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Factors influencing Continuity of Attachment Quality in Early Childhood

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

FACTORS INFLUENCING CONTINUITY OF ATTACHMENT QUALITY IN EARLY CHILDHOOD

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by

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Abstract

Although the study of attachment continuity has flourished over the last several decades, gaps remain in the literature. These include a dearth of studies that have examined: 1) how children differ in their patterns of continuity in attachment quality; 2) factors that underlie these patterns; and 3) the roles that infant characteristics, such as children's levels of susceptibility to parenting influences, have in shaping attachment stability. Correspondingly, this dissertation aimed to identify children's patterns of continuity in attachment quality across early childhood, and to elucidate the processes that influence the development of these different patterns. Using Latent Class Analysis (LCA), we found distinct groups of children within a middle-class sample (n = 63), each with a different pattern of attachment continuity: stable secure and stable insecure attachment trajectories. Further analyses revealed a path-model in which: 1) mothers who were more sensitive at each time-point tended to have children who were concurrently more secure; 2) mothers who were more sensitive at earlier time-points tended to be more sensitive across time; and 3) there were no direct associations between the qualities of children's attachment relationships across time when the effect of maternal sensitivity was taken into account. Results also did not support the prediction that children's levels of susceptibility to parenting mediated the influence of maternal sensitivity on their patterns of attachment stability. These results suggested that continuity in maternal sensitivity underlies continuity, or lack thereof, in the quality of children's attachment relationships. Lastly, LCA was also used to identify patterns of attachment continuity in a high-risk sample of adolescent-mother-child dyads (n = 69). In contrast to the stable patterns observed from the low-risk sample, children from the high-risk sample exhibited attachment trajectories characterized by instability. The prevalence of unstable attachment trajectories in this high-risk sample is consistent with the prediction of greater volatility in maternal sensitivity of adolescent mothers that, in turn, may influence the development of unstable attachments. The current findings mapped out, for the first time, some of the attachment pathways that children traveled, and elucidated the influence of maternal sensitivity in maintaining children's specific attachment trajectories.

Keywords: Attachment Theory, Attachment Stability, Longitudinal Study, Maternal Sensitivity, Differential Susceptibility, Latent Class Analysis, Path Analysis

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Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1

General Introduction

Forming and maintaining social relationships are among the most important adaptive undertakings that humans face. Membership in a social group provides access to resources, protection, and potential mates that facilitate survival and reproduction (Buss & Schmidt, 1993). A sense of identity emerges from close relationships because children and youths learn how they are different and similar to other individuals through social interactions (Labile, Carlo, & Roesch, 2004; Koepke & Denissen, 2012). Feelings of companionship and belonging to a social group are linked to stress management, and thereby influence mental health, physical health, and longevity (Thoits, 2011). Thus, social relationships play essential roles in multiple areas of human development. Unsurprisingly, the infant-caregiver attachment, often considered to be the foundation for subsequent social relationships, has generated ongoing interest and research.

According to Bowlby (1969), the infant-caregiver attachment is an enduring, strong and affectionate tie that develops within the first year of an infant's life. He further argued that, over the course of evolutionary history, infants successful in forming attachments with caregivers are more likely to survive. Consequently, infants are biologically predisposed to engage in attachment behaviours such as crying, clinging, and smiling that signal their caregivers. In turn, caregivers are predisposed to respond to these signals and provide protection and care. The infant-caregiver attachment develops in the context of these early interactions.

The attachment relationship is thus critically important because it promotes the survival of young children. In addition, the nature or quality of the attachment relationship propels infants along particular developmental pathways of later adaptation or mal-adaptation (Egeland & Carlson, 2004). The basic premise of attachment theory is that early attachment experiences with caregivers shape children's senses of security and trust in the availability of significant others in circumstances of stress (Bowlby, 1969, 1973; Bretherton, 1985). Internal working models, which are expectations for behaving and thinking about the self, other individuals, and relationships, emerge from early attachment experiences. In the context of secure attachment relationships, children develop internal working models of themselves as loved and valued and others as

supportive and trustworthy. In contrast, children with insecure attachments develop internal working models of themselves as worthless and unloved, and of others as rejecting and unavailable. Internal working models guide children's interpretations and expectations of social relationships, and in this way act as the mediating connection between early attachment experiences and later social and emotional behaviours (Johnson, Dweck & Chen, 2007). Empirically, the quality of the infant-caregiver attachment has been repeatedly linked to later social and emotional development and to psychopathology in childhood and adolescence (Egeland & Carlson, 2004; Sroufe, 2005; Deklyen & Greenberg, 2008). The study of the development of the quality of infant-caregiver attachment is therefore not only valuable in its own right but also because it has direct bearings on the process of socio-emotional development and its adaptive and maladaptive consequences.

Stability in Attachment Quality

Research examining the developmental continuity of attachment quality has flourished in the last three decades (see review by McConnell & Moss, 2011). The aim of many longitudinal studies was to determine the typical level of stability in the nature of the attachment relationship (Thompson, 2000). Consequently, the majority of these studies focused on the degree of stability within a sample or a single test-retest coefficient in attachment quality between two time points (see review by Thompson, 2000).

Infancy. Initial investigations on the continuity of attachment were focused on the infancy period. The attachment classifications, developed by Ainsworth (Ainsworth, Blehar, Waters & Wall, 1978) and commonly used to characterize the quality of the mother-infant relationship, have typically been first assessed at around 12 months of age and reassessed 6 to 7 months later. Although early studies suggested moderate to high degrees of stability in attachment classifications during infancy in low-risk samples of mothers and children (96% stability in Waters, 1978; 73% stability in Main & Weston, 1981; 78% stability in Owen, Easterbrooks, Chase-Lansdale & Goldberg, 1984), later studies of similar samples revealed only moderate degrees of stability (i.e., 53% in Thompson, Lamb & Estes, 1982; 58% in Easterbrooks, 1989; and 46 and 52% in Belsky, Campbell, Cohn & Moore, 1996). These results prompted debates between some researchers regarding the stability of attachment quality (see Thompson et al., 1982;

Waters, 1983) and led others to conclude that instability, as opposed to stability, is the norm in attachment development (Belsky et al., 1996).

Infancy to early childhood. The availability of valid attachment measures in early childhood (Cassidy & Marvin, 1992; Main & Cassidy, 1988) in the 1990s soon led to an increased interest in the assessment of attachment continuity beyond infancy (Waters, Merrick, Treboux, Crowell & Albersheim, 2000). As were the cases in infancy, studies examining attachment relationships in older children revealed both continuity and change. While some researchers reported a high degree of stability in attachment classifications between infancy and early childhood (72% in Stevenson-Hinde & Shouldice, 1993; 82% in Wartner, Grossman, Fremmer-Bombik & Suess, 1994), others reported instability (38 and 42% in Bar-Haim, Sutton, Fox & Marvin, 2000).

Beyond early childhood. Lastly, at the turn of the century, a handful of studies became available that examined continuity of attachment from childhood to adolescence or adulthood. The reported levels of stability from childhood to adulthood, once again, varied. While some studies reported moderate degrees of stability (63% in Hamilton, 2000; 64% in Waters et al., 2000), others reported instability in attachment classifications (25% stability in Aikens, Howes & Hamilton, 2009).

Summary. Over 30 years of research has prompted the conclusion that children vary considerably in the extent to which the quality of their attachment relationships remains consistent (Thompson, 2000). Given this variability, the quest for an average level of stability, as many of the above longitudinal studies aimed to achieve, seems doomed to failure (Thompson, 2000). This observation suggests the need for researchers to move beyond the characterization of attachment continuity using a single measure, indicating an average level of stability that is used to characterize a sample or population, to a more nuanced exploration of how patterns of continuity[1] in attachment quality vary between children, and of the factors that underlie the development of different patterns of attachment continuity. As a number of researchers have aptly noted, "it is impossible to

[1] For the sake of simplicity, the term “patterns of continuity” is used to cover both attachment trajectories that feature change and trajectories that feature stability. A child that changes from secure to insecure attachment is one example of a pattern that features change, whereas, a children with stable secure attachment is an example of a pattern that features stability.

resolve such debates [about stability] unless researchers focus on patterns of stability and the developmental mechanisms that may give rise to them" (Fraley & Roberts, 2005; Fraley, Vicary, Brumbaugh, & Roisman, 2011).

Individual Differences in Patterns of Continuity

Multiple assessments of attachment. Few studies have examined the quality of children's attachment relationships across three or more time points (see review by Fraley & Brumburgh, 2004). This limitation has made it difficult for researchers to identify children's patterns of continuity in attachment. Specifically, it has been argued that a two-wave pre-post assessment approach, used by the majority of existing longitudinal studies, restricts children's possible developmental trajectories to a linear shape and therefore obscures children's true processes of change (Fraley & Roberts, 2005). Secondly, two-wave data increases the risk of confounding true change in attachment with measurement error. For example, if assessment error renders the attachment relationship insecure instead of secure at the second assessment, researchers might erroneously conclude that there was a change in attachment when a longer temporal view would suggest otherwise (Rogosa, Brandt, Zimowski, 1982). Consequently, researchers have argued that at least three-waves of attachment data are required to examine patterns of continuity in attachment (Singer & Willet, 2003; Fraley & Brumburg, 2004). Therefore, a longitudinal approach in which investigators follow children and their caregivers over time and collect multiple waves of attachment data at sensibly spaced intervals seems to be the logical first step towards identifying children's patterns of continuity in attachment quality.

Variable centered versus person oriented methodology. Bergman and Magnusson (1997) have also drawn a distinction between variable-oriented and person-oriented approaches to longitudinal research. A variable-centered approach assumes that the relationships between variables affect every individual in the population in approximately the same manner and therefore an average pattern of development is adequate in describing the trajectory of all individuals in the population. Consequently, the goal of variable-oriented approaches is to uncover a population's average pattern of continuity in behaviour. Prototypical variable-oriented techniques include degree of stability, repeated measures ANOVA, correlation coefficient, and regressions (Laursen &

Hoff, 2006). As reviewed above, many existing studies examining stability in attachment quality have used variable-oriented techniques (i.e, a measure of the degree of stability in attachment between two time points). While these variable-oriented techniques are able to answer questions such as the average developmental trajectory in attachment quality in the population, they are unable to address the question of if and how developmental trajectories differ between children in the population.

In contrast, a person-oriented approach assumes that the population is heterogeneous with respect to how variables are related to each other, and thus children within a population have distinct and varied patterns of development (Bergman & Magnusson, 1997). The goal of person-oriented approaches is to describe how individuals differ in their patterns of continuity in behaviour (Collins & Lanza, 2010). Latent class analysis (LCA) is a person-oriented technique that is gaining popularity in developmental research (Collins & Lanza, 2010). A number of studies have used LCA to successfully identify the various developmental trajectories of a number of behaviours (see Collins & Lanza, 2010). A detailed description of LCA is provided by Collins and Lanza (2010). In brief summary, LCA identifies mutually exclusive groups of people in multivariate categorical data by clustering together persons who share similar characteristics or behaviours (Collins & Lanza, 2010). In other words, LCA can be used to identify distinct groups of children with homogenous patterns of continuity in attachment quality over time. A one-class solution in LCA indicates no association in distinct patterns of continuity in attachment across time; therefore, all children are categorized into one trajectory group. A two-class solution, in contrast, indicates two groups of children, each with a distinct pattern of continuity in attachment across time (i.e. two trajectories). Similarly, a three or more class solution indicates three or more groups of children, each with a distinct trajectory of attachment development.

LCA offers several advantages to the study of attachment continuity. First, LCA is able to statistically test the theoretical assumption that there is variation between groups of children in their patterns of attachment continuity. As noted above, this question has not been adequately addressed in the existing literature since most studies have used variable-oriented techniques that identify only the average trajectory of change in a sample rather than the natural occurrence of different patterns of continuity in the

data (Thompson, 2000; Fraley et al., 2011). Second, the number of trajectory groups and the characterization of each trajectory group in LCA are based on statistical indices which can then be verified in independent samples (Collins & Lanza, 2010). This contrasts with methodology used in the few previous studies that have attempted to identify patterns of attachment continuity. In these previous studies, the number of trajectories and characterization of each trajectory were based on researchers' unique interpretations of the data (van Ryzin, Carlson & Sroufe, 2011). As a result, two researchers may derive different attachment trajectories depending on their own interpretations.

Despite the advantages, no study to date has applied LCA to the longitudinal research on attachment quality over time. The identification of different groups of children with distinct patterns of continuity in attachment is critically important not only because it addresses a gap in the literature, but more importantly, the emergence of distinct patterns would provide the empirical basis to then ask questions related to antecedents and sequelae of individual differences in distinct trajectories of attachment development. The application of LCA to the longitudinal research on attachment may therefore lead to a more complete understanding of attachment continuity and change.

