. **Somewhat Detached**. This rating should be given to parents who remain involved and interested in the child while at the same time demonstrating the tendency to act in an uninterested, detached or perfunctory manner. Parents alternate between periods of engagement and disengagement. The periods of disengagement may be marked by unemotional or impersonal behavior. There may be a low-level of impersonal/unemotional behavior running throughout the interaction.

4. **Moderately Detached**. This rating should be given to parents who are predominantly detached. While there may be periods of engagement, the interaction is characterized chiefly by disengagement. The parent may be passive and fail to initiate interactions with the child. When interactions do occur, they may be marked by an impersonal, perfunctory style. Parent may show a lack of emotional engagement throughout the interaction

5. **Highly Detached**. This rating should be given to parents who are extremely detached. The child plays without parent attention almost all of the time, even when the parent is within a suitable distance for interacting. In the minimal instances of involvement, the parent's behaviors are simple, mechanical, stereotyped, bland, repetitive, and perfunctory. The parent is clearly not emotionally involved with the child, and appears to be "just going through the motions".

Parent Supportive Presence: A parent scoring high on this scale expresses positive regard and emotional support to the child. This may occur by acknowledging the child's accomplishments on task the child is doing (e.g. building a house of blocks), encouraging the child with positive emotional regard (e.g. "You're really good at this"/"You got another one right") and various other ways of letting the child know that he/she has their support and confidence to do well in the setting (e.g. positive reassuring voice tone). If the child is having difficulty with a task, the parent is reassuring and calm, providing an affectively positive "secure base" for the child, perhaps leaning closer to the child to give a physical sense of support. A parent scoring low on this scale fails to provide supportive cues. They might be passive, uninvolved, aloof, or otherwise unavailable to the child. Such a parent also might give observers the impression that they are more concerned about their own adequacy in the setting than their child's emotional needs. A potential difficulty in scoring this scale is to discount messages by the parents that seemingly are supportive in verbal content but are contradicted by other aspects of the communication (e.g., the parent seems to be performing a supportive role for the camera and not really engaged in what the child is doing or feeling). Signs of such questionable support are improper timing of support, mismatch of verbal and bodily cues, and failure to have the child's

attention in delivering the message. These types of supportive messages would not be weighted highly because such features suggest that supportive presence is not a well practiced aspect of their interaction outside the laboratory setting.

1. Parent completely fails to be supportive to the child, either being aloof and unavailable or being hostile toward the child when the child shows need of some support.

2. Parent provides very little emotional support to the child. Whatever supportive presence is displayed is minimal and not timed well, either being given when the child does not really need it, or only after the child has become upset.

3. Parent gives some support but it is sporadic and poorly timed to the child's needs. The consistency of this support is uneven so as to make the mother unreliable as a supportive presence.

4. This parent does a respectable job of being available when their child needs support. The parent may lean closer as the child shows small signs of frustration and praise the child's efforts to show that they are available and supportive, but inconsistency in this style makes support unreliable or unavailable at crucial times in the session.

5. The parent provides good support, reassurance and confidence in the child's ability, but falters in this at times when the child especially could use more support. Or, parent is universally supportive but gives no evidence of modulation to the child's needs.

6. Parent establishes him/herself as supportive and encouraging toward the child and continues to provide support when the child needs it. As the child experiences more difficulty, parent support increases in commensurate fashion. The parent has some lapses, however, in which the child's performance wavers for lack of support. Yet, they redouble support and attempt to return the child to a level of confidence that is more optimal.

7. Parent skillfully provides support throughout the session. Parent sets up the situation from the beginning as one in which they are confident of the child's efforts. Parent may reject inadequate solutions to problems in a way that does not reduce their support and confidence in the child's ability to get the correct solution. If the child is having difficulty, the parent finds ways to encourage whatever solution the child can make. Parent not only is emotionally supportive but continuously reinforces the child's success.

Parent Intrusiveness: A parent scoring high on this scale lacks respect for the child as an individual and fails to understand and recognize the child's effort to gain autonomy and self-awareness. This parent interferes with the child's needs, desires and interests or actual behaviors. The parent's behavior is guided more by their own agenda rather than the child's needs. Reasonable or appropriate limit setting or directing the child's behavior to the task may be

intrusive, depending on the content of the parent's involvement. Setting limits is crucial to the socialization process at this age, and giving the child directives is part of many tasks. **But behaviors are intrusive if they indicate a lack of respect for the child**. Intrusiveness can occur in a harsh physical manner (parent grabbing the child's arms or hands and placing them somewhere else), or with affection (**inappropriate** contact which interferes with the child's efforts, such as kissing, hugging, etc.), or if the parent does not allow the child autonomy in problem-solving tasks (imposes directions and does not allow opportunities for self-directed efforts). It is important that intrusiveness be evaluated from the perspective of the child. Look at cues from the child preceding or after the parent's behavior to see how the child has perceived the parent's action; and what may seem as intrusive to the coders, may not be to the child (e.g., if fast-paced stimulation from the parent is enjoyed by the child, as shown by smiles or laughter, parental behavior that would otherwise be judged as intrusive will not be counted as such. However, because this judgment is highly subjective, this aspect should not carry a lot of weight when coding, but attention to context is important.)

1. **No Intrusiveness**: No sign of intrusiveness. The parent may be involved yet continues to respect the child's needs, or may alternatively be totally uninvolved with the child and appear withdrawn. In either case, the parent does not impose directives on the child unless it is clear that the child needs direction. If directives are given, it is in a manner showing respect for the child.

2. **Very Low**: The parent may show subtle signs of being intrusive, i.e. stepping in to help before the child demonstrates need, but the child does not perceive these as intrusive and does not appear to become upset by them.

3. **Moderately Low**: There is some indication of intrusiveness but it is not pervasive. These instances are of low intensity and again may not cause the child to become upset. For example, the parent may redirect the child to a new toy/task in a poorly timed fashion. Alternatively, low level intrusiveness may be "chronic"; however, the child has the opportunity to do some exploration.

4. **Moderate**: Clear signs of intrusiveness and/or a feeling of intrusiveness that is easily or clearly picked up by the coders, but parent still allows the child periods of exploration or autonomy. The instances of intrusiveness are generally of low intensity (i.e. the parent provides new instruction before the child has had a chance to complete the last task), yet there may be one high level act at an inappropriate time or there may be an episode of rough physical handling.

5. **Moderately High**: Clear signs that parent does not respect the child's needs and interests. There may be a couple high intensity, or several low level intrusive interactions. E.g., parent may often grab objects from the child, issue directives with no regard for child's response, or do much of the task for the child. However, parent may allow the child **some periods of exploration or autonomy**.

6. **High**: Clear incidents of intrusiveness throughout the session, and the parent's agenda clearly has precedence over the child's needs and interests. There may be either several

high intensity intrusive interactions or persistent low level intrusive interactions. E.g., the parent may grab the child and physically direct behaviour more than once, or the parent may be uninvolved for long periods, **but whenever they do interact, these interactions are consistently intrusive**. **Parent also allows for less autonomy than exhibited in #5.**

7. **Very High**: A highly intrusive parent's agenda clearly has precedence over the child's wishes. Parent frequently intervenes inappropriately without cues from the child, and seems to react to his/her own schedule rather than basing actions upon the child's needs. Frequent high level indicators (i.e. takes stimulus out of child's hands, no regard for what child wants to do, more than in #6) are pervasive throughout the session (i.e. parent appears to be doing task him/herself). May show assertive techniques to get the child to comply with their wishes; these can be either verbal or physical incidents of intrusiveness.

Parent Hostility: This scale reflects the parent's expression of anger, frustration, annoyance, discounting or rejecting of the child. A parent scoring high on this scale would clearly and openly reject the child, blame him or her for mistakes, and otherwise make explicit the message that they do not support the child emotionally. A parent scoring low on this scale may be either supportive or cold and show some expressions of anger, frustration, or annoyance, but they do not blame or reject the child. A rejecting parent may also show some Supportive Presence (and the inconsistency of their behavior would be revealed by these two scores). Given the low frequency and the clinical relevance of rejecting one's child during a videotaped session, any events which are clearly hostile should be weighted strongly in this score.

