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Childhood attachment and behavioral inhibition: Predicting intolerance of uncertainty in adulthood

MAGDALENA A. ZDEBIK,[a,b,c] ELLEN MOSS,[a] AND JEAN-FRANÇOIS BUREAU[d]
[a]*University of Quebec in Montreal;* [b]*University of Montreal;* [c]*Sainte-Justine Hospital's Research Center; and* [d]*University of Ottawa*

Abstract

Intolerance of uncertainty (IU), the tendency to react negatively to uncertain situations, has been identified as an important cognitive component of anxiety disorders, yet little is known about its etiology. Links to temperament, particularly behavioral inhibition (BI), and insecure attachment have been proposed in the development of IU, but no prospective empirical investigation has been performed thus far. In the current study, attachment to caregiver and BI of 60 children were assessed at age 6, using observational measures. Mother's anxiety symptoms were assessed when participants were 14 years old. IU was reported by participants when they were 21 years old, as was neuroticism. Two types of insecure attachment (ambivalent and disorganized–controlling) and BI were positively related to IU over a 15-year span, even after controlling for participants' neuroticism and maternal anxiety. Attachment and BI had no significant interacting effect on the development of IU. Maternal anxiety was positively related to child BI and insecure attachment, but not IU. This study is the first to provide empirical support for a link between ambivalent and disorganized–controlling attachment and BI in preschool children to the development of IU in adulthood. Results have etiological and preventative implications not only for anxiety disorders but also for all disorders related to IU.

Identifying childhood risk factors is a significant and important step in the creation of effective methods to prevent the development of anxiety in adulthood. The cognitive schema of intolerance of uncertainty (IU), a tendency to react negatively to uncertain situations and events (Dugas, Buhr, & Ladouceur, 2004), is an important component contributing to and maintaining anxiety disorders, particularly generalized anxiety disorder (GAD; Dugas, Gagnon, Ladouceur, & Freeston, 1998; Dugas, Marchand, & Ladouceur, 2005; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994; Ladouceur, Gosselin, & Dugas, 2000). Understanding IU's development is important since daily life is full of uncertain situations, and being unable to cope with uncertainty or ambiguity places an individual at great risk for constant worry and anxiety. Early development of IU can negatively impact an individual throughout life (Cassidy, 1995; Dugas et al., 2004). However, IU has principally been documented in adults with GAD (Dugas et al., 1998; Freeston et al., 1994), and very few studies have investigated IU in children (Boulter, Freeston, South, & Rodgers, 2014; Comer et al., 2009), with even fewer investigating its development and contributing factors (Cassidy, Lichtenstein-Phelps, Sibrava, Thomas, & Borkovec, 2009; Tan, Moulding, Nedeljkovic, & Kyrios, 2010). This leaves a significant empirical gap, compromising both deeper understanding of how IU arises and the development of early interventions. Furthermore, IU has more recently been identified as a transdiagnostic cognitive component related to diverse mental health problems, including depression (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013; Gentes & Ruscio, 2011) and has been shown to be a good target for clinical intervention (Dugas & Robichaud, 2007). Thus, understanding IU is relevant to reducing many mental health problems, not just anxiety.

IU has been related to worry throughout multiple developmental stages (adolescence, young adulthood, and adulthood) and has been equally reported in both sexes (Dugas et al., 2004). Individuals with this cognitive filter find uncertain events very distressing, regardless of the probability that these events will happen or not (Dugas et al., 1998), and would rather face a problem with a definite negative outcome than an uncertain one (Dugas et al., 2004). Although patients with other anxiety disorders can also experience IU, Dugas et al. (2004) suggested that the increased specificity of IU in generalized anxiety may be due to the diffuse nature of the anxiety in patients with GAD. Patients with GAD have a low threshold for IU related to a wide range of subjects and contexts, whereas patients with other anxiety disorders have much more specific worries. It has been suggested that this "generalized cognitive filter" may develop quite early in childhood (Cassidy, 1995; Dugas et al., 2004). Supporting this suggestion, in a study involving 5-year-old children, negative expectations predicted symptoms of overanxious or generalized anxiety disorder a year later, even after control-

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Address correspondence and reprint requests to: Magdalena A. Zdebik, Research Unit on Children's Psychosocial Maladjustment, Social and Preventative Medicine, University of Montreal, 3050 Édouard-Montpetit, Room B-232, C.P. 6128, succursale Centre-ville, Montréal, Québec H3C 3J7, Canada; E-mail: magdalena.zdebik@umontreal.ca.

ling for internalizing problems (Warren, Emde, & Sroufe, 2000). Furthermore, when 5- to 9-year-olds were asked to interpret ambiguous scenarios, their cognition related to threat and distress were predictive of anxiety symptoms over a 3-year span (Creswell, Shildrick, & Field, 2011).

Two proposed risk factors for the development of IU are (a) an insecure parent–child attachment and (b) behavioral inhibition (BI), a tendency to react negatively to the unfamiliar. Both have been linked to worry, a lower threshold for tolerating uncertainty and a lack of control over one's environment, concepts all related to increased risk for IU and anxiety disorders (Cassidy, 1995; Hudson & Rapee, 2004). Although insecure attachment has long been proposed as a childhood risk factor for GAD (Cassidy, 1995), specifically through its influence on IU (Dugas et al., 2004), few studies have empirically examined attachment's links to GAD (Cassidy et al., 2009; Tan et al., 2010) and none have looked at its direct role in the development of IU. BI has also been identified as an important risk factor for anxiety disorders (Hudson & Rapee, 2004), but no study has explicitly examined the influence of BI on the development of IU. Very few studies looked at IU as an outcome measure, and most have investigated IU and related risk factors in relation to anxiety and GAD. Identifying the causes of IU would not only have theoretical and etiological implications but also contribute to prevention and treatment for individuals struggling with uncertainty, anxiety, or related mental health problems.