Antecedents of Different Patterns of Attachment Continuity: Maternal Sensitivity

A second limitation to the longitudinal research on attachment quality relates to the lack of studies that have examined the mechanisms that give rise to stability or change in attachment over time (see review by McConnell & Moss, 2011). Theory has from the outset portrayed attachment quality as dynamic and subject to multiple influences across development, rather than as an immutable unitary causal link between early experience and later outcome (Bowlby, 1969; Sroufe, Carlson, Levy, & Egeland, 1999). Bowlby's (1973) metaphor of a complex railway system describes this developmental process. Early in life, multiple developmental pathways are available on which children may travel, some leading to secure attachment, whereas others to insecure attachment. The particular pathway is co-determined by the child and his or her current care-giving environment; however, as development progresses, the child generates momentum and the number of available pathways diminish and branch farther apart, making diversion from the current trajectory more difficult and less likely. The railway

metaphor highlights the idea that a child's specific trajectory of development results from the transaction between the child and his or her past and current experiences with the care-giving environment. Consequently, to fully understand why a child develops his or her pattern of attachment continuity, researchers must first investigate continuity in the child's care-giving environment.

Ainsworth asserted that maternal sensitivity is the key proximal determinant of the quality of children's attachment relationships (Ainsworth et al., 1978). Consistent with her proposition, numerous studies have found that children of mothers who are prompt at responding to distress, appropriately stimulating, warm and involved, and synchronous during interactions are more likely to have secure attachment relationships (see meta-analysis by Goldsmith & Alansky, 1987; De Wolff & van IJzendoorn, 1997; Atkinson, Niccols, Paglia, Coolbear et al., 2000). In contrast, children with mothers who are excessively controlling and intrusive, or conversely unresponsive and uninvolved, are more likely to have insecure attachment relationships (Vondra, Shaw & Kevinides, 1995).

According to the same theoretical argument, children's patterns of continuity in attachment should also be shaped by their experiences of stability and change in maternal sensitivity over time. Specifically, children who receive sensitive care-giving across childhood are more likely to develop a pattern of stable secure attachment, whereas children who receive insensitive parenting across childhood are more likely to develop a pattern of stable insecure attachment. Children who experience a change in their mothers' sensitivity are more likely to evidence a shift in their attachment trajectories during childhood in the parallel direction. The causal relationship between change in maternal sensitivity and change in attachment quality is a fundamental prediction of attachment theory; however, no study has fully tested this prediction (see review by McConnell & Moss, 2011). Specifically, there is no published longitudinal study that has examined both maternal sensitivity and attachment security within the same sample repeatedly over more than two time points. This is a significant gap in the literature that have led researchers to conclude, "theory and research point to maternal care-giving quality as an important predictor of infant attachment security; however, no study to date has been able to address whether changes in maternal care-giving quality are linked to changes in infant

attachment security" (Stupica, 2009). Therefore, logical starting points of focus for studies predicting children's development of different patterns of attachment continuity involve: 1) measuring both maternal sensitivity and attachment security at multiple time points, and 2) examining the link between change in maternal sensitivity and change in attachment security.

Antecedents of Different Patterns of Attachment Continuity: Unique Characteristic of the Child

A third notable gap in the current longitudinal attachment literature involves the limited attention that has been paid to the role of children themselves in shaping their attachment stability outcomes (Stupica, 2009). A lack of attention to children's roles in determining their own attachment trajectories results in part from the assumption that all children are affected equally and in the same way by changes in their care-giving environments (Belsky, 1997). This assumption was challenged with the introduction of the differential susceptibility hypothesis (Belsky, 1997). A detailed introduction of the differential susceptibility hypothesis is provided by Belsky (1997, 2005).

In brief summary, the differential susceptibility hypothesis proposes that children in a family would vary in their susceptibility to the same parenting behaviour for genetic reasons or as a result of very early experiences (Belsky, 1997, 2005). In this theory, differential susceptibility is conceptualized as a "plasticity" trait, such that highly susceptible individuals are more sensitive than others to the effects of both positive and negative parental care, and correspondingly, less susceptible individuals are less sensitive to both positive and negative parental care. In this way, children's levels of susceptibility moderate the effect of maternal behaviour on attachment quality. Children with high levels of susceptibility are more likely to evidence secure attachment relationships when exposed to sensitive care-giving, and in parallel, they are also more likely to evidence insecure attachment relationships given insensitive parenting. In contrast, the attachment relationships of children with low levels of susceptibility are less likely to be as reactive and as strongly associated with sensitive or insensitive care.

Several research groups have tested the differential susceptibility hypothesis in the development of attachment security (see Velderman, Bakersman-Kranenburg, Juffer, & van IJzendroon, 2006; Spangler, Johann, Ronai, & Zimmermann, 2009; Schipper,

Oosertman & Schuengel, 2012). Results supporting the differential susceptibility hypothesis in the development of attachment are, however, mixed. Some studies reported findings consistent with the above noted predictions (Bakermans-Kranenburg & van IJzendoorn, 2006), while others reported results that contradict predictions (Gervai, Novak, Lakatos et al., 2007; Spangler, Johann, Ronai & Zimmerman, 2009). These mixed results suggest that the differential susceptibility hypothesis warrants further research in the current attachment literature.

While a number of studies have examined the moderating role of differential susceptibility in the association between maternal behaviour and attachment security, no study has applied the differential susceptibility hypothesis to the longitudinal link between continuity in maternal behaviour and continuity in attachment security. Specifically, the differential susceptibility hypothesis offers a parallel revision of the causal association between change in maternal behaviour and change in children's patterns of attachment by suggesting that children are not equally affected by changes in maternal sensitivity over time (Belsky 1997, 2005; Stupica, 2009). Thus, the differential susceptibility theory predicts that children's patterns of attachment continuity result not from changes in maternal sensitivity but from the interaction between children's susceptibility levels and maternal patterns of continuity in behaviour. Consequently, highly susceptible children are more likely to change in attachment quality following changes in maternal sensitivity and they are also more likely to show stability in attachment following experiences of stability in maternal sensitivity. In contrast, this causal association is less likely to apply to children with low levels of susceptibility. The differential susceptibility hypothesis adds another dimension to the central tenet of attachment theory that warrants further investigation.

Summary and Outline of Dissertation

Although the study of attachment continuity has flourished within the last several decades, there are still a number of significant gaps in the literature that warrant investigation. These include the dearth of studies that have empirically identified how children differ in their patterns of continuity in attachment development (Thompson, 2000); the few longitudinal investigations examining change in factors that underlie these patterns of continuity, such as change in maternal sensitivity over multiple time points

(McConnell & Moss, 2011); and the limited attention that has been paid to the unique role of children's susceptibility levels in influencing attachment stability outcomes (Stupica, 2009; Belsky, 1995). Consequently, it has been noted that researchers currently do not have a strong understanding of the precise factors that may change a person's attachment style (Fraley, 2010) and additional research looking at factors that could be influential in predicting stability and change in attachment relationships is needed (McConnell & Moss, 2011). A longitudinal study with repeated assessments of both attachment security and theoretical antecedents at sensibly spaced intervals across development is the first step towards addressing these gaps in the literature (Willet, Singer & Martin, 1998).

Purpose. The broad goal of this dissertation is to identify children's patterns of continuity in attachment quality across early childhood and to elucidate the processes that may influence the development of these different patterns. In a series of four inter-related studies, this dissertation attempts to address the gaps in the literature identified above. In each of the four studies, multiple examinations of either or both the predictors of change and attachment security are assessed. The use of such longitudinal data is a significant strength of this dissertation.

Study 1. In brief summary, the first study of this dissertation aims to use LCA to identify the patterns of continuity in attachment quality from infancy to early childhood in a low-risk community sample of mothers and their children. The quality of children's attachment relationships are assessed in infancy, toddlerhood, and preschool years.

Study 2. The second study builds on the results of the first study and investigates the longitudinal association between change in maternal sensitivity and change in attachment security in the same community sample of mothers and children. Specifically, study two assesses how children's experiences of maternal sensitivity over time are related to different trajectories of attachment development. Maternal sensitivity and attachment security are each assessed in infancy, toddlerhood, and preschool years in this study.

Study 3. The third study of this dissertation builds on results of the previous two studies and addresses how children's levels of susceptibility to parenting influences may affect their attachment trajectories in the same low-risk community sample. Children's

levels of susceptibility are assessed in infancy. The moderating role of differential susceptibility in the association between change in maternal sensitivity and change in children's patterns of attachment development is examined.

Study 4. Lastly, the fourth study of this dissertation again uses LCA to identify underlying patterns of continuity in attachment quality over early childhood, but with a sample of high-risk low-SES adolescent mothers and children. In addition to providing a systematic replication of the approach used in Study 1 in a different sample, this study also allows for a comparison of the patterns that emerge from a high-risk sample of children with those in a low-risk sample of children. It is hypothesized that the high-risk sample of children would exhibit more distinct patterns of change in attachment quality and show qualitative different trajectories of change than the low-risk sample of children.

Concluding Comments

Attachment is a dynamic process that is aptly described by Bowlby as lasting "from the cradle to the grave" (Bowlby, 1973). Bowlby's metaphor of a complex railway system illustrates how the development of attachment can proceed along an array of pathways wherein change is always possible but constrained by paths previously taken. Bowlby believed that the key goals of developmental science are to map the pathways by which children develop, and more importantly, uncover the processes that either keep children on their specific courses or allow them to deviate from paths previously travelled (Fraley & Brumburgh, 2004). It is hoped that the findings from this dissertation will help map these attachment pathways and contribute towards increasing understanding of the factors that lead to different pathways of attachment development.

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Chapter 2

Study 1: Patterns of Continuity in Attachment Quality across Early Childhood

An attachment is a strong and enduring emotional connection that develops between an infant and caregiver (Bowlby, 1969). The infant-caregiver attachment is characterized by the infant's tendency to seek and maintain physical proximity and contact to a specific caregiver, particularly when under stress (Colin, 1996). According to Bowlby (1969), the original selective pressure in evolution that fostered the development of the infant-caregiver attachment is protection. Infants faced dangers from predators, cold, and hunger over the course of evolution, and those able to achieve physical proximity and contact to caregivers are more likely to survive (Bretherton & Munholland, 1999). Consequently, infants are predisposed to signal their caregivers via attachment behaviours, such as crying, following, smiling, and clinging. In turn, caregivers are inclined to respond to their infants' signals and provide protection and care. The infant-caregiver attachment develops in the context of these early interactions.

Individual Differences in Attachment Quality

Although the tendency to form attachment relationships with caregivers is innate, the quality of the attachment differs between infant-caregiver dyads. Mary Ainsworth expanded on Bowlby's ideas and pioneered the research on individual differences in attachment quality (Ainsworth, Bell & Stayton, 1971). According to Ainsworth, the manner by which infants organize their attachment behaviours is indicative of their perception of the availability of their caregivers to provide comfort and protection, should these needs arise (Weinfeld, Sroufe, Egeland, & Carlson, 2008). Ainsworth subsequently developed a laboratory procedure, the Strange Situation Procedure (SSP), for assessing individual differences in attachment quality during infancy (Ainsworth, Blehar, Waters & Wall, 1978)

The SSP involves a series of stressful separations and reunions between mothers and infants. Infants' patterns of attachment are considered based on their use of their mothers for safety during experiences of stress: infants that actively seek proximity and comfort from their mothers when stressed are considered to have secure attachment relationships; infants that deliberately avoid proximity and contact are considered to have insecure-avoidant attachment relationships; infants that show a mixture of proximity

seeking and contact resistant behaviours are considered to have insecure-ambivalent/resistant attachment relationships; and infants that display a mixture of odd and contradictory attachment behaviours, and at times appear dazed, confused, or apprehensive of their caregivers are considered to have disorganized attachment relationships (Ainsworth et al., 1978; Main & Solomon, 1990).

Secure, avoidant and ambivalent/resistant attachments are termed organized attachments because they represent efforts by children to organize their behaviours in a coherent manner to achieve proximity to the caregiver. In contrast, disorganized attachment reflects the absence or breakdown in children's coherent attachment strategies for coping with stress (Main & Solomon, 1990). Children classified as disorganized are also assigned a secondary best-fitting organized classification (e.g. disorganized/secure) because organized and disorganized attachments are considered orthogonal dimensions (van IJzendoorn, Schuengel & Bakermans-Kranenburg, 1999).

Empirical Findings of Continuity in Attachment Quality

Longitudinal studies looking at stability in attachment classifications quickly followed the development of the SSP. Initial research found remarkable stability in attachment classifications between 12 and 18 months of age (e.g. 96% in Waters, 1978). Following Water's results, efforts arose to determine the typical level of stability in attachment classifications (Thompson, 2000). Subsequent reports, however, have painted a somewhat inconsistent picture of stability.