1. **Very low**: Parent shows no signs of anger, annoyance, frustration, or rejection. They may or may not be supportive, but they do not try to put down the child or avoid the child in rejecting ways. Passive or emotionally uninvolved parents would be included here if the parent did not reject the child or communicate hostility toward the child.

2. **Low:** This parent did one or two things that seemed to communicate a little hostility (i.e. anger, frustration, annoyance) toward the child. These messages were not overt but rather muted expressions toward the child (e.g., pulling away something with a jerk, putting hand on their hip to show exasperation, giving a negative look at the child briefly, having an exasperated tone of voice, parroting or mimicking the child in a negative fashion).

3. **Moderately low:** Signs of hostility again are very fleeting, but they occurred on several occasions during the session, and at least one sign could be identified as clear and overt or an accumulating sense of unexpressed anger and avoidance toward the child was seen in the parent's behavior.

4. **Moderate**: Several instances of hostile or rejecting behaviors. Two or more of these events are reliably clear to observers, but expressions are brief and do not set the tone of parent's interactions immediately following the episodes.

5. **Moderately high**: parent is overtly rejecting or hostile several times. Behaviors include overt and clearly communicated rejections of child and expressions of hostility or anger

which appear intermittently through substantial periods of the session. This parent's behavior is more rejecting than not, either by the frequency of hostile behavior or by the potency by which rejection is communicated several times in the session.

6. **High**: This parent has frequent expressions of rejection and hostility directed toward the child. There is little or no effort to show warmth during substantial portions of the session, especially after parent becomes irritated with the child (i.e., parent may initially be warm and then rejects the child strongly). Parent is frankly and directly rejecting and hostile (e.g., telling child they will leave him/her behind if he/she does not do the task/play with the toy, using negative performance feedback but little positive feedback, blaming the child for incompetence on the tasks, and overtly refusing to recognize the child's success, e.g., "You couldn't have done it without me showing you!"). Any warmth seems superficial relative to the parent's distancing from the child, and rejection is used as a control technique against the child.

7. **Very high**: This parent shows characteristics of the previous scale point, but expressions of anger toward the child also are accompanied by strong, barely controlled emotions, suggesting the possibility of physical abuse and neglect of the child in some situations.

Parent Quality of Instruction: The important features of this rating are how well the parent structures the situation so that the child knows what the task objectives are and receives hints or corrections while solving the problems that are: (a) timely to his/her current focus, (b) paced at a rate that allows comprehension and use of each hint, (c) graded in logical steps that the child can understand, and (d) stated clearly without unnecessary digressions to unrelated phenomena or aspects of the task that might only confuse the child. The parent's approach suggests that they have some sort of plan for how their instructions will help the child. Yet, the parent is also flexible in their approach and uses alternative strategies or rephrases suggestions when a particular cue is not working, and they coordinate their suggestions to the effort that the child is making to solve the task. **See attached list for a more complete description of the components of quality instruction.**

1. The parent's instructions are uniformly of poor quality. They either are totally uninvolved or fail to structure the tasks so that the child understands what is required, and the parent gives clues that are of no help to the child's problem-solving efforts and appear to embody no effective plan of teaching.

2. Parent occasionally gives effective instruction. Parent may be able to structure the tasks so that the child understands what to do and gives a few helpful hints to the child, but these are minimal compared to the ineffectiveness of most of their attempts or lack of attempts.

3. Parent effectively structures some portions of the tasks and provides good hints, but their assistance is inadequate for much of the session.

4. Parent provides adequate structure and instruction for the child to work on the tasks

during much of the session, but overall their instruction is lacking in major ways at several points during the session. Alternatively, the parent may approach tasks in a way that is very structured but requires the child to attend primarily to their directives and allows little opportunity for the child to engage the tasks directly (i.e., the parent therefore does not have to coordinate their teaching to the child's efforts); **the result is that the child does not gain a sense of competence in performing the tasks.**

5. Parent generally provides instruction that is sufficient and appropriate, but there are some periods in which it is inadequate in amount or quality. Alternatively, the parent may approach tasks in a way that is very structured but requires the child to attend primarily to their directives and allows little opportunity for the child to engage the task directly (i.e., the parent therefore does not have to coordinate their teaching to the child's efforts); **yet, despite their directiveness, child still gains a sense of competence**.

6. Parent's instruction demonstrates **most** of the desirable features for this rating and in general the parent appears to provide good help throughout the session.

7. Parent demonstrates **almost all** the characteristics of effective instruction consistently throughout the session. The tasks are sufficiently structured so that the child understands the objectives and can attempt to solve the problems directly. Parent's assistance coordinated to the child's activity and needs for assistance.

Components of Quality of Instruction

-obtains child's attention
-explains the goal of the task in a developmentally appropriate manner
-provides instructions which are contingent upon the child's previous action (e.g., child picks up a block; parent then tells child to find one that looks the same)
-structures the task into logical steps
-has a range of strategies which they can apply in response to the child's actions
-changes strategies when the current one is not working and does so in a timely manner
-provides appropriate feedback (e.g., okay, that's it, try again)
-uses developmentally appropriate language that their child can understand
-times their instructions based on child's actions; does not present instructions too quickly (while child is still working on previous step) or too slowly (long after the child first shows indications of needing help)
-persists despite difficulties; does not give up

Parent Confidence: Degree to which the parent seems to believe that they can work successfully with the child in the situation and that the child will behave appropriately (whether this is more or less task oriented depends on parent's definition of the situation as a social or achievement oriented activity).

1. **Mostly unconfident**: The parent is uncertain in interactions with their child, being either unduly tentative, restricting, or appeasing (or a combination of these behaviors). Signs of a lack of confidence include doing the tasks for the child, appeasing the child by letting

him do what he wants, overkill with strong reinforcement, showing clear signs of relief when the tasks go successfully, periodic checking with the experimenter to see if they are "doing it right", apologizing for behavior, and/or anxious laughter and giggling in response to their own or their child's efforts. There may be a sense that they are trying to deal with problem situations by using such tactics that distract from the issue rather than dealing with it directly. Alternatively, a parent may not show tentativeness, but be overly power assertive/ intrusive /grabby in their attempts to control her child's behavior.

2. **Somewhat unconfident**: Parent seems fairly confident that they can interact with the child in ways that will be satisfactory; however they do show some evidence of hesitancy or appeasement or anxiety in making requests of the child. A few signs of a lack of confidence (as described above in 1) may be present but are not pervasive and do not persist throughout the session.

3. **Mostly confident**: Parent is quite confident that their interactions with the child will proceed in an acceptable manner and that they need not take special precautions to ensure this. Parent seems relaxed about interacting with their child and seems to believe that they could deal adequately with any problems that might arise. Parent trusts in their instincts and skills as a parent (whether or not we as coders believe that they should!).

Parent Positive Affectivity: This scale is a measure of the frequency and intensity of the parent's expression of positive affect (PA). Positive affect includes facial, vocal, and bodily components. A high score on this scale may be obtained even if the parent expresses negative affect in the session.

1. **Low Parent PA:** Parent shows very little or no positive affect throughout entire session. Examples of low parent PA include lack of smiling, low energy, and subdued/ blunted/ flat affect.

2. **Moderate Parent PA**: Parent exhibits a few instances of positive affect (i.e. slight smiles). The majority of the PA displayed is of low intensity; however, there may be clear, but few, instances of moderate/high intensity PA (i.e. laughing, hugging the child). These elements are only minor elements of the session and are not expressed frequently or consistently.

3. **High Parent PA**: Parent clearly expresses PA at a level that is more intense and frequent than in #2. Parent appears energetic and engaged. Parent may display frequent low level instances of PA (i.e. contentment, smiling), but also displays several high level instances of PA.

Parent Negative Affectivity: This scale is a measure of the frequency and intensity of the parent's expression of negative affect (NA). Negative affect includes facial, vocal, and bodily components. A high score on this scale may be obtained even if the parent expresses positive affect in the session.