Attachment, Uncertainty, and Risk of Anxiety

Attachment typically forms between the child and a significant adult (generally the parent) during the first year of life (Bowlby, 1982/1969). Bowlby (1973) postulated that attachment plays an important role in the development of anxiety disorders. According to attachment theory, in everyday or new and uncertain situations, the child can use a caregiver or parent as a "secure base" from which to explore the environment. When a child encounters a frightening or threatening situation, he or she can seek the physical proximity and comfort of the caregiver to diminish psychological distress or to avoid physical danger (Ainsworth, Blehar, Waters, & Wall, 1978; Goldberg, 2000). Through these experiences, the child acquires knowledge not only about the physical environment but also about the self (by learning to regulate distress) and others (by integrating the expected behaviors of others in response to the child's needs). Individual differences observed in child behavior in stressful situations depend, in part, on the child's interpretation of caregiver behavior and on expectations of his caregiver's responses to his needs for comfort and care (Goldberg, 2000, 2001; Goldberg, Blokland, & Myhal, 2003; Main, Kaplan, & Cassidy, 1985). Attachment theorists postulate that a child develops an attachment bond with a significant caregiver based on generalization of this caregiver's daily reactions to child proximity-seeking behaviors (Bowlby, 1973, 1988). An internal working model of the relationship with the primary caregiver allows the child to interpret and predict the caregiver's behavior, and regulate his own reactions, thoughts, and feelings toward the attachment figure (Bretherton & Munholland, 1999). For infants and preschool children, qualitative differences in the quality of attachment are traditionally inferred from the child's behavior in a separation–reunion procedure (Ainsworth, et al., 1978; Main & Cassidy, 1988), following the assumption that observed behaviors are indicative of the internal working model activated by this procedure.

Four attachment patterns have been identified in infancy: secure (B), insecure–avoidant (A), insecure–ambivalent (C), and insecure–disorganized attachment (D; Ainsworth et al., 1978; Main & Solomon, 1990). In general, when a caregiver is sensitive and responds adequately in a timely, warm, and predictable manner to a child's needs, the child views the caregiver as accessible, consistent, and sensitive, and learns that the caregiver can be counted on for comfort, to help reduce distress in stressful situations, and to help regulate the child's emotions (Ainsworth et al., 1978; Bowlby, 1982/1969). This in turn helps the child develop a secure attachment and a sense of competence in his own capacities to self-regulate (Bretherton, 1990; Cassidy, 1994; Kopp, 1982, 1989). However, if parental responses are unstable or inconsistent, a child may not learn to adequately regulate distress. Children with insecure–avoidant (A) attachment typically have parents who are less sensitive and seen as more inaccessible and rejecting by the child compared with parents of secure children (Ainsworth et al., 1978; Bretherton, 1985; Main & Cassidy, 1988). Children with an insecure–ambivalent (C) attachment tend to have insensitive and inconsistent parents. This inconsistent parenting creates an uncertain environment and leads children to worry about the availability of their parent in time of stress and to view their parent as unpredictable and unreliable (Ainsworth et al., 1978; Bretherton, 1985; Main & Cassidy, 1988). Insecurely attached children are more likely to process or interpret ambiguous information or situations as threatening, hostile, or negative than securely attached children (Cassidy, Kirsh, Scolton, & Parke, 1996; for review, Dykas & Cassidy, 2011).

Secure and insecure attachment patterns are considered to be organized responses to differences in parental behavior. However, an insecure–disorganized (D) attachment, where children display unusual, conflicting, or disoriented behaviors, is characterized by the absence of a coherent strategy to regulate comfort-seeking behavior (Main & Solomon, 1990). When the caregiver is simultaneously a potential source of security and of fear and anxiety to the child (such as in maltreating families or those affected by mental illness), this constant uncertainty about the reactions or availability of the parent can severely affect the quality of the parent–child bond (Main & Hesse, 1990). Main and Cassidy (1988) further observed a transition to controlling behavior in disorganized children (D-controlling) involving parent–child role reversal between infancy and age 6. Moss, Cyr, and Dubois-Comtois (2004) verified that two-thirds of preschoolers clas-

sified as disorganized assumed control of the parent–child relationship by age 7 in either a punitive or caregiving manner. Unable to tolerate the uncertainty and fear caused by a frightening caregiver, these children try to control their surroundings, including their parent, in order to regulate their own anxiety by assuming the role of the parent (Solomon, George, & De Jong, 1995). Still, some children stay disorganized continuing to display the D attachment behaviors seen in infancy.

Certain types of attachment, namely, ambivalent and D-controlling, were proposed as risk factors for the development of IU (Cassidy, 1995; Dugas et al., 2004). Enduring anxiety might result from constantly worrying about the availability of one's parent, such as in an ambivalent attachment dyad, or from having to take care of a parent who cannot assist the child in dealing with his own distress, as in a D-controlling dyad (Cassidy, 1995; Dugas et al., 2004). Cassidy et al. (2009) found adult GAD patients reported higher instances of "role-reversal/enmeshment" (comparable to D-controlling attachment, where the child takes care of the parent's needs) during childhood, compared to controls. Another retrospective study found links between role-reversal/enmeshment and IU as well as the development of GAD in a nonclinical sample (Tan et al., 2010). A limitation of these studies is the use of retrospective questionnaires to assess childhood attachment. No studies have used observational separation–reunion based measures in a prospective manner to examine the influence of childhood attachment on the development of IU in adulthood. Warren, Huston, Egeland, and Sroufe (1997) found that, in an at-risk sample (Minnesota Longitudinal Study of Risk and Adaptation), infant ambivalent attachment predicted child and adolescent anxiety disorders (17 years later) after controlling for newborn temperament and maternal anxiety (Warren et al., 1997). A cross-sectional study with 7- to 18-year-old children with a primary anxiety diagnosis, found that children with self-reported ambivalent attachment reported higher rates of worry compared with other children (Brown & Whiteside, 2008). However, relatively few studies have examined attachment in relation to anxiety disorders, and a recent meta-analysis showed that although insecurity, specifically ambivalent attachment, was most frequently related to anxiety, few studies used observational attachment measures, many only compared security and insecurity and not specific attachment classifications, and outcome measures varied across studies, all contributing to mixed results (Brumariu & Kerns, 2010).

BI, Uncertainty, and Risk of Anxiety

BI, described as fearful reactions or a tendency to withdraw in the face of novel situations, objects, or people, is one of the most widely studied child temperament profiles (Fox, Henderson, Marshall, Nichols, & Ghera 2005; Kagan, Snidman, Kahn, & Towsley, 2007). BI has also been established as an important risk factor for internalizing problems and anxiety disorders (Biederman, Rosenbaum, Chaloff, & Kagan, 1995; Hudson & Rapee, 2004). Biological concepts of physiological reactivity as well as self-regulation are at the core of BI (Goldsmith & Campos, 1990; Kopp, 1982; Rothbart & DerryBerry, 1981). According to Kagan and colleagues (Kagan, Reznick, & Gibbons, 1989; Kagan, Reznick, & Snidman, 1987, 1988), the sympathetic nervous system of inhibited children, commonly related to the fight or flight response, has a lower activation threshold than in uninhibited children, particularly to novel, uncertain, or ambiguous stimuli. Therefore, BI children would require less intense stimuli to activate their sympathetic nervous system compared with uninhibited children (Kagan, 1999; Kagan et al., 1987, 1988). These differences in activation thresholds are thought to be the primary mechanism linking BI to the development of behavioral problems (Kagan, 1999; Kagan et al., 1987, 1988).