Stability in infancy. Early longitudinal studies on attachment stability were focused on the infancy period. Attachment classifications were typically first assessed at around 12 months of age and reassessed 6 to 7 months later. Among low-risk samples: Main and Weston (1981) reported 73% stability for organized (i.e. secure, avoidant, and ambivalent/resistant) infant-mother classifications and 85% stability for organized infant-father classifications; Owen, Easterbrooks, Chase-Lansdale and Goldberg (1984) reported 78% stability for organized infant-mother classifications and 64% stability for organized infant-father classifications; Thompson, Lam and Estes (1982) reported 53% stability for organized infant-mother classifications; and Belsky, Campbell, Cohn and Moore (1996) reported 46% and 52% stability for organized infant-mother classifications, and 46% stability for organized infant-father classifications.

Among high risk samples: Vaughn, Egeland, Sroufe and Waters (1979) reported 62% stability for organized infant-mother classifications; Lyons-Ruth, Repacholi, McLeod and Silva (1991) reported 60% stability for organized infant-mother classifications, but only 30% stability when disorganized attachment was included (resulting in a four-way analysis: secure, avoidant, resistant and disorganized); Vondra, Shaw, Swearingen, Cohen and Owen (2001) reported 45% stability in the four organized and disorganized infant-mother classifications; and lastly, Edwards, Eiden, and Leonard (2004) reported 60% stability in the four infant-mother classifications.

In summary, both stability and change characterized the development of attachment classifications across infancy in these studies. Among low-risk samples, reported stability ranged from low (46% in Belsky et al., 1996) to high (96% in Waters, 1978), whereas, stability in high-risk samples tended to be lower and ranged from low (30% in Lyons-Ruth et al., 1996) to moderate (60% in Edwards et al., 2004). The degree of stability in infant-mother attachment classifications and infant-father classifications was comparable.

Stability from infancy to early childhood. Due in part to a lack of attachment measures that could be applied beyond infancy, few researchers initially planned long-term follow up assessments of attachment (Waters, Merrick, Treboux et al., 2000). Over the last two decades, validated measures for preschoolers (e.g. Cassidy & Marvin, 1992) and 5 to 7 year olds (e.g. Main & Cassidy, 1988) have become available, leading to an increased interest in the assessment of attachment in early childhood. However, the number of studies examining stability in attachment classifications from infancy to early childhood is limited in comparison to the number of infant studies.

Among longitudinal studies examining stability from infancy to age six: Main and Cassidy (1988) reported 84% stability in the four organized and disorganized infant-mother classifications and 61% stability in the four organized and disorganized infant-father classifications; and Wartner, Grossmanna, Fremmer-Bombik and Suess (1994) reported 82% stability in the four organized and disorganized infant-mother classifications. Among longitudinal studies examining stability from infancy to preschool age: Howes, Hamilton and Philipsen (1998) reported 76% stability in organized infant-mother classifications; Bar-Haim, Sutton, Fox and Marvin (2000) reported 64% stability

in infant-mother organized classifications between 14 and 24 months, 42% stability between 14 to 58 months, and 38% stability between 24 to 58 months; and lastly, a study conducted by NICHD Early Child Care research Network (2001) reported "[statistically] significant but modest" stability (k = .057, 46% stability) in the four organized and disorganized infant-mother classifications between 15 and 36 months.

In summary, as with the cases in infancy, available studies reported both stability and change in attachment classifications from infancy to early childhood. All published studies were with low-risk samples. The reported stability levels ranged from low (i.e. 38% in Bar-Haim et al, 2000) to high (i.e. 84% in Main & Cassidy, 1988).

Stability from infancy to adolescence and early adulthood. During adolescence and adulthood, attachment needs and behaviours are gradually transferred to peers and romantic partners (Allen, 2008); however, the impact of early attachment experiences with caregivers remains (Bowlby, 1969, 1982). Internal working models, which are expectations for behaving and thinking about the self, other individuals, and the relationship between self and others, emerge from early experiences with caregivers, and significantly affect adolescents' and adults' abilities to form new relationships (Mcconnell & Moss, 2011). The assessment of attachment quality in adolescence and adulthood focuses on internal working models, also called mental representations of attachment, rather than observable attachment behaviours (Allen, 2008).

Five studies have assessed stability in attachment classifications from infancy to adolescence and adulthood. Among low risk samples: Hamilton (2000) reported 63% stability in organized attachment classifications from infancy to late adolescence; Waters and colleagues (2000) reported 64% stability in organized attachment classifications from infancy to age 20; Lewis, Feiring and Rosenthal (2000) reported 51% stability in secure versus insecure classifications[1] between infancy and age 18; and in the most recent study, Aikens, Howes, and Hamilton (2009) reported 25% stability in the four organized and disorganized classifications between infancy and age 16. Only one study has explored stability from infancy to age 19 in a high-risk sample, and reported 38.6% stability in organized attachment classifications (Weinfield, Sroufe & Egeland, 2000).

[1] Insecure category encompasses avoidant and resistant attachment; disorganized attachment is forced classified into their secondary organized classifications

In summary, five studies have examined stability in attachment classifications from infancy to adolescence and adulthood, and as with the cases focusing on infancy and childhood, have reported stability and change. In low-risk samples, stability levels in these studies ranged from low (i.e. 25% in Aikens et al., 2009) to moderate (i.e. 63% in Hamilton, 2000). Only one study has examined stability between infancy to adulthood in a high-risk sample, in which substantial change was reported (i.e. 38% stability in Weinfield et al., 2000).

Summary. From over 30 years of research arises the conclusion that children vary considerably in the extent to which the quality of their attachment relationships remains individually consistent. This variability makes it impossible to identify a meaningful average level of stability in attachment classifications, as the early longitudinal studies aimed to achieve (Thompson, 2000). Initially researchers found these inconsistent findings somewhat surprising (Thompson, 2000); however, a review of Bowlby's (1973) model of development suggests that these findings are wholly consistent with theoretical predictions.

Theoretical Considerations of Continuity in Attachment Quality

The development of infant-caregiver attachment is aptly described by Bowlby's (1973) metaphor of a complex railway system. Early in life, multiple pathways are available on which a child may travel, some leading to secure attachment, whereas others to insecure attachment. The particular pathway is co-determined by the child and his or her current environments; however, as development progresses, the child generates momentum and the number of available pathways diminish and branch apart, making diversion from the current trajectory difficult and less likely.

Internal working models. Central to Bowlby's developmental pathway model is the concept of internal working models. As mentioned previously, children construct internal working models of themselves, of other people, and of the relationship between self and others as a result of early attachment experiences with significant caregivers (Bowlby, 1973). Children with secure attachment relationships develop internal working models of themselves as loved and valued, and others as supportive and trustworthy. In contrast, children with insecure attachment relationships develop internal working models of themselves as worthless and unloved, and others as rejecting and unavailable.

Internal working models help children predict their caregivers' behaviours and intentions and organize their own behaviours to ensure that their attachment needs (i.e. proximity to the caregiver, and therefore safety from threat) are met (Howe, 2011). Infants with secure attachment relationships approach their caregivers directly with expectations that their distress will be recognized and responded to. In contrast, infants with avoidant or ambivalent/resistant attachments mask or maximize their displays of distress with expectations that their attachment bids will be rejected or inconsistently responded to. Not only do children engage in behaviours that reflect their internal working models, but they also evoke responses from others that are consistent with their mental representations of attachment relationships. Internal working models are therefore self-perpetuating and tend to maintain the existing organization of attachment relationship (Bowlby, 1969).

Transactional process in attachment development. Although internal working models have a propensity towards stability, they are not assumed to be immutable throughout the life course. Internal working models serve an adaptive function and need to be adjusted to environmental changes in order to remain adequately predictive (Bretherton & Munholland, 1999). Internal working models and their associated attachment classifications are therefore revised in certain situations: when an attachment figure persistently behaves in ways that do not match expectations; when new relationships develop that differ from previous relationships; and when individuals acquire cognitive reasoning skills that allow them to re-evaluate the meaning of past relationships (Bretherton & Munholland, 1999). Internal working models are therefore constructed and reconstructed in a transactional process between children and their care-giving environments.

Summary. Since the outset, Bowlby was interested in mapping the pathways by which children develop. A quantitative prediction was never made about the degree of stability in attachment classifications that should be observed across time. In fact, Bowlby presented three core ideas that suggested both stability and change in attachment classifications: (1) children develop internal working models of attachment that tend to maintain their existing qualities of attachment, (2) change in attachment quality is possible and results from the transactional interaction between children and their current

care-giving environments, and (3) children's organizations of attachment behaviour are most flexible early in life, and become more resistant to change over development as internal working models consolidate from repeated and similar interactions. As Fraley and Brumburgh (2004) aptly summarized, "the power of Bowlby's theory lies not in the prediction that it makes about the degree of stability that should be observed […] but in the patterns of stability that should be observed over time". In light of these considerations, understanding the continuity of attachment quality, they argued, requires studying the patterns of stability and change in attachment quality observed, not simply the magnitude of the stability coefficient between two time points.

Universal Versus Individual Patterns of Continuity in Attachment Quality

The majority of longitudinal studies on stability in attachment quality have assessed variation in attachment classifications on two occasions (Fraley & Brumburgh, 2004). This two-wave approach assumes that the degree of stability in attachment classifications between two time points is indicative of the long term course of the attachment relationship (Fraley & Roberts, 2005). This assumption is problematic for two reasons. First, individual change takes place continuously over time and a single test-retest coefficient often obscures information about the process of change. Second, two-wave studies may confound true change with measurement error. If assessment error renders the attachment classification insecure instead of secure at the second time point, researchers might conclude erroneously that there was a change in attachment quality when a longer temporal view would suggest otherwise (Rogosa, Brandt, & Zimowski, 1982). To study continuity in attachment quality, a truly longitudinal perspective needs to be adopted – investigators must follow children and their caregivers over time and collect multiple waves of attachment classification data at sensibly spaced intervals (Willet, Singer, & Martin, 1998).

Universal versus individual patterns of continuity. Bergman and Magnusson (1997) have drawn a distinction between variable-oriented and person-oriented approaches to longitudinal research. A variable-centred approach assumes that the relationships between variables are similar for all individuals in the population. Consequently, a variable-oriented approach is best suited for questions concerning universal patterns of change in a population over time. The goal of a variable-oriented

approach is to describe the average trajectory of change in a single construct and to identify antecedent factors that predict deviation from that trajectory. Prototypical variable-oriented techniques include repeated measures ANOVA, correlations, and regressions (Laursen & Hoff, 2006).

In contrast, a person-oriented approach assumes that the population is heterogeneous with respect to how variables are related to each other. As a result, inter-individual differences need to be examined to thoroughly understand development (Bergman & Magnusson, 1997). The goal of a person-oriented approach is to describe how individuals differ in their patterns of development.

According to attachment theory, all children develop internal working models based on their histories of repeated interactions with caregivers, which then guide their organizations of attachment behaviours (Bowlby, 1973). Changes in attachment classifications are possible but increasingly unlikely across development as children experience repeated and similar interactions that consolidate their expectations and beliefs about themselves, caregivers, and their relationships. The organization of attachment is therefore most flexible early in life, and becomes increasingly resistant to change over time. This theorized developmental trajectory in attachment is assumed to be universal to all children and a variable-oriented approach that investigates the average developmental trajectory is appropriate in examining this aspect of the theory.

Attachment theory also argues that the dynamic interactions between children and their caregivers determine the quality of their attachment relationships (Bowlby, 1973; Ainsworth, et al., 1978). In this way, children would differ in their attachment relationships depending on their unique histories of interactions. Correspondingly, children would also differ in their patterns of continuity in attachment quality depending on their unique histories of interactions with their caregivers. To address this aspect of the theory, a person-oriented approach is needed to identify the different patterns of attachment continuity that exists between groups of children within the population.

Latent class analysis. Latent class analysis (LCA) is a person-oriented approach that allows for identification of distinct groups of children who are homogenous within their developmental trajectory yet distinct from children following other trajectories; such as, children who maintain a secure attachment trajectory versus children who maintain an

insecure attachment trajectory and children who change from secure to insecure attachment across time. A growing body of research has used LCA to study the developmental trajectories of a variety of behaviours (Collins & Lanza, 2010). Although LCA has been used to identify distinct patterns of mother-infant interactions (Bailey, Moran, Pederson et al., 2007), this approach has not been applied to the longitudinal research in attachment quality over time.

Not only can LCA test the theoretical assumption that attachment trajectories systematically differ between children, it also offers a number of advantages to longitudinal analysis with categorical attachment data. These include the ability to compare numerous levels of a categorical variable and accommodate missing values (Bailey et al., 2007; Collins & Lanza, 2010). According to Laursen and Hoff (2006), a concerted effort to match theory, methodological paradigms, and data analytic techniques is essential in longitudinal research. The application of LCA to the longitudinal research on attachment may therefore lead to a more complete understanding of how children differ in their trajectories of attachment development.