1. **Low Parent NA**: Parent shows very little or no negative affect throughout entire session. Examples of low parent NA include lack of irritability, frustration, or any other form of NA (i.e. anger, sadness, fear).

2. **Moderate Parent NA**: Parent exhibits a few instances of negative affect. The majority of the NA displayed is of low intensity (i.e. slightly negative tone of voice). These elements are only minor elements of the session and are not expressed frequently or consistently.

3. **High Parent NA**: Parent either expresses (1) consistent low levels of NA throughout session, or (2) at least two clear instances of NA that are of greater intensity than in #2 (i.e. shouts at child, grabs child).

Scoring Sheet for Parent-Child Interaction Tasks Coding

Start time: Stop time: .

Coder Initials: Date: .

Behavior	Notes/Comments	Score
Parent Sensitivity/Responsiveness		
Parent Detachment		
Parent Supportive Presence		
Parent Intrusiveness		
Parent Hostility		
Parent Quality of Instruction **(code for puzzles with parent task only)**		
Parent Confidence		
Parent Positive Affectivity		
Parent Negative Affectivity		

Appendix D: Age 5 behavioural inhibition tasks coding manual and record forms

Exploring New Objects

Part I, Phase I: Latency to First Touch Objects, First Verbalization, and First Fear Response

Start Time: As soon as experimenter says, "I will be back in a few minutes" or equivalent.

Stop Time: When experimenter returns to the room.

Was Object Touched:

0 = no (child did not touch object)
1 = yes (child touched object)

Latency to First Touch: record the time in seconds between the start time and the time when each object is **first** intentionally touched (don't code subsequent "touches"). Record the latency only for the first time each object is touched. **Enter a score of 9999 for latency for objects that the child does not touch.** Objects must be intentionally (not accidentally) touched. Distinguish between the child touching the cloth and the skull in your coding (i.e., do not count touching the cloth as touching the skull).

Tentativeness: rate the extent to which the child exhibits tentativeness in his or her touching of the object using the following scale:

9999 = child does not touch object
0 = child is not tentative or hesitant at all in touching object; no examination prior to touching object
1 = *some tentativeness* exhibited; child may delay slightly before touching objects hesitantly
2 = child is *clearly tentative, hesitant, and/or slow in touching the object*, or child's hand may dart out and withdraw quickly

Number of Objects Touched: Record the total number of objects touched during the episode. Objects must be intentionally (not accidentally) touched.

Counter Times: Enter the counter time at which the relevant behavior occurs. If no such behavior occurs, enter '9999'.

Latency to First Definite Verbalization: Record the counter time at which the child makes his first verbalization (note that short words such as "hmmmm…,""ugh," or "ewwww!" count as verbalizations, but giggling or grunting do not). To calculate latency, subtract the start time from this counter time. Enter a score of **9999 seconds** if no verbalizations are made. Remember, only verbalizations made **after** the experimenter leaves the room are coded in calculating latency.

Don't count responses made to experimenter as she leaves (e.g., "Okay!" or "Bye!"). Note that if the child is never left alone, no first verbalization is coded as having occurred.

Latency to First Definite Fear Response: Code the time in seconds from when the experimenter leaves the room until the child first displays a clear fear response. Consider facial, vocal, and bodily (i.e., postural fear and stilling/freezing) behaviors reflecting fear. These would usually need to be of at least moderate intensity to be considered a clear fear response (coded as a 2 or higher, see affect example list). Enter a score of **9999 seconds** if no fear response occurs.

Part I, Phase I: Time Playing

Each epoch is 10 seconds in duration.

Scoring guidelines*:* Check off each object that the child plays with during each 10-second epoch. More than one object may be checked off for each epoch. Physical contact with objects must generally occur in order for a behavior to be considered "playing". If the experimenter returns early, draw a line through epochs so it is clear that the child was not given this time to play.

Examples of playing:

(a) Skull = child handles the skull.
(b) Cloth = child handles the cloth.
(c) Worm Box = child sticks hands in worm box or otherwise touches worm box
(d) Tunnel/Tent = child's body is at least partially inside the tent or tunnel; or child deliberately shakes, grabs or rolls tent/tunnel.
(e) Heart Box = child reaches inside opening, pokes at the heart/box, picks up the heart/box, or otherwise plays with the heart/box
(f) Spider = child playfully touches the spider or rolls it.

Part I, Phase II: Experimenter Returns and Requests Child to Touch Each Object

Compliance:

0 = no (child did not touch object)
1 = yes (child touched object

Latency to Touch: If child complies, record the time in seconds, from the time the experimenter first asks the child to touch the object (end of sentence/request) until the child physically touches the object or participates in the requested activity (e.g., crawls through the tunnel). If child grabs object before experimenter requests him/her to touch it, code compliance as '1' and latency as '0.' If child refuses to touch an object, judge whether this is due to clear oppositionality or fear. If due to fear (the most common reason for refusal) code **30 seconds** as the score for latency. If due to oppositionality, code '**9999'**

Tentativeness: rate the extent to which the child exhibits tentativeness in his or her touching of the object using the following scale:

9999 = child refuses to touch object out of noncompliance; may have previously touched object but still refuses experimenter's request
0 = child is not tentative or hesitant at all in touching object; no examination prior to touching object
1 = *some tentativeness* exhibited; child may delay slightly before touching objects in a hesitant manner
2 = child is *clearly tentative, hesitant, and/or slow in touching the object*, or child's hand may dart out and withdraw quickly
3 = child *refuses to touch object* due to fear

Counter Times: Enter the counter time at which the relevant behavior occurs. If no such behavior occurs, enter '9999'.

Part II – Microcoding

Each epoch is 20 seconds in duration.

Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch.
0 = no facial region shows codeable fear movement
1 = fear expression is *ambiguou*s or is of *low intensity*; fear is evident in only one facial region (i.e., brows raised in distress)
2 = fear expression is *definitely* present in *1 facial region* (i.e., brows raised and drawn together, upper eyelids raised)
3 = fear expression is *definitely* present in *both facial regions* (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Angry Affect: rate the peak intensity of angry facial affect that occurs during the epoch
0 = NO facial region shows codeable facial anger movement
1 = anger expression is *ambiguous*, of *low intensity*; expression is present only in 1 facial region (i.e., furrowed brows, narrowed eyes, or tense/squarish mouth)
2 = anger expression is *definitely* present in *1 facial region* (i.e., furrowed brows, or tense/squarish mouth)
3 = anger expression is *definitely* present in *both facial regions* (i.e., furrowed brows, narrowed eyes, and angular/tense mouth)

Sad Affect: code the highest intensity sad affect that occurs during the epoch
0 = NO facial region shows codeable sadness movement
1 = expression of sadness is *ambiguous* or *fleeting*; expression is present only in one facial region (e.g., droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows)
2 = expression of sadness is *definitely* present in *1 facial region* (definitely downturned mouth or definite raising of inner corners of eyebrows)
3 = expression is *definitely* present in *both facial regions* (both definitely downturned mouth *and* definite raising of inner corners of eyebrows)

Postural Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness
1 = child's body reflects *low intensity* fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.)
2 = child's body reflects *moderate intensity* fear or weariness intensity **or the display lasts a majority of the epoch** (e.g. slight defensive body posture; fearful tension)
3 = child's body reflects *high intensity* fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Still/Freezing: enter the total duration of stilling/freezing (in seconds). Duration of freezing is defined as a marked decrease in activity (**>2 secs**) with little or no movement, with or without any indication of muscular tension.

Tentative play: rate the peak intensity of hesitancy the child exhibits during the epoch; hesitancy is reflected by both wariness and physical cautiousness. Take into account the level of boldness vs. inhibition in the child's play, particularly the manner of their approach towards objects and the quality of their play with the objects

0 = no hesitancy; child readily engages in play with objects with no pauses to examine objects, AND expresses no wariness when in contact with objects -- child plays boldly
1 = slight hesitancy; child examines object or pauses briefly (i.e., 2-5 secs) before playing with it, but then does not express wariness while in contact with the object
2 = moderate hesitancy, as indicated by any of the following: child pauses 6 or more secs before playing with an object, or expresses wariness while in contact with the object, or clearly avoids an object
3 = extreme hesitancy; child does not explore or touch objects at all, but may look at or point to objects

Fearful/Wary Questions/Comments: any comments or questions that indicate fear (taking into account both tone of voice and content), such as: "I don't like this", "That is scary".