A physiological vulnerability from birth to react more rapidly or intensely (i.e., a lower sympathetic activation threshold) means that BI children are at increased risk to react intensely to novel or uncertain situations or stimuli before having developed self-regulation. They would therefore tend to avoid novel situations early in life, curbing habituation to such situations and maintaining these behaviors, hence putting them at risk to develop internalizing problems and anxiety disorders (Lonigan & Phillips, 2001; Manassis & Bradley, 1994). An increased sensitivity to novel, uncertain, or ambiguous situations has been documented in BI children (Kagan & Snidman, 2004). In theoretical definitions of BI, IU plays a key role. For example, Zentner and Bates (2008, p. 17) stated that "Kagan sees the core feature of inhibition as an intolerance of uncertainty rather than a proneness to fear." Furthermore, definitions of BI have emphasized reference to the initial tendency to react to unfamiliar events or novelty (Degnan & Fox, 2007; Garcia-Coll, Kagan, & Reznick, 1984) and Reznick, Gibbons, Johnston, and McDonough (1989, p. 30) defined BI as a ". . . vulnerability to the uncertainty caused by unfamiliar events that cannot be assimilated easily." BI children attend more or show greater vigilance to threat or novelty and are less able to disengage from such stimuli than do noninhibited children (for review, see Blackford & Pine, 2012; Degnan & Fox, 2007). Research on information processing has proposed attentional bias to threat or to negative stimuli as a cognitive link between temperament and the development of anxiety disorders (for a review, see Vasey & Macleod, 2001). When asked to perform an ambiguous task (i.e., rating levels of fear in a happy face), adolescents identified as behaviorally inhibited since toddlerhood had abnormally high amygdala activation compared with individuals that were consistently noninhibited (Perez-Edgar et al., 2007). Similarly, young adults previously characterized as BI at 2 years of age, exhibited amygdala hyperactivity to novel faces compared to familiar ones (Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Just as a child who learns that his caregiver is unavailable or inconsistent, a BI child has heightened physiological reactions to the environment and thus acquires a perception of the world as uncertain and threatening, putting the child at risk for later IU. Although numerous studies have linked BI with anxiety disorders (see Hudson & Rapee, 2004), no study has specifically examined BI in relation to IU.

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Neuroticism and Maternal Anxiety

Many additional factors must be considered when studying cognitive concepts related to anxiety disorders. The personality trait of neuroticism, characterized by vulnerability to psychological distress (Costa & McCrae, 1992), has been identified as a risk factor for psychopathology in adulthood (see Costa & McCrae, 1992; Silove, Marnane, Wagner, Manicavasagar, & Rees, 2010). Neuroticism has specifically been associated with worry, tendency to avoid ambiguous situations, anxiety disorders, and specifically GAD (De Bruin, Rassin, & Muris, 2007; Lommen, Engelhard, & van den Hout, 2010; Vreeke & Muris, 2012). Furthermore, neuroticism has been found to be directly related to IU (De Bruin et al., 2007; Sexton, Norton, Walker, & Norton, 2003). Moreover, maternal anxiety may contribute to the development of child anxiety disorders through both genetics and modeling of anxious behaviors (Gerull & Rapee, 2002; Hudson & Rapee, 2004) and has been associated with higher levels of child insecure attachment, BI, and anxiety disorders (Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997; Manassis, Bradley, Goldberg, Hood, & Swinson, 1995). Therefore, both neuroticism and maternal anxiety are important to control for when studying IU.

Objectives

The main objective of the current study was to examine the contribution of BI and attachment at preschool and early school age, when children are between 5 and 7 years old, to the development of IU in adulthood, at approximately 21 years of age. Based on previous empirical work and models of the development of anxiety, we predicted that BI would contribute to the development of IU. In addition, insecure–ambivalent and disorganized–controlling attachment types were predicted to both be associated with IU (Cassidy, 1995; Dugas et al., 2004; Warren et al., 1997). We also tested for potential interactions between BI and attachment. Several studies have documented interaction effects between these two variables on later outcomes, including anxiety disorders (Bohlin, Hagekull, & Andersson, 2005; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Schieche & Spangler, 2005; van Brakel, Muris, Bögels, & Thomassen, 2006), although results are inconsistent (see Vaughn, Bost, & van IJzendoorn, 2008). Since studies describing the interactive effects of BI and insecure attachment have reported inconsistent results, we tested this interaction effect on the risk of developing IU without a prior prediction. As both neuroticism and maternal anxiety have been found to be associated with anxiety disorders (and IU), they were included as covariates.

We used an observational behavioral inhibition measure (BIM; Zdebik, 2013) previously validated with toddlers, with a secondary objective to adapt it here to an older sample of children. Assessment involved validating the BIM against adult measures related to shyness and also testing its divergent validity in relation to attachment. It was predicted that the BIM would not be related to attachment classification but that it would be positively related to measures of adulthood shyness. Finally, we also tested how maternal anxiety would be related to attachment and BI, and predicted that mother's with higher levels of anxious symptoms would have children with higher levels of both BI and insecure attachment. This study will be the first to examine the longitudinal association between child BI and attachment, using observational measures and examining specific attachment subgroups as predictors of IU in adulthood.

Method

Participants

Study participants were 60 French-speaking mother–child dyads taking part in an ongoing longitudinal study examining the influence of the parent–child relationship on developmental adaptation (see Moss & St-Laurent, 2001; Moss et al., 2006). At Time 1 (T1) of the current study, children were aged between 5 and 7 years old. The sample was heterogeneous with respect to income level, maternal education, and family structure (see Table 1 for descriptives). Time 2 (T2) measures were taken 8 years later, when children had a mean age of 13.7 years (SD = 0.64, range = 12.6–15.1 years, N = 79, 47 girls). Approximately 7 years later, at Time 3 (T3), participants were young adults with a mean age of 21.3 years (SD = 0.87, range = 20–23 years, N = 60, 38 young women). Seventy-three percent of participants still lived at home at the time of the study. Thirty-two percent of participants had completed a high school degree, 43% had college-level schooling, and 25% had some university-level training.

Sixty participants completed all three time points. Fifty-three percent of participants were lost to attrition from the first time point of the study (see Moss, Rousseau, Parent, St-Laur-

Table 1. *Demographic characteristics of sample (n = 127)*[a]

	%	Proportion
Sex of child (female)	54.3	69/127
Maternal education		
At least 12 years of education	40.2	51/127
At least some college or university schooling	59.8	76/127
Mother-headed home	36.2	46/127
Family income (1992 Can. $)		
<$20,000	25.2	32/127
$20,000–$50,000	42.5	54/127
>$50,000	32.3	41/127
	Mean	*SD*
Mother's age (years)	28.6	3.7
Child age (months)	75	12.6

[a]Demographic characteristics correspond to initial data collection, when children were between 5 and 7 years old.