Change in Attachment Classification versus Change in Degree of Attachment Security

A longstanding debate within the attachment literature is whether individual differences in attachment are continuously or categorically distributed. As the review that follows will argue, the manner in which the attachment construct is conceptualized has important implications for longitudinal research on attachment quality.

Categorical versus continuous measures of attachment. During the coding of the SSP, coders first rate children on four continuous scales that describe their attachment behaviours toward their mothers: avoidance, proximity seeking, contact maintenance, and resistance to contact. Infants are then classified into attachment categories based on their behavioural scores and through comparisons with prototypical secure, avoidant and ambivalent/resistant attachments as described by Ainsworth (Ainsworth et al., 1978).

In a multiple discriminant function analysis predicting attachment classifications from the four continuous scales, Ainsworth and colleagues (1978) found that 92% of their sample were correctly classified on the basis of a linear combination of behavioural ratings. Though Ainsworth and colleagues developed a set of continuous scales that were

able to capture individual differences in the patterns of infant attachment behaviours, they adopted a categorical model of attachment for two main reasons: (1) they believed that the behavioural scales were not fully representative of all the ways in which infants with secure, avoidant and ambivalent/resistant attachments differed from one another; and (2) they argued that "classificatory groups help retain the picture of patterns of behaviour, which tend to become lost in – or at least difficult to retrieve from – the quantification process". The categorical model has since become the standard for researchers investigating attachment.

Researchers have since questioned whether variation in attachment quality can be comprehensively described using a categorical model (Cummings, 1990; Fraley & Spieker, 2003). Fraley and Spieker (2003) applied Meehl's (1973) taxometric techniques for uncovering latent structures to 1139 infant-mother dyads and found that organized attachment patterns do not adhere to a categorical structure. Their analysis indicated that variation in infant attachment quality is continuously distributed.

Cummings (1990) also provided four arguments for a continuous approach to attachment. First, a continuous approach provides more subtle information about differences between individuals, which may be lost when individuals are lumped together in broad categories. Second, an individual's true attachment organization may be on the borderline between categories, leading to potential errors in classifications. Third, normal and very deviant attachment organizations would be represented by variations along the same dimension, enhancing statistical comparisons. And lastly, a continuous approach may substantially increase statistical power (Cohen 1988).

At present, it is unclear whether variation in attachment quality is better conceptualized as categorically or continuously distributed. While a categorical approach conceives individual differences as a matter of kind, a continuous approach conceives differences as a matter of degree (Zachrisson, 2008). Longitudinal research using a categorical measure of attachment can be used to describe changes across group membership (i.e. change form secure to insecure), while longitudinal research using a continuous measure can be used to describe changes in the degree of attachment security. As a result, the two approaches to longitudinal research are considered by some researchers to be fundamentally different (Zachrisson, 2008). In light of the arguments

for both approaches, examining continuity in both categorical and continuous measures of attachment is important and necessary to the study of attachment stability.

Purpose of Present Study

Attachment is a dynamic process that lasts "from the cradle to the grave" (Bowlby, 1973). Bowlby's railway system metaphor illustrates how the development of attachment can proceed along an array of pathways wherein change is always possible but constrained by paths previously taken. Bowlby believed that the key goals of developmental science are to map the pathways by which children develop, and more importantly, uncover the processes that either keep children on their specific courses or allow them to deviate from paths previously travelled (Fraley & Brumburgh, 2004).

Empirical research examining the continuity of attachment has flourished within the last three decades; however, studies have commonly focused on the degree of stability between two time points. Although Bowlby believed that early attachment relationships serve as the foundation for subsequent relationships, he never made a quantitative predication about the degree of stability that should be observed. Both stability and change in attachment quality are equally consistent with his theory. Understanding the development of attachment quality, therefore, requires examining not simply the magnitude of stability but also the patterns of continuity in attachment (Fraley & Brumburg, 2004).

The overall goal of the present study is to identify children's patterns of continuity[2] in attachment quality across early childhood. Early childhood is a critical period for examining continuity in attachment because internal working models are just emerging, and the associated attachment classifications are most flexible during this period (Bowlby, 1973).

Further considerations. A review of the longitudinal literature on attachment revealed three methodological issues that need to be considered. First, assessment of developmental continuity requires the collection of multiple waves of data across time.

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[2] For the sake of simplicity, the term "patterns of continuity" is used to cover both attachment trajectories that feature change and trajectories that feature stability. A child that changes from secure to insecure attachment is one example of a pattern that features change, whereas, a children with stable secure attachment is an example of a pattern that features stability.

Two-wave data, commonly reported in the literature, might confound true change with measurement error and obscure information about the process of change. Therefore, repeated assessments of attachment in infancy, toddlerhood, and preschool years are conducted in this study.

Second, Bowlby's theory postulates universal and individual differences in patterns of continuity in attachment quality. According to Bowlby, the developmental trajectories of some children would differ from those of others depending on the interaction between children and their environments (Laursen & Hoff, 2006). The present study is interested in increasing understanding of both universal processes and between-individual patterns of continuity in attachment quality and accordingly, both variable and person-oriented approaches are employed.

Lastly, a categorical model to individual differences in attachment is fundamentally different from a continuous model. While longitudinal research with categorical data assesses change in group membership, longitudinal research with continuous data assesses change in the degree of security. At present it is unclear whether individual differences in attachment is better conceptualized as categorically or continuously distributed. Consequently, researchers have recommended the combined use of continuous and categorical data (Colin, 1996). Accordingly, the present study examines both categorical and continuous measures of attachment in infancy, toddlerhood, and preschool years.

Summary. To recapitulate, the present study aims to identify: (1) the patterns of continuity in attachment classifications from infancy to early childhood, and (2) the patterns of continuity in a continuous measure of attachment security from infancy to early childhood. It is hoped that a combined use of classification and continuous data would yield more information about the developing mother-child attachment relationship than either measure could yield by itself. Given the exploratory nature of this study, no hypotheses are formulated.

Method

Participants

This study is part of a longitudinal investigation of a community sample of mother-child dyads conducted by the Child Development Centre at Western University.

Seventy-eight mothers and their children (*n* = 36 female, *n* = 41 male, *n* = 1 withdrew before demographic data were collected) were recruited from two hospitals in London Ontario in 2005 (see Appendix A for the Ethics Approval, and Appendix B for Letter of Information and Consent Form). Mothers were approached shortly after the infant's birth. All infants were of full term gestation and physically healthy at birth.

The present study employed data from 63 mother-infant dyads at 13 months infant age (*n* = 30 female, *n* = 33 male); 60 dyads at 27 months of age (*n* = 30 female, *n* = 30 male); and 46 dyads at 42 months of age (*n* = 24 female, *n* = 22 male). There were no demographic differences between participants that completed the study and participants that dropped out (see Appendix C). Demographic data were collected during a 3-month home visit and updated over time. Average maternal age at the time of the infant's birth was 30.08 years (*SD* = 4.97, *range* = 20.20 – 44.85), and average paternal age was 32.27 (*M* = *SD* = 5.95, *range* = 20.43 - 53.97). Five percent of the mothers were single, 1.3% were separated, 18.4% were living in common law, and 75% were married. Ninety-six percent of mothers were on maternity leave at the start of the study. Reported household income ranged from less than $10, 000 (*n* = 1) to greater than $80, 000 (*n* = 21); the average was within the CAN $50 -59, 000 range, which was consistent with the average household income for the city of London Ontario in 2005 (Statistics Canada, 2005). Average maternal education was 14.52 years (*SD* = 1.73, *range* = 11-18 years), and average paternal education was 14.20 years (*SD* = 2.00, *range* = 10 – 20 years). A composite socio-economic status score was calculated by standardizing household income and education then adding the standard scores (Cohen, Doye & Baum, 2006). This variable was employed in all subsequent analyses. Tests of potential demographic confounding variables are reported in Appendix D. None of the demographic variables met criteria for inclusion as covariates (Leerkes, Blankson & O'Brien, 2009) and were therefore not retained in further analyses.

Measures

Strange situation procedure. At 13 months infant age, mother-infant dyads visited Western University and participated in the Strange Situation Procedure (SSP; Ainsworth et al., 1978). This SSP consists of a series of increasingly stressful 3-minute separation and reunion episodes designed to elicit infant attachment behaviour. The

quality of the attachment relationship is determined from the pattern of attachment behaviour displayed by the infant upon reunion with the mother after brief stressful separations. Attachment behaviour is rated along four continuous 7-point dimensions: proximity seeking, contact maintenance, proximity avoidance, and contact resistance. Based on the infant's scores along these four dimensions, the mother-infant relationship is classified into one of three organized patterns: secure, avoidant, and ambivalent/resistant.

The extent of disorganization of each relationship is also assessed in the SSP (Main & Solomon, 1990). Disorganization is evidenced by seven categories of "odd" or "incoherent" behaviour (e.g., disorientation) displayed by the infant during the SSP. Disorganized behaviour is assessed using a continuous 9-point scale. An infant with a score greater than five is classified as disorganized. Disorganized attachment is theorized to be orthogonal to organized attachment patterns. Therefore, an infant with a disorganized classification is also assigned a best-fitting secondary organized classification (e.g. disorganized/secure).

In the current study, trained coders who had passed the official SSP reliability test and were blind to all other participant data assigned the attachment classifications. Twenty SSP were randomly selected and independently coded for the purpose of reliability. The coders agreed on the primary classifications 18 out of 20 times (90% agreement, $\kappa = .83$, $p<.01$). Disagreements between coders were resolved by consensus.

Interesting but scary paradigm. At 27 months of age, mother-toddler dyads visited Western University and participated in the Interesting but Scary Paradigm (IbS; De Oliveira, 2001), a validated measure of attachment for children in this age range (Forbes, Evans, Moran & Pederson, 2007). Retaining many of the procedural elements of the SSP (Ainsworth et al., 1978), the IbS involves a 10-minute separation, a 5-minute reunion and free play session, and the introduction of an interesting but at the same time slightly scary toy spider (3 minutes). The toy spider is designed to activate toddlers' attachment systems and elicit attachment behaviour, but at the same time and in conflict, it serves as a novel and interesting toy, which should activate exploratory behaviour. How toddlers use their mothers as part of their strategies for coping with the two conflicting systems gives important indications of the quality of their attachments.

The quality of the attachment relationship is determined from the global pattern of attachment behaviour displayed by the toddler upon reunion with the mother and throughout the introduction of the spider stimulus. Attachment behaviour is rated along four 7-point scales, three of which parallel the SSP dimensions (i.e. proximity seeking, contact maintenance, and contact resistance). The fourth scale, failure to engage caregiver, is used to assess proximity avoidance in the spider episode. The failure to engage caregiver scale is an elaboration of the SSP proximity avoidance scale, and considers physical avoidance, inhibition of social and affective interaction, and lack of assistance seeking from the mother (See Appendix E).

As with the attachment classification system used in the SSP, mother-toddler dyads are first classified into one of three organized attachment relationships (i.e. secure, avoidant, and resistant/ambivalent) based on children's behaviours in the reunion and spider episodes. Dyads are then assessed according to indices of disorganization, and those with a score of five or higher are classified as primary disorganized with a best-fitting secondary organized classification (e.g. disorganized/secure).

In the current study, a primary coder trained in IbS coding, and blind to other data about the participants, assigned the classifications. Sixteen IbS were randomly selected and independently coded by a secondary coder for the purpose of reliability. Coders agreed on the attachment classifications 13 out of 16 times (81% agreement, $\kappa = .72$, $p < .01$). Disagreements between coders were resolved by consensus.

Preschool strange situation procedure. At 42 months of age, mother-child dyads visited Western University and participated in the Preschool Strange Situation Procedure (Preschool-SSP; Cassidy & Marvin, 1992). Several differences exist between the Preschool-SSP and Ainsworth's SSP: (1) the separations are slightly longer, (2) mothers are not as constrained in their behaviour, and (3) mother-child dyads are allowed to negotiate the separation. According to Cassidy and Marvin (1992), such changes were made to fit the more advanced communication, loco-motor, cognitive, and emotional regulation skills of preschool-age children. The Preschool-SSP involves a series of two separations and two reunions/free play sessions with the caregiver (approximately 5 minutes each in duration).

Based upon children's attachment behaviours during the Preschool-SSP (Cassidy & Marvin, 1992), dyads are assigned one of the following primary attachment classifications: secure, avoidant, ambivalent/resistant, disorganized, role-reversed, or insecure-other. Secure, avoidant, and ambivalent/resistant classifications in the Preschool-SSP parallel those in the infant SSP and toddler IbS. Role-reversed and insecure-other classifications are subsets of a larger disorganized group classification. Children with role-reversed attachments appear to take on either a care-giving or punitive parental role toward their mothers, while children with insecure-other attachments appear to lack a coherent strategy for approaching their attachment figures. In the Preschool-SSP, a secondary classification is given only if children demonstrate additional behaviours characteristic of another attachment classification. Therefore, unlike the infant and toddler classification systems, preschool children with disorganized attachments may not necessarily be assigned a secondary organized attachment.