0 = child did not make an utterance of this kind during the epoch
1 = child makes a low intensity fear or wariness verbalization
2 = child makes a moderate/high intensity fear or wariness verbalization

Amount of time talking: the overall amount/duration of verbalizations made by the child

0 = child does not speak
1 = child makes a brief utterance (e.g., "ooh"/"Ah", incomplete sentences)
2 = child makes an extended/complete utterance (e.g., child states a full sentence)

Time spent playing: degree to which the child engaged in purposeful manipulation, exploration, or symbolic interaction (e.g., talking to an object) with the objects

0 = child did not play with any toys during the epoch
1 = child played with toys for less than half of the epoch

2 = child played with toys for more than half of the epoch
3 = child played with the toys for the entire epoch

References experimenter: the peak/max degree to which child references experimenter, if the experimenter is present, before complying with the request; should clearly reflect wariness/fear, rather than merely noncompliance

0 = child does NOT comment to or glance toward the experimenter in a timid manner before complying
1 = child questions the experimenter regarding the request before complying, or clearly looks again at the experimenter before complying (even though it is obvious they understand the request); child obviously seems timid about or is reluctant to engage in the requested behavior
9999 = experimenter is not present during the epoch

Exploring New Objects
Part I – Latencies and Counter Times

Subj No.	
Coder Initials	
Date coded (MM/DD/YYYY)	

PHASE I

START TIME (when exp. says "*I'll be back in a few minutes*"):_____

END TIME (when experimenter returns): _____

OBJECT	OBJECT TOUCHED?	COUNTER TIME AT FIRST TOUCH	LATENCY TO FIRST TOUCH (SECS)	TENTATIVENESS
1. TUNNEL/TENT				
2. CLOTH				
3. SKULL				
4. WORM BOX				
5. HEART BOX				
6. SPIDER				

NUMBER OF OBJECTS TOUCHED: _____

COUNTER TIME AT FIRST DEFINITE VERBALIZATION: _____

COUNTER TIME AT FIRST DEFINITE FEAR RESPONSE: _____

BEHAVIOR	LATENCY (SECS)
FIRST DEFINITE VERBALIZATION	
FIRST DEFINITE FEAR RESPONSE	

START TIME: As soon as experimenter says, “I will be back in a few minutes” or equivalent.
END TIME: When experimenter returns.

TIME PLAYING:

Counter time:																						
1. TUNNEL/ TENT																						
2. CLOTH																						
3. WORM BOX																						
4. HEART BOX																						
5. SKULL																						
6. SPIDER																						
Counter time cont’d:																						
1. TUNNEL/ TENT																						
2. CLOTH																						
3. WORM BOX																						
4. HEART BOX																						
5. SKULL																						
6. SPIDER																						

Exploring New Objects
Part I – Latencies and Counter Times

Subj No.	
Coder Initials	
Date coded (MM/DD/YYYY)	

PHASE II
START TIME (when experimenter returns): _____

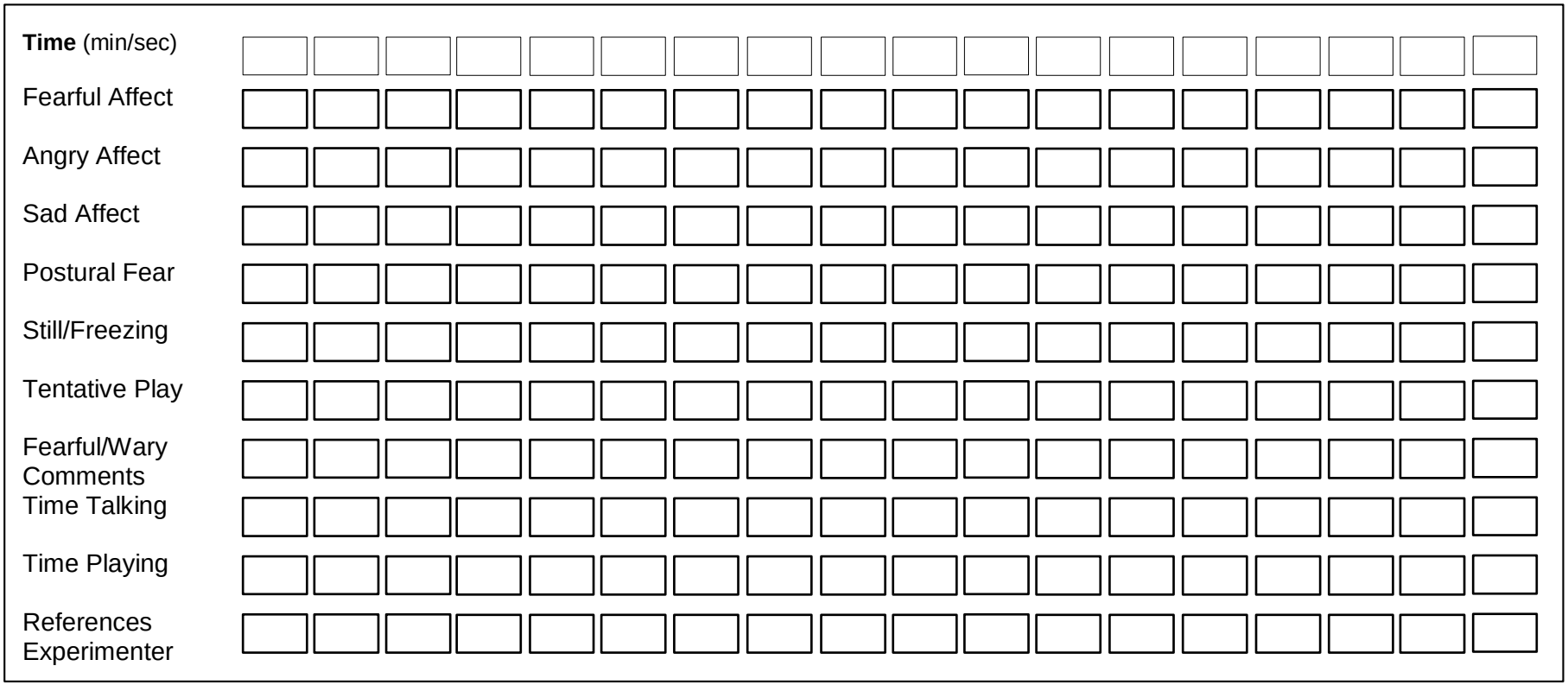
END TIME (when experimenter and child leave the room): _____

COMPLIANCE WITH EXPERIMENTER'S REQUEST TO TOUCH:

OBJECT	COMPLIANCE	LATENCY (SEC)	TENTATIVENESS
1. TUNNEL/TENT			
2. CLOTH			
3. SKULL			
4. WORM BOX			
5. HEART BOX			
6. SPIDER			

Exploring New Objects
Part II – Microcoding

Epochs are 20 sec in duration



Friendly Stranger

Part I – Counter Times and Latencies

Start Time: enter the counter time at which the stranger knocks on the door.

Stop Time: enter the counter time when the child leaves the room.

First Definite Fear Response: enter the counter time at which the child *first initiates* a definite fear response (coded as a **2 or higher**). Enter '9999' if no relevant behaviors occur.

Latency to First Definite Fear Response: calculate the time in seconds between when the stranger *enters* the room until the child first *initiates* a *clear* fear response. Consider facial, vocal, and bodily behaviors reflecting fear; this includes stilling/freezing. These would generally need to be of **at least moderate intensity** (2 or higher) to be considered a clear fear response (see affect example list). If the child never exhibits a fear response, assign a score of **9999 seconds**.

Time at Stranger Comment: For each statement made by the stranger, note the counter time at which the stranger is *finished talking*.