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ent, & Saintonge, 1998). From the adolescent phase (T2), 24% ($N = 19$) of participants did not complete the young adult phase (T3): 6 refused to participate, 7 never responded to repeated contacts by the project's research assistants, 3 had nonvalid phone numbers, 2 moved away, and 1 accepted to participate but did not attend the laboratory appointment. Analysis of variance and χ^2 analyses of sociodemographic variables (age, sex, maternal education, family income, type of family, and maternal anxiety) were conducted to compare participants lost to attrition with those remaining in the study. These analyses revealed no significant differences between T1 and T2 and between T2 and T3. However, the proportion of male participants dropped from T1 to T3, χ^2 (1, 127) = 4.51, $p = .05$, and mothers of children still participating in the study had more years of education at T1 ($M = 14.7$ years, $SD = 2.97$) compared to mothers whose children did not participate at T3 ($M = 13.2$ years, $SD = 2.85$; $t = 3.04$, $p < .05$).

General procedure

Participants were contacted by telephone 2 weeks prior to each phase of the project and were sent questionnaires to complete at home and bring to the laboratory. When children were 5 to 7 years old (T1), mothers and their children were invited to the laboratory to complete an interactive play task, which included a free-play session, and to participate in a separation–reunion procedure. Upon arrival, two research assistants greeted participants and collected the questionnaires. They invited the dyad into the experimental room, where they introduced the interactive task, which consisted of a mock grocery store within which items were to be collected from a given grocery list. The mother and child were given 2 min to explore the task and toys (free play) before the mother was asked to leave the room for about 5 min while the child completed the first task alone. The mother then came back to the room to complete the task with her child (20 min). The task was followed by a 45-min separation during which the mother left the room to fill out questionnaires with an experimenter and the child completed problem-solving tasks with another experimenter. An unstructured 5-min period during which the child was free to play with toys in the room preceded each reunion. Without being given any particular instructions, the mother was then asked to rejoin her child in the experimental room. The reunion lasted 5 min. Following the reunion period, the dyad stayed in the room for a 10-min snack time. A second separation (about 30 min) followed the snack time, structured similarly to the first separation, followed by a 5-min reunion.

The child's behaviors during both reunion periods were used for attachment classification. This procedure, akin to the procedure by Main and Cassidy (1988), was used because the children were of preschool and school age and its validity for classifying attachment behavior in children in this age range has been repeatedly demonstrated (Cassidy, 1988; Cohn, 1990; Groh, Roisman, van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012; Moss et al., 2004; Solomon et al., 1995). The child's behaviors during the interactive task free-play were used to code BI. Finally at T1, in addition to a sociodemographic questionnaire, mothers completed a questionnaire measuring the child's vocabulary.

During the adolescent phase of the study (T2), when the children were between 13 and 15 years old, they were invited to fill out questionnaires at the laboratory. None of the children's questionnaires from this phase were used in the current study. Mothers once again filled out sociodemographic questionnaires and also the Symptom Checklist 90—Revised (SCL-90-R; Derogatis, 1994). At T3, the young adult phase, participants came to the laboratory without their parents. They completed the Revised Neuroticism-Extraversion-Openness Personality Inventory (NEO PI-R; Costa, & McCrae, 1992) and the Intolerance of Uncertainty-12 Short Form (IUS-12; Carleton, Norton, & Asmundson, 2007) in addition to filling out sociodemographic information about themselves. Participants were given $20 for their participation in each phase of the study. Informed written consent from all participating families was obtained at each assessment. The study was approved by the Université du Québec à Montréal Research Ethics Committee.

Instruments

Attachment classification and distribution. The Preschool Attachment Classification System (Cassidy & Marvin, 1992) for the 5-year-olds and the Main and Cassidy (1988) system for the 6- to 7-year-olds, which are conceptually similar, were used to classify the children's reunion behaviors. Both systems use a six-category attachment coding scheme to classify children into three organized (A, B, and C) and three disorganized (controlling–caregiver [Ccare], controlling–punitive [Cpuni], and behaviorally disorganized [BehD]) attachment patterns. Videotaped reunions were coded by the second author and a graduate student. Both were unaware of participant scores on any other measures. Both coders were trained by R. Marvin and achieved reliability with him on a separate sample of tapes. All discrepancies were resolved by reviewing the tapes until consensus was achieved. Reliability for the classifications of the 5-year-old children was calculated separately from that of the 6- and 7-year-old children, which were comparable and both indicated excellent agreement ($\kappa = 0.86$ and 0.88, respectively). Overall agreement for the major classifications (A, B, C, and D) was 88% ($\kappa = 0.81$), calculated on 30% of the sample. Reliability was also calculated for the disorganized classification subtypes for the 14 D videotapes in the reliability pool. Agreement was as follows: 4/4 (100%) for Ccare, 4/5 (80%) for Cpun, and 4/6 (67%) for BehD (overall agreement for the D subtypes was thus 80%). In the current study, in order to test if disorganized controlling and ambivalent attachment patterns are related to the development of IU, both disorganized controlling (Dcontrol) subtypes were combined for analyses as they are theoretically similar in terms of the children's role reversal and internal working models of their caregiver related to feeling unprotected and

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vulnerable (Moss et al., 2004). The BehD, although small, was left as a distinct category. There were no significant differences in the relative proportions of the various attachment classifications between T1 and T2, T1 and T3, or T2 and T3 (Table 2; χ^2 tests; all *p*s $>$ .05), indicating no differences in attrition rates. As main analyses were multivariate regressions, attachment was coded into dummy variables contrasting each specified attachment group (A, C, Dcontrol, and BehD) to the reference secure group (B; Cohen & Cohen, 1983). In order to identify how different attachment groups (A, B, C, Dcontrol, and BehD) may differ on sociodemographic variables, correlations, *t* tests and χ^2 tests were performed with participant age, sex, maternal age, maternal education, and family income. Attachment groups did not differ on any of these sociodemographic variables (all *p*s $>$ .05).

BIM. BI was measured using the BIM, a protocol based on the laboratory studies of Kagan and colleagues (Garcia-Coll et al., 1984; Kagan et al., 1989) and on the Strange Situation procedure (Ainsworth et al., 1978). The Strange Situation procedure has all the necessary components to evaluate BI in children: an unfamiliar situation, novel objects, opportunity for exploration, and the introduction of an unfamiliar individual (Ainsworth et al., 1978; Garcia-Coll et al., 1984). However, Zdebik (2013) showed that only the initial free-play session, even prior to the entrance of the stranger, was sufficient to observe inhibited behavior in children, as BI is said to refer to the initial negative or fearful reactions to novelty (Garcia-Coll et al., 1984; Degnan & Fox, 2007). Children's reactions to a novel room and toys even in the presence of their mother were varied enough to discern BI and risk for internalizing symptoms (Zdebik, 2013). Here, the BIM was adapted and validated for older children.