Preschool attachment classifications were assigned by trained coders who had passed the official Preschool Attachment Classification System (Cassidy & Marvin, 1992) and were blind to other data regarding the dyads. Nine Preschool-SSP were randomly selected and independently coded by two coders for the purpose of reliability. These coders agreed on the primary classifications 8 out of 9 times (88% agreement, κ = .83, p<.01). Disagreements between coders were resolved by consensus.

Mini-attachment q-sort. The Attachment Q-Sort (AQS; Waters & Deane, 1985) is a validated measure of attachment security (see meta-analysis by van IJzendoorn, Verijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). The AQS can be used in a number of settings to assess the degree of attachment security in children ages one to five (Waters, n.d.). It contains 90 item statements with specific references to children's attachment behaviours (e.g. "Child clearly shows a pattern of using mother as a base from which to explore"). Trained sorters arrange the statements into nine piles of 10 cards, ranging from pile-1(*least like the child*) to 9 (*most like the child*). Each item statement is assigned a score based on which pile it is sorted into (i.e. a score from 1 to 9). An attachment security score is obtained by performing a correlation between the AQS of the observed child with the criterion sort of the prototypically secure child provided by a group of experienced researchers in the field of attachment. A highly positive correlation

indicates a strong similarity between the observed child and the prototypically secure child. In other words, children who are more able to use their mothers as a secure base and safe haven receive higher AQS scores than those who are less effective in doing so.

The sorting of the 90 AQS items is labour intensive and requires approximately an hour to complete. A condensed version of the AQS, the Mini-AQS containing 30 item statements, was created in response to the time consuming requirement of the 90-item sort. The 30 items were chosen to reflect statements that had the lowest and highest scores (e.g. scores of 1 and 9) on the 90-item AQS criterion sort. Trained coders sort the 30 item statements into five equal piles of six cards, ranging from 1 (*least like the child*) to 5 (*most like the child*). AQS data of 50 mother-infant dyads were randomly selected from a previously collected high-risk sample and examined (see Forbes et al., 2011 for a description of this sample). The correlation between the Mini-AQS and 90-item AQS in the high-risk mother-infant sample was .92.

Three coders, blind to other data regarding the mother-child dyad, completed the mini-AQS after watching videotaped observations of the 13-month SSP, 27-month IbS, and 42-month Preschool-SSP, respectively. Application of AQS methodology in a laboratory setting involving a modified SSP has been conducted by previous researchers (see Carlson, Hostinar, Mliner, & Gunnar, 2014). In the current study, 20 Mini-AQS at 13 months, 13 at 27 months, and 11 at 42 months were randomly selected and independently sorted for the purpose of reliability. Average item-by-item inter-rater reliability was .75, .73, and .72 for the 13, 27, and 42-month assessment, respectively.

Procedure

At three months infant age, mother-infant dyads were visited at home, during which demographic data were collected. The larger study of which these participants were part of involved a number of other measures conducted at this time. These were not utilized in the analyses presented here. Mother-infant dyads then visited Western University and participated in the SSP at 13 months, IbS at 27 months, and Preschool-SSP at 42 months. The interactions between mother-infant dyads during the SSP, IbS, and Preschool-SSP were videotaped and used for the assessment of the quality of their attachment relationships at 13, 27, and 42 months.

Overview of Data Analysis

The current study explored patterns of continuity in both categorical and continuous measures of attachment across early childhood. First, patterns of continuity in the four-way categorical distribution (i.e. secure, avoidant, ambivalent/resistant, and disorganized) were assessed. The four-way distribution was then collapsed into a two-way secure versus insecure dichotomy. In other words, attachment relationships were characterized as simply secure or insecure. Theory and empirical research consistently suggest that children with secure attachment relationships show more favourable socio-emotional outcomes than children with insecure attachment relationships (Deklyen & Greenberg, 2008). As a result, a secure versus insecure dichotomy is the most general division of attachment patterns used in the literature (Crittenden, Claussen, & Kozlowska, 2007). A secure versus insecure dichotomy is also more comparable to the continuous measure of attachment (i.e. Mini-AQS Scores) used in the current study since they both assess continuity on the dimension of security (Carlson et al., 2014). Given these reasons, and in keeping with much of the longitudinal research on attachment (see the literature reviewed in the introduction), patterns of continuity in the two-way secure versus insecure dichotomy were examined second. Finally, the patterns of continuity in Mini-AQS scores, a continuous measure of the degree of attachment security, were explored.

Latent class analysis. The underlying patterns of continuity in attachment classifications across all three time-points were examined with latent class analysis (LCA). Detailed descriptions of LCA are presented by Collins and Lanza (2010). In general, LCA identifies mutually exclusive groups of people in multivariate categorical data by clustering together persons who share similar characteristics or behaviours. In this way, LCA can be used to identify distinct subgroups of children with homogenous patterns of continuity in attachment classifications over time. A one-class solution indicates no distinct patterns of continuity in attachment classifications and therefore all children are categorized into one trajectory group. A two- or more class solution, in contrast, indicates subgroups (classes) of children, each with a distinct pattern of continuity in attachment classifications (i.e, two or more developmental trajectories). An increasing number of classes are applied to the data in LCA until the association between variables is no longer significant. The latent classes are then characterized by examining

the conditional probabilities for class membership, which is the likelihood of an individual having the latent characteristic given their latent class.

In the current study, LCA was conducted using Mplus version 5 (Muthén & Muthén, 1998 – 2007; see Appendix F for a sample Mplus script). Multiple fit statistics were used to identify the best fitting model (i.e. the number of latent classes; Collins & Lanza, 2010). The Likelihood Ratio (LR) statistic was used to determine absolute goodness of fit, with a non-significant LR statistic indicating that the model fits the data well (Collins & Lanza, 2010). The Bootstrap Likelihood Ratio Test was used to evaluate the extent to which the specified model fit better than a model with one less class. Akaike Information Criterion (AIC; Akaike, 1987), Bayesian Information Criterion (BIC; Schwarz, 1978), and Sample-size Adjusted Bayesian Information Criterion (SABIC; Sclove, 1987) were used to compare statistical fit across models, with lower values indicating improved fit. Selection of the best-fitting model was therefore based on the smallest of AIC, BIC, or SABIC values, a significant bootstrapped LRT test, and a non-significant LR statistic. Substantive interpretation was also used to guide model selection (Muthén, 2004; Colins & Lanza, 2010). Model selection was thus considered within the context of the study objective and theoretical perspective. Results from Monte Carlo studies suggest that SABIC and the Bootstrapped LRT are more likely to identify the correct number of latent classes when testing latent class models with small sample sizes and unequal class sizes (Nylund, Asparouhov & Muthén, 2007). Therefore, the SABIC and Bootstrapped LRT were relied more heavily upon in the current study to determine the number of classes in the final model.

Latent profile analysis. Latent profile analysis (LPA), an extension of LCA using continuous variables, was then used to identify the underlying patterns of stability and change in Mini-AQS scores. Similar to LCA, overall model fit in LPA is determined by the AIC, BIC, Sample Size Adjusted BIC and Bootstrap LRT (Collins & Lanza, 2010). A one-class model indicates no distinct patterns of continuity in Mini-AQS scores across the three time points, while a two- or more class solution indicates distinct subgroups of children, each with distinct patterns of continuity (i.e., trajectory) in Mini-AQS scores across time.

Missing data. The Missing Value Analysis command in SPSS 20 was used to examine patterns of missing data. Little's Missing Completely at Random (MCAR) test indicated that the data points were missing completely at random, $\chi 2(11) = 3.66$, $p = .98$. The analyses performed on this data were therefore considered unbiased (Howell, 2012). To address the issue of loss of power in LCA and LPA due to missing data, full information maximum likelihood (FIML) estimation was used in Mplus. FIML is one of the preferred methods of handling missing data and has been shown to produce unbiased parameter estimates and standard errors when data are missing at random (Enders & Bandalos, 2001). In FIML, individuals with complete and partially complete data are analyzed together and model estimates are adjusted on the basis of all of the information provided by these individuals (Collins & Lanza, 2010). Thus, a likelihood function for each individual is estimated based on the variables present so that all the available data are used. Details on FIML are presented in Graham (2009).

Results

Patterns of Continuity Using a Four-Way Categorical Distribution

Descriptive statistics. The proportions of secure, avoidant, ambivalent/resistant, and disorganized dyads at 13, 27, and 42 months are presented in Table 1. The proportions of secure and resistant classifications increased across time, while the proportions of avoidant and disorganized classifications decreased.

Chi-square analyses. Chi-square analyses were then used to examine stability in attachment classifications between all combinations of two time points, i.e., between 13 and 27 months, 13 and 42 months, and 27 and 42 months. No significant overall stability was found in the four-way secure, avoidant, ambivalent/resistant, and disorganized attachment distribution between 13 and 27 months (50% stability, $\chi^2(9) = 10.98$, *ns*, $\kappa = .19$, *ns; Fisher's exact test* $p = .19$, see Table 2a), between 13 and 42 months (41% stability, $\chi^2(6) = 5.22$, *ns*, $\kappa = .05$, *ns; Fisher's Exact Test* $p = .58$, see Table 2b), and between 27 and 42 months (48% stability, $\chi^2(4) = 3.43$, *ns*, $\kappa = .04$, *ns; Fisher's Exact Test* $p = .42$, see Table 2c).

Table 1.

Frequencies of 4-Way Secure, Avoidant, Resistant, and Disorganized Attachment at 13, 27, and 42 Months

	Attachment Classifications *n* (%)				
Months	Avoidant	Secure	Ambivalent/Resistant	Disorganized	Total
13	10 (16%)	30 (48%)	1 (2%)	22 (34%)	63 (100%)
27	7 (11%)	39 (65%)	1 (2%)	13 (22%)	60 (100%)
42	0 (0%)	29 (63%)	6 (13%)	11 (24%)	46 (100%)

Table 2a.

Chi-Square Test: Concordance between 4-Way Attachment Distribution at 13 and 27 Months

	Attachment Classifications *n* (expected *n*) 27-Months				
13-Months	Avoidant	Secure	Ambivalent/Resistant	Disorganized	Total
Avoidant	2(1.2)	5(6.5)	1(.2)	2(2.2)	10
Secure	1(3.3)	22(18.2)	0(.5)	5(6.1)	28
Ambivalent/Res.	0(.1)	1(.7)	0(0)	0(.2)	1
Disorganized	4(2.5)	11(13.6)	0(.4)	6(4.6)	21
Total	7	39	1	13	60

Note. 50% stability, $\chi^2(9) = 10.98$, *ns*, $\kappa = .19$, *ns; Fisher's exact test p* = .19

Table 2b.

Chi-Square Test: Concordance between 4-Way Attachment Distribution at 13 and 42 Months

	Attachment Classifications *n* (expected *n*) 42-Months				
13-Months	Avoidant	Secure	Ambivalent/Resistant	Disorganized	Total
Avoidant	0(0)	3(3.8)	0(.8)	3(1.4)	6
Secure	0(0)	15(13.2)	2(2.7)	4(5)	21
Ambivalent/Res.	0(0)	1(.6)	0(.1)	0(.2)	1
Disorganized	0(0)	10(11.3)	4(2.3)	4(4.3)	18
Total	0	29	6	11	46

Note. 41% stability, $\chi^2(6) = 5.22$, *ns*, $\kappa = .05$, *ns; Fisher's Exact Test p* = .58.

Table 2c.

Chi-Square Test: Concordance between 4-Way Attachment Distribution at 27 and 42 Months

	Attachment Classifications *n* (expected *n*) 42-Months				
27-Months	Avoidant	Secure	Ambivalent/Resistant	Disorganized	Total
Avoidant	0(0)	2(3.8)	1(.8)	3(1.4)	6
Secure	0(0)	20(18.3)	3(3.8)	6(6.9)	29
Ambivalent/Res.	0(0)	0(0)	0(0)	0(0)	0
Disorganized	0(0)	7(6.9)	2(1.4)	2(2.6)	11
Total	0	29	6	11	46

Note. 48% stability, $\chi^2(4) = 3.43$, *ns*, $\kappa = .04$, *ns; Fisher's Exact Test p* = .42.

Latent class analysis. Following the chi-square analyses, LCA was used to examine the underlying patterns of continuity in attachment classifications. Four LCA models (i.e. one- through four-class) were tested. All four models produced non-significant Likelihood Ratio (LR) values, indicating that all the models fit the data adequately. The bootstrap LRT did not indicate significant differences between neighbouring models. However, the model with the lowest AIC, BIC, and SABIC values was consistently the two-class model, followed by the three-class model, one-class model, and finally the four-class model. Given the exploratory nature of this study, both the two- and three-class models were further examined (see Table 3).