Time at Child Response: After each comment made by the stranger, note the counter time at which the child *initiates* a response. Responses can include nonverbal behaviors (e.g. nodding). Enter '9999' if no relevant behaviors occur.

Latency to Respond to Stranger: for each comment made by the stranger, calculate the time in seconds between when the stranger *stops* speaking and when the child *initiates* a response. Assign a score of **9999 seconds** if the child does not respond.

Quality of Responses to Stranger: rate the quality of the child's response to each of the stranger's queries. Be alert for pauses in the child's response in assigning ratings (e.g., a child who responds initially with one word, but then elaborates after a few seconds would be assigned a score of '2').

0 = child does not respond to stranger's query
1 = child provides a brief, one-word, or otherwise minimal response to the stranger's query (e.g. only nonverbal responses)
2 = child provides a lengthy (i.e., > 1 word) response to the stranger's query, or responds briefly but then continues to converse with the stranger on another topic

Attempts to Engage Stranger in Play: code whether the child provides the stranger with a clear invitation to join them or play with the toy. This behavior most often occurs in response to the stranger's request to play, but should be coded as present if it occurs at any time when the child and stranger are alone.

0 = child does not engage stranger in play at all. Child either does not answer stranger's request to play or refuses to play with stranger (e.g., says "no").
1 = child engages the stranger in play. This includes overt verbal behaviors (e.g., "You

can play with this,") as well as handing the stranger a toy, or other behaviors clearly intended to include the stranger in play. Also include hesitant or ambiguous attempts to engage in play (e.g., child says "yes" or "maybe" in response to stranger's request to play but does not offer stranger a toy).

First Attempt to Engage in Play: enter the counter time at which the child first *clearly* attempts to engage the stranger in play. Enter '9999' if no relevant behavior occurs.

Latency to Engage in Play: calculate the time in seconds from when the stranger enters the room until the child **initiates** an attempt to engage the stranger in play. If the child never attempts to engage the stranger in play, assign a score of **9999 seconds**.

Part II – Micro Coding

Each epoch is 20 seconds in length. If the final epoch is less than 10 seconds, do not code that epoch; change the "Stop Time" to the counter time associated with the start of that last, uncoded epoch.

Note: Only Approach, Avoidance, Gaze Aversion, and Verbal/Nonverbal Interaction pertain exclusively to the child's interaction with the stranger. All other codes apply regardless of the context.

Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch.

0 = no facial region shows codeable fear movement
1 = fear expression is *ambiguou*s or is of *low intensity*; fear is evident in only one facial region (i.e., brows raised in distress)
2 = fear expression is *definitely* present in *1 facial region* (i.e., brows raised and drawn together, upper eyelids raised)
3 = fear expression is *definitely* present in *both facial regions* (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Postural Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness
1 = child's body reflects *low intensity* fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.)
2 = child's body reflects *moderate intensity* fear or weariness intensity **or the display lasts a majority of the epoch** (e.g. slight defensive body posture; fearful tension)
3 = child's body reflects *high intensity* fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Still/Freezing: enter the total duration of stilling/freezing (in seconds). Duration of freezing is defined as a marked decrease in activity (**>2 secs**) with little or no movement, with or without any indication of muscular tension.

Distress Vocalizations: rate the peak intensity of distress vocalizations that occur during the epoch.

0 = NO distress vocalizations
1 = mild distress vocalizations that are *ambiguous* in nature
2 = distress vocalizations that indicate *some fear or sadness*, either through the content or intonation, (e.g., "Who are you?", "Where's my mommy?", or nervous laughter)
3 = vocalizations that indicate *clearly fearful or sad* overtones, either through content or intonation (e.g., "don't come closer", "I want my mommy")

Approach: rate the peak intensity of approach behaviors (any behavior initiated by the child to decrease the distance between himself and the stranger). If the child continues to face toward the stranger in subsequent epochs, s/he should continue to be coded a 1 only if the child originally initiated this movement. Include movements toward the stranger made by the child in the course of leaving the room, at the end of the episode.

0 = child exhibits NO approach behaviors
1 = child's body faces toward the stranger
2 = child *hesitantly* approaches the stranger (e.g. slow, wary steps or wary posture)
3 = child approaches the stranger *without hesitation* (e.g. strides boldly to the stranger)

Avoidance: rate the peak intensity of avoidance behaviors (behaviors initiated by the child to maintain or increase the distance between himself and the stranger). If the child is coded a 1 for one epoch, then continues to be turned away during the following epochs, s/he should continue to be coded a 1 only if the child originally initiated this movement. Include movements away from the stranger made by the child in the course of leaving the room, at the end of the episode.

0 = child exhibits NO avoidance behaviours -- child stands in place or approaches the stranger
1 = low avoidance -- child's body faces away from the stranger
2 = moderate avoidance -- child moves *slightly* further away from the stranger
3 = high avoidance -- child moves *much* further away from the stranger, possibly going to the far corner of the room

Gaze Aversion: rate the peak intensity of gaze aversion that occurs during the epoch

0 = NO gaze aversion (consistently makes eye contact with the stranger)
1 = child glances down or away from the stranger in a deliberate attempt to avoid eye contact (i.e., only darting glances toward stranger)
2 = child makes NO eye contact with the stranger at all during the epoch

Verbal/Nonverbal Interaction: the peak quality of the child's verbal responses to the stranger

0 = child does NOT respond to questions or initiate conversation with stranger
1 = child makes neutral or eager responses to questions, either verbally or nonverbally (i.e., nodding in response to a question), but does NOT initiate conversation with the stranger
2 =child initiates conversation with stranger, or elaborates on a response

Angry Affect: rate the peak intensity of angry facial affect that occurs during the epoch

0 = NO facial region shows codeable facial anger movement

1 = anger expression is *ambiguous*, of *low intensity*; expression is present only in 1 facial region (i.e., furrowed brows, narrowed eyes, or tense/squarish mouth)
2 = anger expression is *definitely* present in *1 facial region* (i.e., furrowed brows, or tense/squarish mouth)
3 = anger expression is *definitely* present in *both facial regions* (i.e., furrowed brows, narrowed eyes, and angular/tense mouth)

Sad Affect: code the highest intensity sad affect that occurs during the epoch
0 = NO facial region shows codeable sadness movement
1 = expression of sadness is *ambiguous* or *fleeting*; expression is present only in one facial region (e.g., droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows)
2 = expression of sadness is *definitely* present in *1 facial region* (definitely downturned mouth or definite raising of inner corners of eyebrows)
3 = expression is *definitely* present in *both facial regions* (both definitely downturned mouth *and* definite raising of inner corners of eyebrows)

Attempts to Engage Stranger in Play: rate the peak quality of the child's verbal and behavioral attempts to engage the stranger in play
0 = child makes NO attempts to involve the stranger in play
1 = child initiates play with the stranger either verbally or nonverbally (e.g. gestures to toy, or hands a toy to the stranger), but does so *hesitantly*
2 = child initiates play with the stranger either verbally or nonverbally, *without hesitation or reservation*

Friendly Stranger
Episode # 6

Subj No.	
Coder Initials	
Date coded (MM/DD/YYYY)	

CHILD SEX: Male ○ Female ○

START TIME (when stranger knocks on door): _____

STOP TIME (when child leaves room): _____

Part I – Counter Times and Latencies

TIME AT FIRST DEFINITE FEAR RESPONSE:	
LATENCY TO FIRST DEFINITE FEAR RESPONSE (SECS)	

RESPONSES TO STRANGER:

STATEMENT	TIME AT STRANGER"S COMMENT	TIME AT CHILD'S RESPONSE	LATENCY (SECS) TO RESPOND	QUALITY OF RESPONSE
HAVING A GOOD TIME?				
PLAYING WITH LOTS OF TOYS?				
PLAY TOO. WHAT DO YOU THINK?				