Behaviors such as spontaneous vocalizations, displays of negative affect or fretting, play, and proximity to the mother (within 1 m, between 1 and 2 m, and beyond 2 m) were coded in terms of frequency and length from the videotaped free-play session of the interactive grocery task at the beginning of the laboratory visit, when children were aged between 5 and 7 years old. The videotaped segment used to code BI did not overlap with the footage used to code attachment. Frequency or duration (in seconds) of the operationalized behaviors were divided by the total length of the duration of the free-play session and standardized. Scores that were not observed for over 20% of the sample were coded as either present or not (0 or 1). Composite scores were computed based on theoretical representation of a behavioral inhibited profile in the literature (Garcia-Coll et al., 1984). The BIM score was composed of the sum of reversed spontaneous vocalizations, negative affect, proximity to mother 0 to 1 m, reversed proximity to mother 1 m to 2 m, reversed proximity to mother 2 m and over, and reversed play scores, where higher scores represented higher levels of BI. The BIM was previously validated in a study using principal component analysis, which revealed a score describing inhibited–uninhibited behaviors (Zdebik, 2013). The BIM has previously been corroborated against validated temperament questionnaires: the Fear and Approach Scales of the revised Infant Behavior Questionnaire (Gartstein & Rothbart, 2003) and the Shyness and Sociability Scales of the Early Childhood Behavioral Questionnaire (Putnam, Gartstein, & Rothbart, 2006) as well as a temperament questionnaire filled out by research assistants having observed children at home for over 2 hr (Non-caregiver Observational Temperament AQS-based scale; Zdebik, 2013). The BIM was also comparable to an existing laboratory-based BI protocol (White, McDermott, Degnan, Henderson, & Fox, 2011) and was also shown to have excellent reliability (Zdebik, 2013).

In the current sample, the BIM was adapted to an older sample of children, while still using the same behaviors as in the original construction of the protocol. Videotapes were coded for inhibition by the main author, who was blind to attachment classification. A second coder, trained by the main author and blind to inhibition and attachment classification, coded 15% of randomly selected videotapes. Intraclass correlations ranged from .83 to 1.00 (all *p*s $<$ .001). BI was not significantly related to any of the sociodemographic variables (participant age, sex, maternal age, maternal education, and family income; correlations and *t* tests; all *p*s $>$ .05).

Child vocabulary. Because a large part of the BIM is related to vocalization behaviors, differences in vocalization rates could potentially be related to differences in vocabulary knowledge and proficiency. Therefore, children's vocabulary

Table 2. *Attachment classifications at the three time points*

	Attachment				
	B	A	C	Dcont	BehD
Time 1	61% (42 girls, 35 boys)	16% (10 girls, 11 boys)	9% (6 girls, 5 boys)	10% (6 girls, 7 boys)	4% (5 girls, 0 boys)
Time 2	57% (26 girls, 19 boys)	16% (8 girls, 5 boys)	9% (4 girls, 3 boys)	13% (5 girls and 5 boys)	5% (4 girls, 0 boys)
Time 3	59% (24 women, 11 men)	19% (8 women, 3 men)	10% (2 women, 4 men)	7% (1 woman, 3 men)	5% (3 women, 0 men)

Note: B, secure; A, avoidant; C, ambivalent; Dcont, disorganized controlling; BehD, behaviorally disorganized.

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ability was measured at T1, using the French Canadian version of the Peabody Picture Vocabulary Test—Revised, l'Échelle de vocabulaire en images Peabody (EVIP; Dunn, Dunn, & Thériault, 1993) for children between 2.5 and 18 years of age. The EVIP requires no reading or writing on the child's part, making it well suited for testing shy children. It consists of 5 trial items and 170 test items arranged in increasing degree of difficulty. Each item is composed of four black-and-white drawings presented in a multiple-choice format. The child must choose the image that best corresponds to the stimulus word that is read out by the experimenter. Although the EVIP measures receptive language abilities, it is designed to rapidly assess the child's range of acquired vocabulary and verbal competence as well as the child's academic aptitude.

Maternal anxiety symptoms. Maternal anxiety was measured using the Anxiety Scale of the SCL-90-R (Derogatis, 1994), a self-report 90-item questionnaire evaluating symptoms of psychopathology. Participants rate, if each symptom has applied to them in the last 7 days from 0 (*not at all*) to 4 (*extremely*). The anxiety scale ($\alpha = 0.90$) refers to symptoms such as tension, nervousness, trembling, feelings of terror and panic, in addition to somatic manifestations. The SCL-90-R demonstrated high internal consistency, and its validity and reliability have been well documented in both research and clinical populations (Derogatis & Lynn, 1999). Total anxiety scale score could range from 0 to 40. As participants were from the general population, over 25% of mothers scored zero (scores ranged from 0 to 31 with a median score of 2). Therefore, the score was dichotomized and mothers scoring 10 and above were classified as "anxious" and the remainder as "nonanxious."

NEO PI-R. The NEO PI-R (Costa & McCrae, 1992) is a 240-item measure of adult personality. Participants rate statements pertaining to themselves from 0 (*strongly disagree*) to 4 (*strongly agree*). Higher scores indicate a higher level of the trait. Five personality domains are assessed: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each of the five domains (48 items each) is composed of six subscales (8 items each). Validity and reliability of the NEO PI-R has been widely documented and internal consistency coefficient αs for the domain scales range from 0.86 to 0.92 and from 0.56 to 0.81 for subscales (Costa & McCrae, 1992). The neuroticism domain (Cronbach $\alpha = 0.86$), where high scores refer to increased proneness to psychological distress, and its subscales (anxiety, $\alpha = 0.83$; angry hostility, $\alpha = 0.68$; depression, $\alpha = 0.78$; self-consciousness, $\alpha = 0.60$; impulsiveness $\alpha = 0.65$; and vulnerability $\alpha = 0.80$) were used in the present study (see Table 3 for description of subscales).

IUS-12. The IUS-12 (Carleton et al., 2007) is a 12-item self-report questionnaire and the short form of the original 27-item Intolerance of Uncertainty Scale (Freeston et al., 1994).