In the two-class model (see Table 4), 17% of children were assigned to class one, a group with moderate prevalence of disorganized and insecure attachments and low prevalence of secure attachment across time. At 13 months, all children in class one had a disorganized or avoidant attachment, at 27 months 86% had disorganized, avoidant, or resistant attachment, and at 42 months 72% had disorganized or resistant attachment. Class one, thus, consisted of a high prevalence of children with insecure (i.e. disorganized, avoidant, resistant) attachment across time and was therefore labelled as "Stable Insecure". In sharp contrast, 83% of children were assigned to class two, a group with moderate to high prevalence of secure attachment and low prevalence of disorganized, avoidant, and resistant attachments at each of the three time points. Class two was therefore labelled as "Stable Secure". See Figure 1 for a graphic presentation of the two-class model.

Table 3.

LCA: Model Fit Indices for 4-way Secure, Avoidant, Resistant, and Disorganized Attachments

Classes	2 *	3
Likelihood Ratio Chi-Square Test	p =.99	p = .99
AIC	352.78*	363.62
BIC	389.22*	419.62
Sample Size Adjusted BIC	335.72*	337.52
Bootstrapped LRT	1 vs 2 classes p = .39	2 vs 3 classes p = .64
n in each class	C1 = 11 (17%) C2 = 52 (83%)	C1 = 25 (39%) C2 = 8 (13%) C3 = 30 (48%)

Note. * lower AIC, BIC, and Sample-Size Adjusted BIC values indicate better model fit.

Table 4.

LCA Two-Class Solution: Conditional Probabilities of Secure, Avoidant, Resistant, and Disorganized Attachment at 13, 27, and 42 months, by Latent Class Membership

	Probability of Category					
	Class I: Stable Insecure n = 11 (17%)			Class II: Stable Secure n = 52 (83%)		
	13-Month	27-Month	42-Month	13-Month	27-Month	42-Month
Secure	.00	.14	.28	.59	.78	.72
Avoidant	.42	.44	.00	.10	.04	.00
Resistant	.00	.08	.18	.02	.00	.12
Disorganized	.58	.34	.54	.29	.18	.16

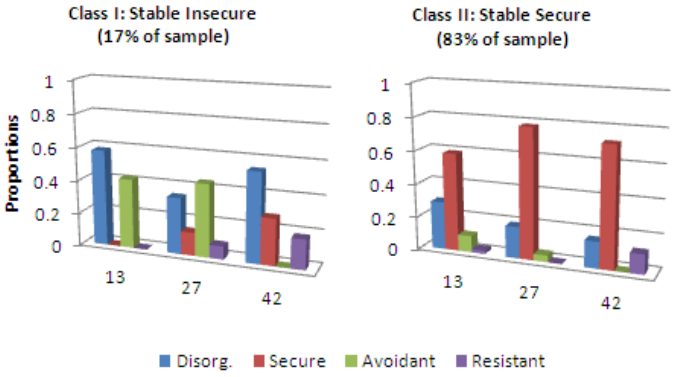

Figure 1. LCA identified two groups of children with distinct patterns of continuity in attachment classifications: (1) children with stable insecure attachment, and (2) children with stable secure attachment.

In the three-class model (see Table 5), 39% of children were assigned to class one, a group with an initial moderate prevalence of secure and disorganized attachment at 13 and 27 months; however, by 42 months, there was a high prevalence of secure attachment, low prevalence of resistant attachment, and no disorganized and avoidant attachment. Therefore, class one reflected a group with decreasing prevalence of disorganized attachment and an increasing prevalence of organized (i.e. secure and resistant) attachment over time and was labelled as "Disorganized and Secure Shifting towards Organization". Class two, in contrast, consisted of 13% of the sample with initial moderate prevalence of disorganized and avoidant attachment at 13 and 27 months; however, by 42 months, there was a high prevalence of disorganized attachment and a low prevalence of secure, avoidant, and resistant attachment. Class two thus reflected a group with early disorganized and insecure attachments that increased in prevalence of disorganization across time. Class two was labelled "Disorganized and Insecure Shifting towards Disorganization". Lastly, 48% of children were assigned to class three, a group with a high prevalence of secure attachment and low prevalence of disorganized, avoidant, and resistant attachment across time. Class three was labelled "Stable Secure". See Figure 2 for a graphic presentation of the three-class model.

Table 5.

LCA Three-Class Solution: Conditional Probabilities of Secure, Avoidant, Resistant, and Disorganized Attachment at 13, 27, and 42 Months, by Latent Class Membership.

	Probability of Category								
	Class I: Disorganized & Secure Shifting towards Organization *n* = 25 (39%)			Class II: Disorganized & Insecure Shifting towards Disorg. *n* = 8 (13%)			Class III: Stable Secure *n* = 30 (48%)		
	13-Month	27-Month	42-Month	13-Month	27-Month	42-Month	13-Month	27-Month	42-Month
Secure	.47	.51	.70	.00	.05	.24	.65	1.00	.70
Avoidant	.00	.11	.00	.56	.46	.00	.17	.00	.00
Resistant	.00	.00	.30	.00	.11	.00	.04	.00	.00
Disorg.	.53	.38	.00	.44	.38	.76	.14	.00	.30

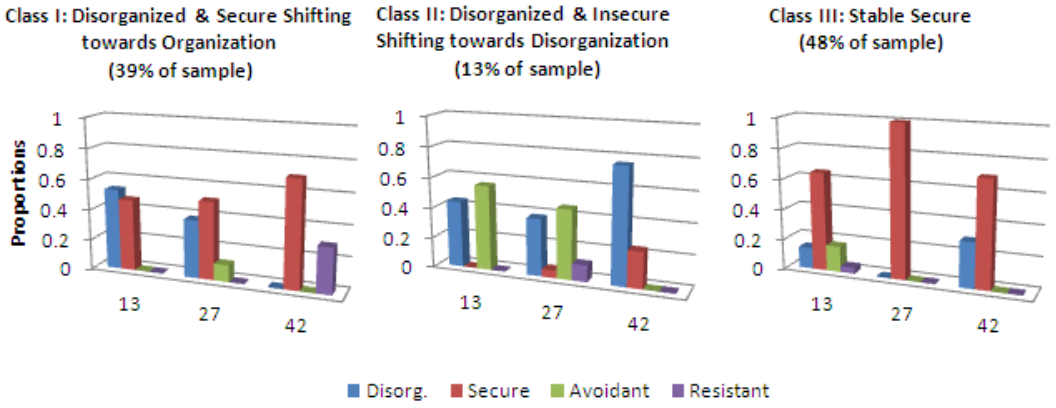

Figure 2. LCA identified three groups of children with distinct patterns of continuity in attachment classifications: (1) children with initial disorganized and secure attachment shifting towards organization, (2) children with initial disorganized and insecure attachment shifting towards disorganization, and (3) children with stable secure attachment.

Summary. Chi-square analyses did not reveal significant stability in the four-way secure, avoidant, ambivalent/resistant, and disorganized attachment classifications across any of the three sets of two time points. However, further examination across all three time points with LCA revealed subgroups of children with distinct underlying patterns of continuity in attachment classifications. Two LCA solutions emerged with adequate fit: a two- and three-class model. The two-class model revealed two groups of children with distinct trajectories of stability: children with stable secure attachment, and children with stable insecure attachment. In contrast, the three-class solution identified one group of children with stable secure attachment, a second group of children with a history of disorganized and secure attachment that was shifting towards organization over time, and a third group of children with a history of disorganized and insecure attachment shifting towards greater disorganized attachment over time. Although the three-class model was novel and conceptually interesting, the two-class model had the better statistical fit, was more parsimonious, and consistent with theoretical predictions. Therefore, the two-class model was considered the best fitting model. Additional research is needed to examine whether the three class model would emerge from other longitudinal samples of mothers and children.

Patterns of Continuity Using a Two-Way Secure versus Insecure Dichotomy

The four attachment classifications were then collapsed into a two-way secure versus insecure dichotomy. This practice is consistent with current longitudinal research on attachment continuity (Van Ryzin et al., 2011). Subsequent analyses explored continuity in attachment when characterized as simply secure or insecure.

Descriptive statistics. The proportions of secure and insecure dyads at 13, 27, and 42 months are presented in Table 6. The proportion of secure dyads increased over time, while the proportion of insecure dyads decreased.

Chi-square analyses. When examining stability in attachment across two time points, chi-square analyses revealed significant stability in secure versus insecure attachment between 13 and 27 months (65% Stability, $\chi^2(1) = 4.45$, $p < .05$, $\kappa = .26$, $p < .05$, see Table 7). Examination of the individual cells of the chi-square indicated that dyads classified as secure at 13 months were significantly more likely to be classified

Table 6.

Frequencies of 2-Way Secure versus Insecure Attachment at 13, 27, and 42 Months

	Attachment Classifications *n* (%)		
Months	Secure	Insecure	Total
13	36(57%)	27 (43%)	63 (100%)
27	41(68%)	19(32%)	60 (100%)
42	32(70%)	14 (30%)	46 (100%)

Note. Disorganized relationships were force classified according to their secondary organized Secure or Non-Secure Classifications

Table 7.

Chi-Square Test: *Concordance between 2-Way Secure versus Insecure Attachment at 13 and 27 Months*

	Attachment classifications *n* (expected *n*) 27-Months		
13-Months	Secure	Insecure	Total
Secure	27(23.2)*	7(10.8)*	34
Insecure	14(17.8)*	12(8.2)*	26
Total	41	19	60

Note. Stabilty between 13 and 27 months secure versus insecure classifications was significant (65%, $\chi^2(1) = 4.45$, $p<.05$, $\kappa = .26$, $p<.05$); In contrast, stability in secure versus insecure attachment between 13 and 42 months (61% stability, $\chi^2(1) = 1.53$, *ns*, $\kappa = .18$, *ns*) and between 27 and 42 months (65% stability, $\chi^2(1) = 2.05$, *ns*, $\kappa = .21$, *ns*) was not significant. These tables are consequently not presented here. * indicates cells with adjusted standardized residuals +/-2 ($p<.05$).

as secure ($z = .21$, $p < .05$), and significantly less likely to be classified as insecure ($z = -.21$, $p < .05$) at 27 months. In a parallel fashion, dyads classified as insecure at 13 months were more likely to be classified as insecure ($z = .21$, $p < .05$) and less likely to be classified as secure at 27 months ($z = -.21$, $p < .05$). Consistent with these results, a significant positive correlation ($r = .27$, $p < .05$) was found between 13 and 27-month secure versus insecure attachment, dummy coded as 1 and 0 respectively.

In contrast to the above results, there was no significant overall stability in secure versus insecure attachment between 13 and 42 months (61% stability, $\chi^2(1) = 1.53$, *ns*, $\kappa = .18$, *ns*) and between 27 and 42 months (65% stability, $\chi^2(1) = 2.05$, *ns*, $\kappa = .21$, *ns*). The correlations between 13 and 42 months ($r = .18$, *ns*) and 27 and 42 months ($r = .21$, *ns*) secure and insecure classifications were not significant.

Latent class analysis. Three LCA models (i.e. one-, two-, and three-class) were developed and tested when attachment relationships were characterized as simply secure or insecure. The one and two-class models produced non-significant LR values, indicating that the models fit the data adequately (see Table 8). The three-class model was not identified and discarded from further consideration. The bootstrap LRT indicated that the two-class model fit the data better than the one-class model ($p < .10$). A less stringent p value has been recommended in LCA models with small samples (see Steffen, Glanz & wilkens, 2007). The two-class model also showed a lower SABIC value. The two-class model was thus selected for closer examination.

In the two-class model (see Table 9), 29% of children were assigned to class one, a group with a high prevalence of insecure and low prevalence of secure attachment at 13 and 27 months. By 42 months there was a notable increase in the prevalence of secure attachment in this group, although the majority of children remained insecure. Class one was therefore labelled as "Stable Insecure with Some Shifting towards Security". In contrast, 71% percent of children were assigned to class two, a group with a high prevalence of secure attachment and low prevalence of insecure attachment across time. Class two was therefore labelled as "Stable Secure" (see Figure 3).

Table 8.

LCA Model Fit Indices for 2-Way Secure Versus Insecure Attachment across 13, 27, and 42 Months

Classes	**1**	**2**
Likelihood Ratio Chi-Square Test	$p = .12$	$p = 1.00$
AIC	223.50	224.24
BIC	229.93	229.24
Sample Size Adjusted BIC	220.49	217.22*
Bootstrapped LRT	n/a	1 vs 2 classes $p = .08^{t}$
n in each class	C1= 63 (100%)	C1 = 18 (29%) C2 = 45 (71%)

Note. $^{t}p<.10$; * lower SABIC indicates better model fit.

Table 9.