ENGAGES STRANGER IN PLAY?	
TIME AT FIRST ATTEMPT TO ENGAGE IN PLAY	
LATENCY TO ENGAGE IN PLAY (SECS)	

Part II – Micro Coding

Epochs are 20 sec in duration

Time (min/sec)											
Fearful Affect											
Postural Fear											
Still/Freezing											
Vocal Distress											
Approach											
Avoidance											
Gaze Aversion											
Verbal/Nonverbal Interaction											
Angry Affect											
Sad Affect											
Attempts to Engage S in Play											

Object Fear

Part I – Counter Times and Latencies

General Instructions:

Start Time: enter the counter time at which the experimenter finishes saying she is leaving the room.

Stop Time: enter the counter time at which the child leaves the room.

Behavior Occurs: code whether the child performed the behavior.

0 = no (behavior did not occur)
1 = yes (behavior occurred)

Counter Times: record counter time at which behavior was first **initiated**. If no relevant behavior occurred, enter '9999' for counter time.

Latencies: code the time in seconds from when the experimenter finishes saying she is leaving the room until the child **initiates/performs** the relevant behavior **for the first time**. Children who never engage in the relevant behavior should be assigned a score of **9999 seconds**.

Tentativeness: rate the extent to which the child exhibits tentativeness in his or her behavior using the following scale:

0 = child is not tentative or hesitant at all in engaging in behavior
1 = *some tentativeness* exhibited; child may delay slightly before engaging in behavior
2 = child is *clearly tentative, hesitant, and/or slow* in engaging in behavior, or child may perform behavior very rapidly in a fearful manner (e.g., child's hand may dart out and withdraw quickly from carrier)
3 = child does *not* engage in the behavior, *clearly* due to fearfulness

Experimenter Present: code whether the experiment was present in the room when the child performed the behavior.

0 = no (experimenter absent)
1 = yes (experimenter present)
9999 = child never performs behaviour regardless of experimenter's presence

Behavior-Specific Instructions:

First Approaches Pet Carrier: In order for an approach behavior to have occurred, the child's movement must result in the child being a maximum of three feet (i.e., close enough to see inside) from the carrier (e.g., a child who takes two steps from the door toward the carrier but

subsequently stops would not be considered to have approached). Children need not touch or open the pet carrier to be coded as having approached it. If the child has already moved to be within very close proximity of the carrier before the experimenter leaves the room, code as usual and record the experimenter as being present.

First Touches Pet Carrier: Any instance of the child physically contacting the pet carrier is considered touching.

First Looks Inside of Pet Carrier: The child should clearly be looking *inside* in order for this behavior to be judged as having occurred (e.g., leaning forward to see inside the carrier). Merely looking **at** the carrier does not count as looking inside.

First Touches Inside of Pet Carrier: The child needs to clearly touch the *inside* of the pet carrier for this to be coded as having occurred.

First Definite Verbalization: Code only verbalizations made **after** the experimenter says she is leaving the room. Don't count responses made to experimenter as she leaves (e.g., "Okay!" or "Bye!"). Note that if the child is never left alone, no first verbalization is coded as having occurred. Also note that short words such as "hmmmm…," "ugh," or "ewwww!" count as verbalizations, but giggling or grunting do not.

0 = no (verbalization did not occur)
1 = yes (verbalization occurred)

First Definite Fear Response: Consider facial, vocal, and bodily behaviors reflecting fear, as well as stilling/freezing. These would usually need to be of at least moderate intensity (2 or higher for facial, vocal, and bodily fear; 3 seconds or longer for stilling/freezing) to be considered a clear fear response (see affect example list). Distress vocalizations made while the experimenter is leaving the room may be coded as first definite fear response although they would not be coded as first definite verbalization.

0 = no (fear response did not occur
1 = yes (fear response occurred)

First Definite Withdrawal Attempt: Code the first clear withdrawal attempt made by the child (i.e., they attempt to leave room OR clearly back away from carrier in an attempt to avoid it **due to fear)**. Children who try to leave the room clearly out of boredom (this can be gauged by whether they attempt to leave after having explored carrier) should be assigned a score of **9999** in the 'Behavior Occurs' column, but still indicate the time at which the withdrawal attempt occurs.

0 = no (withdrawal attempt does not occur)
1 = yes (child makes withdrawal attempt)
9999 = child makes withdrawal attempt that is *clearly* due to *boredom*, <u>not</u> fear

Part II - Micro Coding

Each epoch is 20 seconds in length. If the final epoch is less than 10 seconds, do not code that epoch; change the "Stop Time" to the counter time associated with the start of that last, uncoded epoch.

Fearful Affect: rate the peak intensity of fearful/wary facial expression that occurs during the epoch.

0 = no facial region shows codeable fear movement
1 = fear expression is *ambiguous* or is of *low intensity*; fear is evident in only one facial region (i.e., brows raised in distress)
2 = fear expression is *definitely* present in *1 facial region* (i.e., brows raised and drawn together, upper eyelids raised)
3 = fear expression is *definitely* present in *both facial regions* (i.e., brows raised and drawn together, upper eyelids raised to show whites of eyes, corners of mouth opened and drawn back)

Postural Fear: rate the peak intensity of fearful bodily expression that occurs during the epoch.

0 = child's body never reflects fear or weariness
1 = child's body reflects *low intensity* fear or weariness (e.g., cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.)
2 = child's body reflects *moderate intensity* fear or weariness intensity (e.g. slight defensive body posture; fearful tension), **or the display lasts a majority of the epoch**
3 = child's body *reflects high intensity* fear or weariness (e.g., definite defensive body posture, jumping back in fear)

Still/Freezing: total duration of stilling/freezing (in seconds). Duration of freezing is defined as a marked decrease in activity (>2 secs) with little or no movement, with or without any indication of muscular tension.

Distress Vocalizations: rate the peak intensity of distress vocalizations that occur during the epoch

0 = NO distress vocalizations
1 = mild distress vocalizations that are *ambiguous* in nature
2 = distress vocalizations that indicate *some fear or sadness*, either through the content or intonation
3 = vocalizations that indicate *clearly fearful or sad* overtones, either through content or intonation

Approach: rate the peak intensity of approach behaviors (any behavior initiated by the child to decrease the distance between himself/herself and the pet carrier). If the child continues to face toward the pet carrier in subsequent epochs, s/he should continue to be coded a 1.

0 = <u>NO</u> approach behaviors
1 = moderate approach -- child *hesitantly* approaches the carrier (e.g. slow, wary steps or wary posture)
2 = high approach -- child approaches the pet carrier *without hesitation* (e.g. boldly walks

up to the carrier) or stays in close contact with the carrier

Avoidance: rate the peak intensity of avoidance behaviors (behaviors initiated by the child to maintain or increase the distance between himself and the pet carrier). If the child is coded a 1 for one epoch, then continues to be turned away during the following epochs, s/he should continue to be coded a 1. Do not code child leaving the room at the experimenter's instructions at end of episode.

0 = child exhibits NO avoidance -- child stands in place or approaches the carrier
1 = moderate avoidance -- child moves *slightly* farther away from the pet carrier; includes ambiguous movements away from pet carrier (e.g., leans back or steps back to let experimenter pass)
2 = high avoidance -- child *clearly* moves farther away from the pet carrier OR stays by door and faces away from carrier

Angry Affect: rate the peak intensity of angry facial affect that occurs during the epoch

0 = NO facial region shows codeable facial anger movement
1 = anger expression is *ambiguous*, of *low intensity*; expression is present only in 1 facial region (i.e., furrowed brows, narrowed eyes, or tense/squarish mouth)
2 = anger expression is *definitely* present in *1 facial region* (i.e., furrowed brows, or tense/squarish mouth)
3 = anger expression is *definitely* present in *both facial regions* (i.e., furrowed brows, narrowed eyes, and angular/tense mouth)

Sad Affect: code the highest intensity sad affect that occurs during the epoch

0 = NO facial region shows codeable sadness movement
1 = expression of sadness is *ambiguous* or *fleeting*; expression is present only in one facial region (e.g., droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows)
2 = expression of sadness is *definitely* present in *1 facial region* (definitely downturned mouth or definite raising of inner corners of eyebrows)
3 = expression is *definitely* present in *both facial regions* (both definitely downturned mouth *and* definite raising of inner corners of eyebrows)