Table 3. *Correlations and descriptive statistics between the BIM and the neuroticism domain and subscales (N = 57)*

Variables	BIM	N1	N2	N3	N4	N5	N6	N	No N4
Behavioral inhibition (BIM)	—								
N1 anxiety (level of fear, worry and nervousness)	.24	—							
N2 dngry hostility (level of anger, frustration and bitterness	.03	.66**	—						
N3 depression (tendency to experience depressive affect)	.19	.71**	.62**	—					
N4 self-consciousness (shyness and social anxiety)	.30*	.63**	.38**	.69**	—				
N5 impulsiveness (inability to control cravings or urges)	−.02	.36**	.44**	.25	.22	—			
N6 vulnerability (inability to cope with stress)	−.04	.66*	.55**	.72**	.62**	.39**	—		
Neuroticism (N) (proneness to psychological distress)	.16	.87**	.77**	.86**	.76**	.55**	.85**	—	
Neuroticism no N4 (no N4)	.12	.87**	.81**	.85**	.66**	.59**	.84**	.99**	—
M	0.00	17.63	14.85	16.60	16.23	18.13	12.30	95.70	79.42
SD	3.25	5.74	4.18	5.30	4.35	4.22	5.00	22.47	19.44
Range	−7.15–6.36	5–31	4–23	3–28	7–26	6–30	0–25	37–155	30–130

Note: BIM, Behavioral Inhibition Measure; N1–N6, neuroticism subscales with description; No N4, total neuroticism score without N4 subscale.
*$p < .05$. **$p < .01$.

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Participants rate items related to uncertainty, ambiguous situations, and future events, such as "unforeseen events upset me greatly" and "uncertainty keeps me from living a full life," from 1 (*not at all characteristic of me*) to 5 (*entirely characteristic of me*; $\alpha = 0.89$). Higher scores indicate a higher level of IU. The IUS-12 was shown to be comparable and highly correlated ($r = .96$, $p < .01$) to the original long form (Carleton et al., 2007; Khawaja & Yu, 2010). It has good internal consistency, convergence, and discriminant validity (Carleton et al., 2007; McEvoy & Mahoney, 2011).

Sociodemographic questionnaire. A family background questionnaire, containing items regarding sociodemographic information, was completed by mothers at T1 and T2. Information relating to family income, parental education and marital status, child sex, and child age was included in the questionnaire. At T3, the young adults completed a sociodemographic questionnaire, documenting income, education, living situation, and relationship status.

Results

Preliminary analyses

Prior to analysis, data were checked for outliers and normality (Tabachnick & Fidell, 2007). As continuous variables were normally distributed, no transformations were necessary. All main analyses were conducted with the 60 participants remaining in the study at T3. Correlations and *t* tests were performed with participant age, sex, maternal age, maternal education, family income, siblings (having zero vs. one or more siblings) and adulthood living situation (living with parents versus independently) in order to identify potential sociodemographic covariates related to the dependent variable, that is, IU scores. No significant associations were found with sociodemographic variables and IU (all *p*s $> .05$); therefore, they were not included in further analyses.

Power considerations

A power analysis was performed to determine the estimated effect size that could be reasonably detected in our study for a sample of $n = 60$, a power of 0.80, and $\alpha = 0.05$. For our final model, including interaction terms, we could detect a large effect size ($f^2 = 0.32$). For the first steps of our hierarchical model, we would be able to detect a medium to large effect size ($f^2 = 0.14$–0.26). Hence, although the sample was small, the statistical power was adequate for the analysis.

BI

We first addressed the validity of the BIM. No significant correlations between the BIM score and any of the attachment groups were observed (Table 4, all *p*s $> .05$). Analysis of variance with attachment treated as a categorical variable (A, B, C, Dcontrol, and BehD) revealed similar results, suggesting that the BIM score measures a separate concept from attachment, consistent with previous research (for a review, see Vaughn et al., 2008).

The BIM was then compared to neuroticism and its subscales. Of particular interest for validation purposes was the N4 self-consciousness subscale that is related to shyness and social anxiety. Correlations revealed no significant relationship between BIM and the main neuroticism domain nor its subscales, except for the N4 subscale ($r = .30$, $p = .026$, all other *p*s $> .05$). Children with higher BIM scores had significantly higher self-consciousness scores (Table 3).

Table 4. *Correlations and descriptive statistics between main analyses variables (N = 56)*

Variables	B	A	C	Dcont	BehD	BIM	No N4	IU
Attachment								
Secure (B vs. other)[a]	—							
Avoidant (A vs. other)[a]	−.58**	—						
Ambivalent (C vs. other)[a]	−.39**	−.15	—					
Dcont vs. other[a]	−.35**	−.13	−.09	—				
BehD vs. other[a]	−.30*	−.11	−.07	−.07	—			
Behavioral inhibition (BIM)	−.15	.13	.06	.05	−.02	—		
No N4 (NEO PI-R)[b]	−.10	.09	.005	.11	−.07	.11	—	
IU (IUS-12)[c]	−.26	−.03	.33*	.28*	−.12	.30*	.57**	—
M						0.00	95.14	27.11
SD						3.17	20.06	8.94
Range						−7.15–6.36	30–130	13–53

Note: B, secure; A, avoidant; C, ambivalent; Dcont, disorganized controlling; BehD, behaviorally disorganized; BIM, Behavioral Inhibition Measure; No N4, total neuroticism score without N4 subscale; IU, intolerance of uncertainty; NEO-PI-R, Neuroticism-Extraversion-Openness Inventory Personality Inventory Revised; IUS-12, Intolerance of Uncertainty Short Form.
[a]Attachment coded as dummy variables.
[b]Total neuroticism score without the N4 subscale.
[c]Partial correlations controlling for neuroticism score without the N4 subscale.
*$p < .05$. **$p < .01$.

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As a large part of the BIM is related to vocalizations, correlation between the BIM and vocabulary competence were performed to ensure that the vocalization coding was not related to child vocabulary. Children's vocabulary competence was not significantly related to the BIM score ($r = –.24$, $p > .05$). Divergent validity of the BIM score with attachment coding and convergent validity with a concept related to shyness and social anxiety validated the use of the BIM score in subsequent analyses.

Maternal anxiety

We then examined the relation of maternal anxiety to both attachment and BI to confirm previous research linking these variables. Insecure children were significantly more likely to have anxious mothers: no secure child had a mother classified as anxious (Fisher $p = .011$). Furthermore, children classified as disorganized–controlling were significantly more likely to have anxious mothers compared with other children, while this effect approached significance in avoidant children (Dcontrol: Fisher $p = .039$; A: Fisher $p = .052$). Anxious mothers had children with significantly higher BI scores than did nonanxious mothers ($M = 3.98$, $SD = 1.95$; $M = –0.54$, $SD = 2.95$, respectively), $t\ (51) = 3.64$, $p = .001$, $d = 1.58$.