LCA Two-Class Solution: Conditional Probabilities of Secure and Insecure Attachment at 13, 27, and 42 Months, by Latent Class Membership

	Class I: Stable Insecure with Some Shifts Toward Security *n* = 18 (29%)			Class II Stable Secure *n* = 45 (71%)		
	13-Month	27-Month	42-Month	13-Month	27-Month	42-Month
Secure	.22	.30	.45	.74	.86	.82
Insecure	.78	.70	.55	.26	.14	.18

Note. Disorganized relationships were force classified according to their secondary organized Secure and Insecure classifications

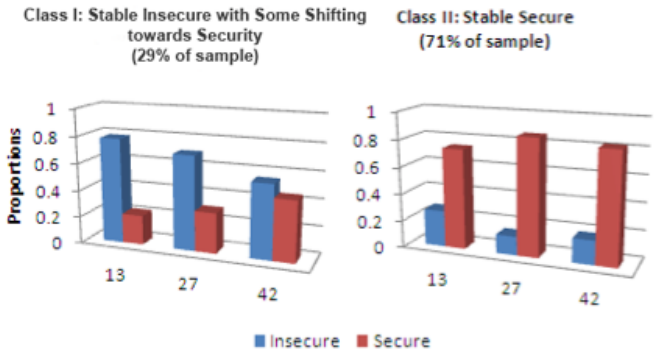

Figure 3. LCA identified two groups of children with distinct patterns of continuity in attachment security: (1) children with stable insecure attachment with some shifting toward security, and (2) children with stable secure attachment.

Summary. When attachment relationships were characterized as simply secure or insecure, chi-square analyses revealed significant stability between 13 and 27 months, but instability between 13 and 42 months and 27 and 42 months. Further analysis with LCA revealed two groups of children with distinct patterns of continuity in attachment across all three time points. The first group contained children with a pattern of stable secure attachment, while the second group consisted of children with a pattern of stable insecure attachment with some shifts toward attachment security.

Patterns of Continuity Using Continuous Attachment Security Scores (Mini-AQS)

While the above analyses explored continuity in attachment classifications, the final set of analyses explored continuity in the degree of security across early childhood.

Descriptive statistics. Mean Mini-AQS at 13, 27, and 42 months were .24 (*SD* = .48), .30 (*SD* = .47) and .25 (*SD* = .47), respectively.

ANOVA and correlation. A one-way repeated-measures ANOVA was used to examine the change in mean level of Mini-AQS scores. Change in mean Mini-AQS scores was not significant, $F(2, 90) = .25$, *ns*. Consistent with this finding, correlations revealed that relative levels of Mini-AQS scores were stable between 13 to 27 months ($r = .35$, $p < .01$), 13 to 42 months ($r = .44$, $p < .01$), and 27 to 42 months ($r = .44$, $p < .01$).

Latent profile analysis. Underlying patterns of continuity in Mini-AQS scores were then examined with LPA. Three LPA models (i.e. one-, two- and three-class) were tested. The model with the lowest AIC, BIC, and Adjusted BIC values was the three-class model (See Table 10). The bootstrap LRT also indicated that the three-class model fit the data significantly better than the two-class model ($p < .01$). In the three-class model, 13% of children were assigned to class one, a group of children with low Mini-AQS scores at 13 (*M* = -.13), 27 (*M* = .11), and 42 months (*M* = -.40). Class one was therefore labelled as "Stable Insecure". In contrast, 70% of children were assigned to class two, a group with high Mini-AQS scores at each of the three time points (*M* = .38, .56, and .54, respectively). Class two was therefore labelled as "Stable Secure". Lastly, 17% of children were assigned to class three, a group with initially low Mini-AQS scores at 13 (*M* = -.05) and 27 Months (*M* = -.46), but high Mini-AQS scores at 42 months (*M* = .39). Class three was therefore labelled as "Shift from Insecure to Secure" (See Figure 4 for the graphic presentation of the three-class model).

Table 10.

LPA Model Fit Indices for Mini-AQS scores across 13, 27, and 42 Months

Classes	1	2	3
AIC	220.36	189.57	173.36*
BIC	233.22	210.99	203.37*
Adjusted BIC	214.34	179.53	159.31*
Bootstrapped LRT	n/a	1 vs 2 classes $p = .00$	2 vs 3 classes $p = .00$
n in each class	C1 = 63 (100%)	C1 = 15 (24%) C2 = 48 (76%)	C1 = 8 (13%) C2 = 44 (70%) C3 = 11 (17%)

Note. * lower AIC, BIC, and Sample-Size Adjusted BIC values indicate better model fit.

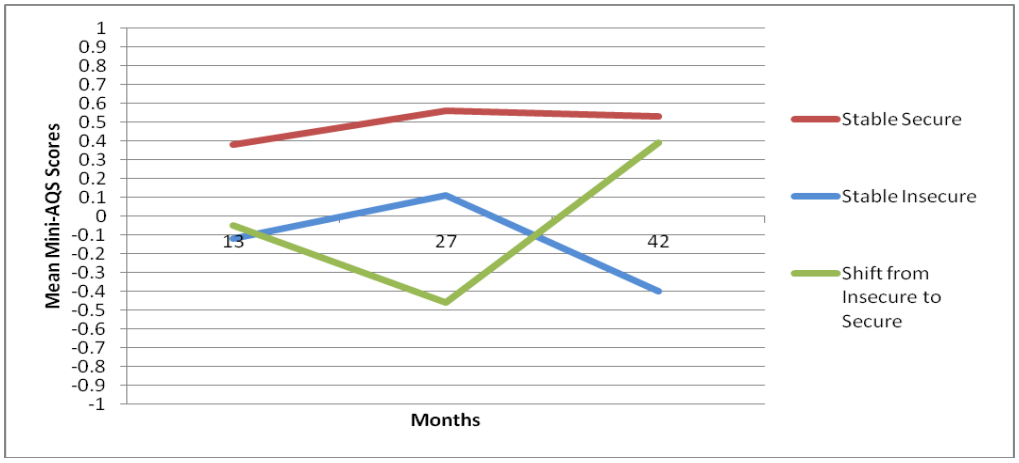

Figure 4. LPA identified three groups of children with distinct patterns of continuity in Mini-AQS scores: (1) children with stable insecure attachment, (2) children with stable secure attachment, and (3) children shifting from attachment insecurity towards security.

Summary. Correlation analyses indicated stability in relative levels of Mini-AQS scores across time. Specifically, children with higher Mini-AQS scores at 13 months were more likely to have higher Mini-AQS scores at 27 and 42 months, and in parallel, children with lower Mini-AQS scores at 13 months were more likely to have lower scores at 27 and 42 months.

Further analysis with LPA revealed three groups of children with distinct patterns of continuity in Mini-AQS scores over time. The first group consisted of children with low Mini-AQS scores across time suggestive of stable insecure attachment, the second group consisted of children with high Mini-AQS scores across time suggestive of stable secure attachment, and the third group consisted of children with initial low Mini-AQS scores at 13 and 27 months but high Mini-AQS scores at 42 months, suggestive of a shift from attachment insecurity to security.

Discussion

The central purpose of this study was to identify empirically children's patterns of continuity in attachment quality over early childhood. At present, it is unclear whether individual differences in attachment quality is better conceptualized as categorically or continuously distributed (Ainsworth et al., 1978; Cummings, 1990; Fraley & Spieker, 2003). Consequently, the present study examined attachment quality using both categorical and continuous measures in infancy, toddlerhood, and preschool years. It is hoped that a combined use of categorical and continuous data would yield more information about a child's developing attachment relationship than either measure could alone. In the sections below, we first summarize and discuss the implications of the patterns of continuity that emerged when attachment was measured categorically, then summarize the patterns that emerged when attachment was assessed continuously, compare the patterns of continuity that emerged between the two measurement methods, and lastly, present the limitations and directions for future work.

Underlying Patterns of Continuity in Attachment Classifications

The first purpose of this study was to identify the patterns of continuity in attachment classifications in a sample of middle-class mother-child dyads. First, and consistent with much of the current longitudinal attachment literature, chi-square analyses were used to examine the degree of stability in attachment classifications

between two time points (see Belsky et al., 1996; Bar-Haim et al., 2000; NICHD, 2001). LCA was then introduced to help identify underlying patterns of continuity in attachment classifications across all three time points. LCA is a data analytic technique designed to cluster together persons who share similar characteristics into mutually exclusive groups (Collins & Lanza, 2010). In other words, children with similar patterns of continuity in attachment classifications were identified in LCA and clustered into distinct trajectory groups in this study. LCA has not been previously used in the existing longitudinal attachment literature (Collins & Lanza, 2010).

In the current study, chi-square analyses indicated that stability and change in children's attachment classifications were equally likely when attachment was examined across each of the three combinations of two-time-points: 50% stability between infancy and toddlerhood, 41% between infancy and preschool years, and 48% between toddlerhood and preschool years. These levels of stability are consistent with those reported in existing longitudinal investigations with large middle-class samples (i.e. Belsky et al., 1996; Bar-Haim et al., 2000; NICHD, 2001) and convey little about children's development of attachment other than that change and stability are equally likely. In contrast, when attachment classifications were examined over all three time points using LCA, two groups of children emerged, each with a distinct trajectory of attachment continuity. The first group was characterized by a pattern of stable secure attachment, and the second group was characterized by a pattern in which their attachment relationships remained relatively insecure with some tendency to shift towards security. In other words, this study found two groups of children with different patterns of attachment continuity. Significantly, these two distinct patterns of continuity were lost when children were analyzed as one homogeneous group in the chi-square analyses. The two patterns of continuity emerged only after LCA was used to separate children into distinct groups.

The emergence of these two separate groups of children, each with a distinct trajectory, has significant theoretical and methodological implications. According to Bowlby (1973), children's patterns of continuity in attachment quality are related systematically to their environmental experiences. In this way, children may maintain the quality of their attachment relationships given stability in environmental experiences or

they may change the quality of their relationships following disruptions in their environments. Previous research on continuity in attachment has tended to only report the degree of stability between time points; however, an exclusive focus on the degree of stability cannot test Bowlby's above argument of systematic continuity in attachment since high and low levels of stability are equally consistent with theory (see Fraley & Brumburgh, 2004). In contrast, the emergence of different groups of children with different trajectories gives credence to the idea of systematic continuity, and provides a basis for asking additional questions related to antecedents and sequelae of individual differences in these patterns of development.

The current findings also have important methodological implications. As already noted, most longitudinal studies of attachment continuity have used a single test-retest coefficient to examine the degree of stability in attachment quality between time points (i.e., Belsky et al., 1996; Bar-Haim et al., 2000). The focus on a single degree of stability assumes that the pattern of continuity in attachment quality is the same across all children. The growth trajectories of all individuals are thus described using one pattern (Andruff, Carraro, Thompson, Gaudreau & Louvet, 2009; Bergman & Magnusson, 1997). Attachment theory has, however, acknowledged that children vary in their patterns of continuity in attachment (Bowlby, 1973; Ainsworth, et al., 1978). As a result, studies using a methodology that assumes only one pattern of development cannot adequately capture if and how developmental patterns differ between children. Consistent with this concern, the current study found no clear pattern of stability when attachment continuity was assessed using a statistical method widely used in the literature (i.e, chi-square analysis); however, different patterns of continuity in separate groups of children emerged when LCA was used. This result suggests that a novel method to studying attachment continuity, one that is able to identify how developmental trajectories differ between some individuals but may be shared by others, is warranted in future research. Fraley and colleagues (2011) have noted that "the methods that are typically used to answer questions about continuity and change are, paradoxically, incapable of doing so". The results of this study suggest that LCA may be a method that is capable of the task that Fraley and colleagues envisioned.

Patterns of Attachment Continuity with a Continuous Measure

The second purpose of this study was to examine the patterns of continuity that emerged when attachment was assessed using a continuous measure and compare these patterns to the ones that emerged from a categorical method. For the sake of simplicity, these two measurement methods are referred to as the categorical and the continuous approach in this discussion.

Three groups of children emerged from LPA when attachment was assessed continuously. The first group of children was characterized by a pattern of stable secure attachment over time; the second group by stable insecure attachment over time; and the third group by a tendency to shift from insecurity towards security. Although LPA with a continuous measure identified one more group of children than LCA with a categorical measure, further examination indicated that the same underlying patterns of stability and change in attachment quality were evident in both measurement approaches. First, the majority of children in this sample were identified as having a stable secure attachment trajectory, regardless of a categorical or continuous measurement approach. Second, both measurement approaches found that a minority of children either remained insecure over time or shifted from insecurity towards security; however, the continuous approach was able to statistically differentiate these latter children into two distinct trajectory subgroups, "stable insecure" and "shift from insecure to secure", whereas the categorical approach grouped these children into one overarching trajectory group, "stable insecure with some shifts towards security". Given that the same underlying patterns were identified regardless of the measurement method, but that only the continuous approach found a statistical difference between children that remained insecure and children that shifted towards security, we hypothesize that this statistical difference may be the result of an increase in statistical power with the use of a continuous measure.