Object Fear
Episode # 8

Subj No.	
Coder Initials	
Date coded (MM/DD/YYYY)	

CHILD SEX: Male ○ Female ○

START TIME (when experimenter finishes saying she is leaving room): _____

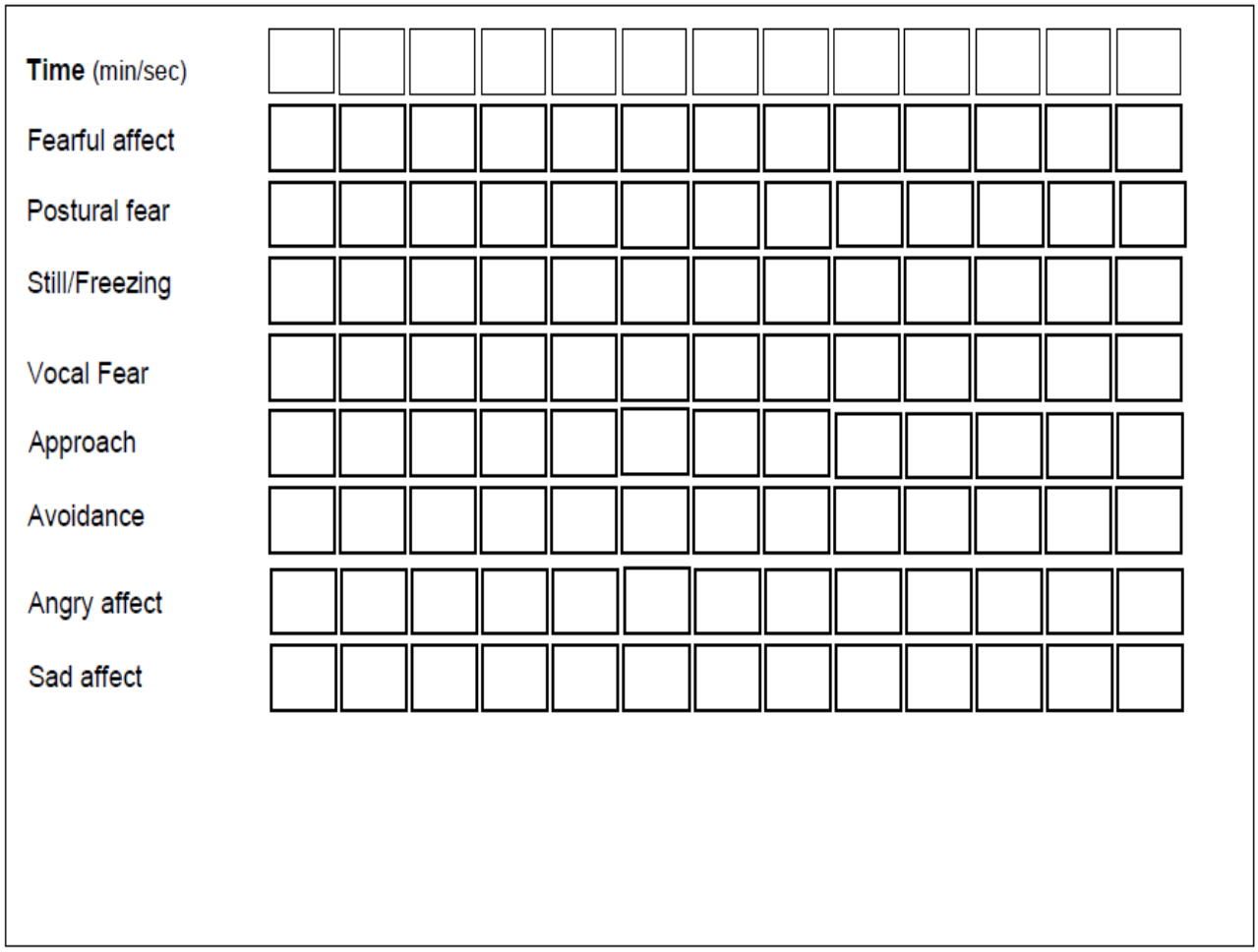
END TIME (when child leaves room): _____

	BEHAVIOR OCCURS?	COUNTER TIME BEHAVIOR INITIATED	LATENCY (SECS)	TENTATIVENESS	EXPERIMENTER PRESENT?
FIRST APPROACHES PET CARRIER					
FIRST TOUCHES PET CARRIER					
FRST LOOKS INSIDE OF PET CARRIER					
FIRST TOUCHES INSIDE OF PET CARRIER					

BEHAVIOR	BEHAVIOR OCCURS?	COUNTER TIME BEHAVIOR OCCURS/INITIATED	LATENCY (SECS)
FIRST VERBALIZATION			
FIRST DEFINITE FEAR RESPONSE			
FIRST DEFINITE WITHDRAWAL ATTEMPT			

Part II – Micro Coding

Epochs are 20 secs in duration



Office of Research Ethics

The University of Western Ontario
Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. E.P. Hayden
Review Number: 15121S **Review Level:** Full Board
Review Date: May 2, 2008

Protocol Title: Gene-Environment Interplay and the Development of Child Temperament
Department and Institution: Psychology, University of Western Ontario
Sponsor: CANADIAN INSTITUTE OF HEALTH RESEARCH
Ethics Approval Date: June 11, 2008 **Expiry Date:** July 31, 2013
Documents Reviewed and Approved: UWO Protocol, Letter of Information and Consent (Parent Consent for Self), Letter of Information and Consent (Parent Consent for Child), Advertisement.

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 (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted 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 NMREB'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 study or consent form may be initiated without prior written approval from the NMREB 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 NMREB:

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 NMREB 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 NMREB.

Chair of NMREB: Dr. Jerry Paquette

Ethics Officer to Contact for Further Information			
☑ Grace Kelly (grace.kelly@uwo.ca)	☐ Janice Sutherland (jsutherl@uwo.ca)	☐ Elizabeth Wambolt (ewambolt@uwo.ca)	☐ Denise Grafton (dgrafton@uwo.ca)

This is an official document. Please retain the original in your files.

cc: ORE File

Curriculum Vitae

Victoria Catherine-Sam Johnson

Education:

2013 – Present	Master of Science Candidate, Psychology. Clinical Program. University of Western Ontario, London, ON. *Supervisor:* Dr. Elizabeth Hayden *Thesis:* Biological and Contextual Predictors of the Stability of Behavioural Inhibition in Early Childhood
2008 – 2012	Bachelor of Arts, Honours, Dean's Honour List with Distinction (Psychology). Queen's University, Kingston, ON. *Supervisor*: Dr. Leandre Fabrigar *Thesis:* Effects of Between- and Within-Dimension Attitudinal Ambivalence on Persuasion

Academic Publications and Presentations:

Johnson, V. C., Olino, T. M., Klein, D. N., Dyson, M. W., Bufferd, S. J., Durbin, C. E., Dougherty, L. R., & Hayden, E. P. (2014, September). A longitudinal investigation of predictors of the stability of behavioural inhibition in early childhood. Poster presented at the annual meeting of the Society for Research in Psychopathology, Evanston, IL.

Johnson, V. C., Olino, T. M., Klein, D. N., Dyson, M. W., Bufferd, S. J., Durbin, C. E., Dougherty, L. R., & Hayden, E. P. (under review). A longitudinal investigation of predictors of the stability of behavioural inhibition in early childhood. *Journal of Research in Personality,* 39 manuscript pages.

Refling, E. J., Calnan, C. M., Fabrigar, L. R., MacDonald, T. K., **Johnson, V. C.**, & Smith, S.M. (2013). To partition or not to partition evaluative judgments: Comparing measures of structural ambivalence. *Social Psychological and Personality Science, 4*(4), 387-394.

Calnan, C. M., Refling, E. J., Fabrigar, L. R., MacDonald, T. K., **Johnson, V. C**., & Smith, S. M. (2013, January) To partition or not to partition evaluative judgments: Comparing measures of structural ambivalence. Poster presented at the annual meeting of the Society for Personality and Social Psychology, New Orleans, LA.