Preschool BI and attachment as predictors of adult IU

Prior to main analyses, neuroticism and maternal anxiety were also tested as possible covariates of IU. As anticipated, participants with higher neuroticism scores also had significantly higher IU scores ($r = .60$, $p < .001$); therefore, neuroticism was controlled for in main analyses. However, participants with anxious mothers ($M = 1.40$, $SD = 0.14$) did not differ from those with nonanxious mothers ($M = 1.48$, $SD = 0.16$) in IU, $t\ (53) = 1.19$, $p = .24$, $d = 0.58$. Therefore, maternal anxiety was not included in main analyses.

Given that the N4 self-consciousness subscale of neuroticism was shown to be related to BI, it was removed from the total neuroticism score so that BI and neuroticism could be addressed as separate predictors of IU, avoiding redundancy in the results. Therefore, a neuroticism score without the N4 scale was computed by summing all other neuroticism subscale scores (neuroticism no N4; Table 3). The neuroticism no N4 score was used in the subsequent analyses. Table 4 presents correlation coefficients as well as means and standard deviations for variables included in main analyses and online-only supplementary Figure S.1 presents a scatterplot of the relationship between BI and IU for each of the attachment classifications.

A hierarchical regression was performed to examine the independent and interactive contributions of BI and attachment at preschool age to the development of IU in adulthood (Table 5). In order to ensure that BI and attachment would independently predict IU from other potential risk factors for psychopathology, neuroticism was entered as a first step in the prediction model since it was collected at the same time point as our outcome variable. The regression analysis was therefore performed with neuroticism in Step 1 (control variable = neuroticism no N4), BI in Step 2 and attachment in Step 3. Insecure–ambivalent (C; $\beta = 0.32$) and disorganized controlling (Dcontrol; $\beta = 0.23$) attachment significantly differ from security (B) in predicting IU (explaining 15.4% of the variance), even after controlling for neuroticism ($\beta = 0.57$) and BI ($\beta = 0.24$), which independently explained 33.0% and 6.0% of the variance, respectively. When Attachment × BI interaction terms, using a centered transformation of the continuous variable, were added to the model, they

Table 5. *Hierarchical regression model with preschool attachment and behavioral inhibition as predictors of adult intolerance of uncertainty (N = 56)*

Predictor Variables	ΔR^2	ΔF	*df*	β
Intolerance to Uncertainty (IUS-12)				
Step 1	.33	26.48**	1, 54	
Neuroticism no N4 scales (NEO PI-R)				0.57**
Step 2	.06	4.85*	1, 53	
Behavioral inhibition (BIM)				0.24*
Step 3	.15	4.11**	4, 49	
Attachment				
Avoidant (A vs. B)[a]				−0.03
Ambivalent (C vs. B)[a]				0.32**
Dcont vs. B[a]				0.23*
BehD vs. B[a]				−0.04

Note: IUS-12, Intolerance of Uncertainty Short Form; No N4, total neuroticism score without N4 subscale; NEO-PI-R, Neuroticism-Extraversion-Openness Inventory Personality Inventory Revised; BIM, Behavioral Inhibition Measure; A, avoidant; B, secure; C, ambivalent; Dcont, disorganized controlling; BehD, behaviorally disorganized.
[a]Attachment coded in dummy variables contrasting each group with the reference group (B).
*$p < .05$. **$p < .01$.

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failed to reach statistical significance. Furthermore, when the interaction terms were added, the total variance explained of the model dropped from 48.3% to 45.4%, making it a weaker fit. Therefore the better fitted model is one that includes preschool attachment and BI as predictors of IU while controlling for neuroticism.

Discussion

Insecure attachment and BI in childhood independently predicted IU in adulthood 15 years later, while controlling for neuroticism and maternal anxiety. These results are consistent with theoretical models of the development of IU and anxiety (Cassidy, 1995; Cassidy et al., 2009; Dugas et al., 2004; Shamir-Essakow, Ungere, & Rapee, 2005; Warren et al., 1997). Furthermore, as predicted and consistent with previous studies, maternal anxiety was related to both increased BI and an increased likelihood of insecure attachment in children (Manassis et al., 1995). However, maternal anxiety was not significantly correlated with IU. Finally, we successfully validated a new observational BI measure, developed for toddlers, to an older population of children. This study is the first to longitudinally assess the intrinsic and external developmental factors that contribute to the development of an individual's IU.

Insecure attachment, specifically the C and the Dcontrol subtypes, differs from secure attachment in predicting IU over and above neuroticism, maternal anxiety, and child temperament. This finding underscores the importance of early child–caregiver relationships as an influence on intolerance for uncertain and ambiguous situations (Cassidy, 1995; Cassidy et al., 2009; Dugas et al., 2004). Concordant with our results, Warren et al. (1997) found ambivalent attachment to be a stronger predictor of anxiety disorders in adolescence than maternal anxiety and infant temperament, although they did not include the D attachment classification. Our results are consistent with Warren et al.'s (1997) hypothesis that ambivalent attachment would be related to anxiety disorders due to chronic inconsistent parenting. Consistent with previous results (Tan et al., 2010), Dcontrol attachment, compared to secure attachment, also predicted IU above and beyond neuroticism, maternal anxiety, and child temperament. Our results suggest that the perceived threat of ambiguity or uncertainty and a lack of control over one's environment may play a crucial role in the development of IU.

A reduced sense of control over one's environment in early age was suggested as a risk for anxiety disorders (Chorpita & Barlow, 1998). Inconsistent parenting could contribute to such a sense of lack of control particularly in the case of children with ambivalent attachment. Disorganized children who experience helpless or hostile parenting or maltreatment would also experience a sense of lack of control. As they grow older, disorganized children would be unable to tolerate this lack of control over their environment, or in this case their parent. Developing a controlling attachment would enable these children to regain some control and reduce uncertainty through role reversal. Out of the two disorganized groups in our study, only the controlling type was related to IU and not the behaviorally disorganized group. Children who develop a Dcontrol attachment may have a lower threshold for tolerating uncertainty than those that remain disorganized at older ages (BehD). Although differences are documented between Dcontrol and BehD attachment (Moss et al., 2004), future studies with larger sample sizes should further investigate these discrepancies in relation to IU. Larger samples would also allow examining potential differences between the two types of controlling attachment (O'Connor, Bureau, McCartney, & Lyons-Ruth, 2011).