Academic Awards and Scholarships:

2015-2019	Doctoral Fellowship, Social Sciences and Humanities Research Council (total amount: $80,000).
2014-2015	Canada Graduate Scholarship – Master's Program, Canadian Institute of Health Research (total amount: $17,500).

2014-2015	Ontario Graduate Scholarship Offer, University of Western Ontario (total amount: $15,000).
2013-2014	Ontario Graduate Scholarship, University of Western Ontario (total amount: $15,000).
2013-2014	Quality of Life Graduate Research Award, Children's Health Foundation, Children's Health Research Institute (total amount: $9,000)
2008-2012	Dean's Honour List with Distinction, Queen's University.
2008-2012	Queen Elizabeth II Aiming for the Top Scholarship (total amount: $400).
2012	Prince of Wales Prize B.A. (Honours), Honourable Mention, awarded to the graduating student with the second highest standing on the B.A. (Honours) list, Queen's University.
2012	Arts and Science Undergraduate Society Scholarship, Queen's University (total amount: $1,000).
2011	R. W. Leonard Penultimate Year Scholarship, Queen's University (total amount: $400).
2011	Arts/Commerce 1944 Scholarship, Queen's University (total amount: $835).
2010	Ann Adamson Scholarship in Psychology, Queen's University (total amount: $1,960).
2010	Gordon and Myrtle Adams Scholarship, Queen's University (total amount: $1,205).
2010	Wallace Near Prize in Classics, Queen's University (total amount: $410).
2008-2010	Principal's Scholarship, Queen's University (total amount: $10,000).

Teaching Experience:

2014-2015 Fall-Winter	Co-supervisor of Undergraduate Student, Psychology 4850E, Honours Thesis, University of Western Ontario, Adeline Liou.
2014 Winter and Fall	Graduate Teaching Assistant, Psychology 2320A/B: Abnormal Child Psychology, University of Western Ontario.

Community Lectures:

Johnson, V. C., & Ouellette, S. J. Talk Title: *Nature AND Nurture: The Interplay Between Biology Environment in Depression*. Finding your way: The eighth annual lecture series on the psychology of everyday life. Central Library, London, ON. February 2015.

Johnson, V. C., & Ouellette, S. J. Talk Title: *Coping with Stress: Distress Tolerance and Mindfulness.* Finding your way: The seventh annual lecture series on the psychology of everyday life. London Life, London, ON. April 2014.

Johnson, V. C., & Ouellette, S. J. Talk Title: *Coping with Stress: Distress Tolerance and Mindfulness.* Finding your way: The seventh annual lecture series on the psychology of everyday life. Weldon Library, University of Western Ontario, London, ON. March 2014.

Johnson, V. C., & Ouellette, S. J. Talk Title: *Coping with Stress: Distress Tolerance and Mindfulness.* Finding your way: The seventh annual lecture series on the psychology of everyday life. Clarke Road Secondary School, London, ON. March 2014.

Johnson, V. C., & Ouellette, S. J. Talk Title: *Coping with Stress: Distress Tolerance and Mindfulness.* Finding your way: The seventh annual lecture series on the psychology of everyday life. Central Library, London, ON. February 2014.

Research and Academic Work Experience:

2013 – Present. Graduate Research Assistant, Dr. Elizabeth Hayden, Personality and Emotion Development Laboratory, University of Western Ontario, London, ON.

- Responsible for observational coding of temperament and parenting tasks with children, recruiting participants, data file management, and data analysis
- Responsible for training, and supervising research assistants in observational coding and data entry

2010 – 2012. Research Assistant and Honours Student, Dr. Leandre Fabrigar, Attitudes and Persuasion Laboratory, Queen's University, Kingston, ON.

- Responsible for designing experimental materials, running experimental studies, recruiting study participants, date file management, data analysis, and data coding, entry, and transcription
- Responsible for training and overseeing research assistants in running experimental studies
- Experience with SPSS, MediaLab, and DirectRT

Clinical Experience

January 2015 – March 2015. Regional Mental Health Care – Assessment Program, Parkwood Institute, London, St. Joseph's Health Care London. Initial Assessment Practicum. Supervisor: Dr. Stephanie Dubois. Adult inpatient tertiary care, Assessment program.

January 2015 – June 2015. Thames Valley District School Board. Initial Assessment Practicum. Supervisor: Dr. Deborah Reitzel-Jaffe. Child assessment (school-based).

May 2014 – November 2014. Student Development Centre, University of Western Ontario. Initial Intervention Practicum. Supervisor: Dr. Naomi Wiesenthal. University student population.

Additional Training and Relevant Work Experience:

Applied Suicide Intervention Skills Training. Certification obtained June 2014.

"This is who I am. This is what I need". Domestic and Sexual Violence Workshop through Kingston Frontenac Anti-Violence Coordinating Committee. Certificate of Completion obtained April 2012.

2012 – 2013. Boys and Girls Club After School Program, Second in Command, St. Patrick School, Kingston, ON

- Responsible for facilitating an after school program with children ages 4-12, many of whom struggle with behavioural and emotional issues
- Prepared and implemented program plans for the 4-6 and 9-12 age groups
- Certified in High Five Training: Principles of Healthy Child Development, Standard First Aid, and CPR

Volunteer Experience

2013 – Present. National Initiative for Eating Disorders (NIED), ON

- Responsible for developing a network of contacts with various eating disorder agencies and organizations throughout Canada
- Responsible for community outreach to schools when advertising symposia hosted by NIED
- Assist at symposia hosted by NIED
- Assist with first-ever fundraising walk in support of NIED

2011 – Present. Windrush Stable, Therapeutic Riding Centre, Moffat, ON

- Assist in therapeutic horseback riding lessons as a leader and sidewalker for students with a variety of physical, developmental, behavioural, and emotional disabilities
- Assist in a variety of barn chores, horse care, and exercising of school horses

2013 – 2014. Let's Talk Science: Teacher-Partnership, London, ON

- Responsible for delivering interactive science lessons to a junior-level elementary school class

2013 – 2014. Psychology Graduate Students' Association, Graduate Affairs Committee Member, University of Western Ontario, London, ON

- Responsible for discussing policy matters relating to the recruitment, financing, education, research training, and evaluation of graduate students, and other issues pertaining to graduate affairs

2013 – 2014. Advocacy Through Action: "Finding Your Way: A Lecture Series on the Psychology of Everyday Life", Marketing Committee Member, London, ON

- Responsible for advertising the lecture series to the London community

2013. Pathways to Education, High School Tutor, Kingston, ON,

- Tutored high school students in various subjects

2008 –2012. Queen's University Good Times Diner Soup Kitchen, Kingston, ON

- Prepared and served weekly dinners to disadvantaged and low-income citizens of Kingston

2011 – 2012. Queen's University Good Times Diner Soup Kitchen, Executive Member, Grants and Sponsorship Coordinator, Kingston, ON

- Responsible for researching potential grants and sponsors in the community and reaching out to these businesses
- Organized and lead the first annual mitten drive for patrons of the soup kitchen, attaining most of the donated items through sponsorship while building links with local businesses

2011 – 2012. Queen's University Stand Against Genocide, Executive Member, Chair of Finances, Kingston, ON

- Responsible for managing the group's budget and accounting

2012. Let's Talk Science: All Science Challenge, Volunteer, Kingston, ON

- Facilitated a science competition at Queen's University for 13 teams of elementary school students

2012. Think First: Brain Day, Kingston, ON

- Taught a grade five class about the brain and the five senses, facilitated hands-on activities, and encouraged brain injury prevention through "Think First: Brain Day", an event in which elementary schools partner with universities and allow university students to come into their grade five classes for a day to teach the younger students about the brain

2010 – 2011. Queen's University Stand Against Genocide, Executive Member, High School and Community Outreach, Kingston, ON

- Established networking links with high schools throughout the greater Kingston community

Membership in Professional Societies:

2013 – Present	Society for Research in Psychopathology
2013 – Present	Society for a Science of Clinical Psychology

Research Interests:

- Etiology, onset, and course of mood disorders
- Personality and temperament
- Behaviour genetics