We found that BI in childhood contributed to a low threshold for tolerating uncertain situations or events, above and beyond neuroticism and maternal anxiety. These results are consistent with Vreeke and Muris (2012), who found higher levels of BI were related to children's anxiety symptoms after controlling for neuroticism, in both a nonclinical and a clinical sample, and that BI was not directly related to the overall neuroticism score. Therefore, our findings raise the possibility that being behaviorally inhibited early in life can have an effect on intolerance of uncertainty in adulthood and this above current psychological vulnerability. BI involves heightened reactions to novelty and uncertainty, and these reactions potentially predispose children to learn or develop a view that the environment can be uncertain and dangerous. In this respect, inhibited children are similar to children who learn that their caregiver is unavailable or inconsistent and perceive uncertainty as a threat. However, BI explained a small percentage of the variance in IU. A possibility is that BI was measured in an unselected sample, contrary to most BI research that examines children at the extremes of inhibition (scoring high or low), which usually yield stronger results (Degnan & Fox, 2007; Reznick et al., 1989).

BI and attachment did not have interacting effects on IU, consistent with some but not all previous research examining the effects of attachment and BI on anxiety (Muris, van Brakel, Arntz, & Schouten, 2011; Shamir-Essakow et al., 2005; see Vaughn et al., 2008). Our small sample may have made the detection of an interaction effect difficult. Methodological differences across studies should also be considered. A recent meta-analysis reported that inconsistent results in studies examining attachment and anxiety disorders could be related to methodological issues such as type of attachment measure used, age of participants, type of population (i.e., clinical or nonclinical), and reported outcome measures (Brumariu & Kerns, 2010). However, another meta-analysis examining attachment and internalizing behaviors (including anxiety disorders) reported that such issues had little effect on internalizing outcomes (Groh et al., 2012), as opposed to externalizing behaviors (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010). Regarding BI, type of measure (observational vs. parent report), type of population (selected vs. unselected sample), and stability of BI have all been identified as having potential effects on outcomes (Kagan & Snidman, 2004; Kagan et al., 2007; Reznick et al., 1989). Therefore, more research must be done on BI and attachment in relation

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to distinct anxiety disorders in clinical and nonclinical samples, before clearly establishing these effects.

Although the BIM is a new measure of BI, our results suggest that it is a valid and reliable measure. As predicted, anxious mothers' children had higher levels of BI, supporting previous results (Biederman et al., 1995). Fearful reactions by mothers may help maintain BI in children (Gerull & Rapee, 2002). Furthermore, the fact that our BI measure was not associated with the overall neuroticism score, but only the subscale related to shyness, suggests that the BIM measures a concept more closely related to self-consciousness in public, discomfort around others, and uneasiness in awkward social situations rather than overall vulnerability to negative emotions and maladjustment (Costa & McCrae, 1992). Having already been validated in a younger population of children (Zdebik, 2013), these results further support the BIM as a promising observational BI measure. Furthermore, as the vocalizations are measured in terms of syllables, this measure can be used with culturally diverse populations as it is not necessary to understand the language of the participants even in older populations of children (Zdebik, 2013). However, further validation in different at-risk, clinical or culturally diverse samples would be important to establish its generalizability across populations.

Limitations and future studies

Although our results are promising, there are some limitations to address. The young adulthood data (IU and neuroticism) were taken at the same time point and were self-reports, potentially inflating the relationship between these variables due to shared method variance. However, as some childhood measures were related to IU and not neuroticism, and vice versa, shared variance cannot fully account for our findings. Due to attrition, our final sample had fewer males and fewer individuals with lower maternal education than the original sample, and hence increased representation of these groups would increase the generalizability of our results. However, attrition typically diminishes statistical power, yet we detected meaningful associations between variables. Replication in other populations would of course be valuable, and a larger sample would also be beneficial, enabling the study of different anxiety disorders with sufficient statistical power. Furthermore, BI and attachment were measured at the same time point of the study, and video footage from the same laboratory session was used to code both measures, also possibly creating shared method variance. However, distinct parts of the sessions were used for each measure and no relation was found between the two variables, making shared variance also improbable in this case.

In addition, controlling for other maternal characteristics, for example, maternal personality and parenting style, would be important as these have been shown to moderate the relationship between child temperament and later social adjustment (Coplan, Arbeau, & Armer, 2008). Although maternal anxiety was not associated with IU, it is important to consider that the well-being of both parents can affect a child's vulnerability to certain disorders and should be considered in future studies (Bögels, Stevens, & Majdandžić, 2011). With the increasing evidence of paternal attachment relationship influencing anxious–withdrawn behavior (Vershueren & Marcoen, 1999) and social competence (Boldt, Kochanska, Yoon, & Nordling, 2014), future studies would benefit from investigating the father's role in the development of IU. As the role of peers in late childhood and adolescence increases (see Allen, 2008), investigating how peer influence could moderate the effects of attachment and temperament on the development of IU would also be important. Similarly, romantic partner attachment may impact IU as adolescent relationships develop (see Feeney, 2008). Stressful life events and gradual increases in individual responsibilities have been suggested as risks for the development of GAD (Dugas et al., 2004); therefore, important life transitions (living on one's own, parenthood, etc.) are other likely candidates for the development of IU. Hence, a life span approach would benefit the understanding of IU.

A notable line of investigation was suggested by Dugas et al. (2004). Due to the stable character of IU, it was proposed that it may act as a "cognitive diathesis" increasing an individual's chances of developing anxiety in reaction to increased stress. A next step would be to investigate if individuals experiencing higher levels of IU are at increased risk of developing GAD and if this link is moderated by the amount of stress they have experienced throughout their life. Sroufe, Egeland, and Kreutzer (1990) also described the enduring influence of early attachment patterns and how they can resurge under certain circumstances, particularly in stressful situations, throughout an individual's life. It is possible that early integrated experience, shaped by both attachment and temperament, can resurface in times of stress, such as in late adolescence and early adulthood, a period synonymous with increased responsibilities compared to childhood. Finally, identifying underlying mechanisms linking specific aspects of temperament and early attachment in the etiology of interpretation of uncertainty as well as developing prevention strategies and therapies could help examine causal links between BI, attachment, and IU.

Conclusion

Our study is the first to provide empirical support that preschool attachment, particularly ambivalent and disorganized controlling types when compared to secure attachment, as well as BI independently predict IU in adulthood, even after controlling for neuroticism and maternal anxiety. Furthermore, we were able to further validate a new observational BI measure that can be easily integrated into studies with appropriate video footage, adding valuable childhood temperament information and providing substantial advantages over retrospective questionnaires. Finally, our work emphasizes the role of early cognitive processes in the development of later psychopathology. In our study, early cognitive processes related to perceived insecurity and uncertainty on a tempera-

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mental and relational level are important in the development of the cognitive schema of IU, hence proposing new opportunities for preventative treatment not only with young children but also with their caregivers.

Supplementary Material

To view the supplementary material for this article, please visit https://doi.org/10.1017/S0954579417001614.

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