A longstanding argument for a continuous approach to attachment over a categorical approach is that the former substantially increases statistical power (Cummings 1990; Cohen 1988). Dawson and Weiss (2012) argued that grouping individuals into broad categories may be seen as an extreme form of rounding that results in an inevitable loss of information and power. Our current findings are consistent with this suggestion. Researchers must thus carefully consider how the metric of measurement

may affect the power to detect mutually exclusive groups of children with distinct trajectories. Specifically, a larger sample size may be required when LCA is conducted on attachment quality measured categorically.

Directions for Future Research

We acknowledge that although considered a sizeable sample among studies using complex attachment measures repeated across time, 63 children is a small sample by the standards of multivariate statistical procedures. A small sample size can diminish power to detect different patterns of attachment continuity and consequently decrease the chance that a statistically significant result reflects a true effect (Button, Loannidis, Mokrysz et al., 2013). A study with a larger sample may therefore detect additional groups of children with other patterns of attachment continuity that were not reported in this study. Therefore, the number and patterns of continuity that emerged in the current study are considered preliminary. Replication of this study with a larger sample size would be an important consideration for future research.

The emergence of groups of children with distinct trajectories of development also begs investigation into antecedents of individual differences. Specifically, what are the factors that influence children to develop different patterns of continuity in attachment quality? Attachment theory has outlined a number of possible mechanisms. These include changes in the quality of care-giving (Ainsworth et al., 1978; Forbes et al., 2007), family environment (Vaughn et al, 1979), and children's maturing cognitive abilities (Crittenden & Ainsworth, 1989). Few studies have, however, systematically investigated the relationship between change in these contextual variables and children's patterns of continuity in attachment. The scarcity of investigations has prompted researchers to conclude that the precise factors involved are not well known (Thompson 2000; Fraley, 2010). Therefore, a second important avenue for future research is to examine the mechanisms that maintain children's existing attachment trajectory or deflect them towards alternative pathways.

Furthermore, research has also consistently reported a link between maternal attachment status and infant attachment security. Specifically, studies have repeatedly found that mothers with autonomous states of mind regarding attachment (i.e, secure attachment) are more likely to have infants who are securely attached, and conversely,

mothers with non-autonomous states of mind are more likely to have infants who are insecurely attached (see meta-analysis by van IJzendoorn, 1995). Maternal sensitivity has been proposed to be the key mechanism of transmission between maternal attachment quality and infant attachment quality (Ainsworth et al., 1978). Research on this model of intergenerational transmission has, however, found that maternal sensitivity accounts for only a small proportion of the link between maternal attachment and infant attachment (van IJzendoorn, 1995). van IJzendoorn (1995) consequently termed this the "transmission gap". We argue that a possible reason for the transmission gap may be that existing studies have focused exclusively on predicting children's attachment classifications at one point in time, rather than on children's patterns of continuity in attachment. A single analysis of the relationship can increase measurement error and can miss information about the attachment relationship that is more accurately captured by an assessment of children's trajectories of attachment. To more accurately predict the mediating effect of maternal sensitivity on the link between maternal attachment security and infant attachment security, researchers may need to examine children's patterns of continuity in attachment, not simply a single analysis of the relationship. Thus, a third interesting avenue for future research may be to assess the link between maternal states of mind and children's patterns of continuity in attachment, and examine whether maternal sensitivity mediates this link.

Lastly, the emergence of distinct patterns of attachment continuity has important implications for research examining sequelae of attachment. Since its inception, attachment theory has been concerned with the implications of different patterns of attachment (Sroufe, Carlson, Levy, & Egeland, 1999). While early attachment experiences are not considered direct causes of psychopathology, they serve as initiating conditions that establish tendencies and expectations that shape subsequent development (Sroufe et al., 1999). The relationship between early attachment relationships and future socio-emotional development has been documented by a number of researchers (Egeland & Carlson, 2004; Deklyen & Greenberg, 2008); however, some studies have failed to confirm the expected link, leading some reviewers to conclude that the association between attachment and later behavior is "modest" or "weak" (see reviews by Belsky & Cassidy, 1994). Thompson (1999) noted that many of these investigations involved only

a single analysis of the attachment relationship and assumed continuity in attachment over time. He argued that intervening events may have altered the developmental processes initiated by a secure or insecure attachment, thus resulting in a weak predictive association on later socio-emotional outcomes. In order to accurately predict the association between attachment and later socio-emotional outcomes, researchers need to examine the patterns of continuity in attachment classification, not simply a single assessment of the relationship (Sroufe et al., 1999). A fourth avenue for future research is therefore to examine the socio-emotional consequences of different trajectories of attachment quality.

Conclusion

In conclusion, empirical research examining the continuity of attachment has flourished within the last three decades; however, most studies have focused on the magnitude of a single test-retest coefficient (Fraley & Brumbaugh, 2004). The current study provides a unique contribution to the literature by assessing not simply the degree of stability in attachment quality between two time points, but also children's distinct patterns of continuity in attachment quality. The emergence of different groups of children with distinct patterns of stability in this study is a significant finding that suggests systematic continuity in the development of attachment over time.

In Bowlby's view, the key goals of developmental science are to map the pathways by which children develop and to uncover the processes that either keep children on a specific course or allow them to deviate from paths previously travelled (Fraley & Brumburgh, 2004). The present study took an important step in this direction. To ultimately achieve Bowlby's objective, additional longitudinal studies are needed that systematically examines not only the patterns of stability and change in attachment quality, but also the factors that may influence the development of these patterns. This is explored in the second study of this dissertation.

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Chapter 3

Study 2: Patterns of Continuity in Attachment Quality

The Role of Maternal Sensitivity

The first study of this dissertation found distinct groups of children, each with a different pattern of continuity in attachment quality. We hypothesized in the first study that, in accordance with attachment theory (Bowlby, 1969/1982), systematic differences in environmental factors may have led to the emergence of these distinct groups of children with different patterns of attachment continuity. The current study expands on the findings from Study 1 and examines environmental factors that may have influenced children to develop different patterns of continuity in attachment quality.

Maternal Sensitivity Shapes Children's Trajectories of Attachment

The fundamental tenet of attachment theory is that the quality of a mother's interaction with her child is critical in determining the security of their attachment relationship (Ainsworth, Blehar, Waters & Wall, 1978), and by the same logic, the relationship can be modified via subsequent interactions. The quality of a mother's interaction with her child is therefore a logical starting point to focus our investigation into factors that may influence the development of different patterns of continuity in attachment quality.

Ainsworth conducted extensive studies of mother-child interactions in the home setting and concluded that a history of sensitive maternal interactions is the primary determinant of a secure attachment relationship (Ainsworth et al., 1978). Ainsworth defined sensitivity as the mother's ability to accurately perceive and interpret her infant's signals, and to subsequently respond in a prompt and appropriate manner (Ainsworth et al., 1978). According to Ainsworth and colleagues (1978), children with a history of sensitive care would come to develop expectations that their caregivers would respond to specific signals during periods of distress. These children would therefore be predisposed to signal for proximity and contact (i.e., a secure attachment relationship). In contrast, children with a history of nonresponsive or inconsistent care would come to develop expectations that their caregivers would not respond to their signals. These children would, in turn, be predisposed to inhibit their expressions for proximity and contact during periods of stress (i.e., avoidant attachment in the presence of a

nonresponsive caregiver), or maximize their expressions of distress during low and high stress situations (i.e., ambivalent/resistant attachment in the presence of an inconsistently responsive caregiver).

Numerous studies have since examined the link between maternal sensitivity and attachment security (for meta-analyses, see Goldsmith & Alansky, 1987; De Wolfe & van IJzendoorn, 1997; Atkinson, Niccols, Paglia et al., 2000) and they have consistently found that mothers who are prompt at responding to distress, behave in an appropriately stimulating, warm, and involved manner, and are synchronous during mother-child interactions are more likely to have children with secure attachment relationships (Crockenberg, 1981; Isabella & Belsky, 1991; Bates, Maslin, & Frankel, 1985). In contrast, mothers who are excessively intrusive and controlling, or conversely, uninvolved and unresponsive, are more likely to have children with insecure attachment relationships (Vondra, Shaw & Kevinides, 1995).

These results support the theorized link between maternal sensitivity and attachment security. By the same logic, they also suggest that the quality of the attachment relationship may be altered by a change in the quality of maternal interaction. Thus, children's patterns of continuity in attachment quality are theoretically tied to their experiences of maternal sensitivity over time, such that: continuous sensitive care-giving would lead to the formation of a stable secure attachment trajectory; continuous insensitive care-giving to a stable insecure attachment trajectory; and a change in the quality of care-giving to a change in the trajectory of the relationship in a parallel direction. To our knowledge, no published study has systematically examined over time the developmental link between stability and change in maternal sensitivity and children's patterns of continuity in attachment quality. Evidence suggestive of this link has, however, come from two sources: attachment based interventions and studies with high-risk samples.

Attachment-based interventions. The primary goal of most attachment-based interventions is to prevent or correct insecure attachment by changing maternal interaction. In an early example, Anisfeld, Casper, Nozyce and Cunningham (1990) intended to promote maternal responsiveness by increasing physical contact between mothers and children in a high-risk sample. Forty-nine mother-infant dyads were

randomly assigned to an experimental group that received soft baby carriers (more physical contact) at birth or to a control group that received plastic infant seats (less contact). An assessment of the mothers' behaviours at three months revealed that the experimental group was significantly more responsive than the control group. The experimental group also received higher ratings on sensitivity, but this difference was not significant. At 13 months, significantly more of the infants in the experimental group (83%) were securely attached compared to the control group (38%). Anisfeld et al. (1990) concluded that increased physical contact achieved through the use of the soft baby carriers led mothers to be more responsive to their infants and promoted the formation of more secure attachments.

Van den Boom (1991/1994) conducted an intervention study that more directly assessed the developmental link between maternal sensitivity and attachment security. One hundred mothers were randomly assigned to either an intervention group that received interaction coaching or to a control group. Maternal sensitivity was assessed at 6 and 9 months. They found that mothers who had received interaction coaching were significantly more responsive, stimulating, visually attentive and controlling in their interactions with their infants at 9 months than control mothers. Moreover, significantly more of the infants in the intervention group (68%) were securely attached than those in the control group (28%) at 12 months.

Lastly, Moran, Pederson and Krupka (2005) also conducted a similar home-visitor based intervention program with a sample of high-risk adolescent mothers. Forty-three mothers were randomly assigned to an intervention group and 46 to a comparison group. Clinically trained home visitors visited participants in the intervention group on eight occasions when infants were between 7 and 12 months of age. The intervention involved videotaping the mothers and infants at play and reviewing the tapes with the mothers. Participants in the control group were visited only once by home-visitors at nine months to videotape the mother-infant interaction. Maternal sensitivity was assessed at 6, 12 and 24 months. At 6 months, maternal sensitivity was not significantly different between the intervention and control group. At 12 months, the sensitivity of mothers in the intervention group had declined less than that of those in the control group, and at 24 months, the intervention group had a higher level of sensitivity than control group,

though this difference was not statistically significant. Finally, at 12 months, significantly more of the infants in the intervention group (57%) were securely attached than those in the control group (28%).

Taken as a whole, the literature from attachment-based interventions has consistently found that mothers who had received interventions to increase maternal sensitivity, compared to those who were in control groups, had more infants that were securely attached. This finding supports the claim that an increase in maternal sensitivity facilitates the development of secure attachment relationships; however, change in attachment security was never assessed in these studies because attachment was measured only once at post-intervention. Consequently, the link between change in maternal sensitivity and change in attachment was not directly assessed.

Studies with high-risk samples. The literature on attachment in high-risk populations is a second area from which researchers have cited support for the existence of the link between change in maternal sensitivity and change in attachment quality (Vaughn, Egeland, Sroufe & Waters, 1979; Vondra, Hommerding & Shaw, 1999). Families in high-risk environments tend to display lower stability of attachment and higher instances of attachment insecurity. Instability of attachment security has been suggested to be the product of lower maternal sensitivity arising from stresses within a high-risk environment including low income, maltreatment, and a lack of social support (Belsky, 1999; Solomon & George, 2000). Consistent with this proposal, Vaughn et al. (1979) found a significant association between maternal stress and a shift from secure to ambivalent/resistant attachment between 12 and 18 months. They hypothesized that detrimental changes in the quality of maternal interactions mediated this link.

In a related study of early trajectories towards attachment security, insecurity, and disorganization among low SES mother-infant dyads, Vondra et al. (1999) reported a general trend for the prevalence of secure attachment relationships to decrease and of disorganized attachment relationships to increase between 12 and 18 months. Infants who developed a disorganized attachment at 18 months had mothers who reported the most number of unstable and disruptive family life events during the aforementioned period. The authors proposed that disruptions in the environment may have triggered changes in

the quality of maternal interactions and, as a result, the quality of their attachment relationships.

Once again, although these studies suggest that children's patterns of continuity in attachment quality are linked to changes in maternal behaviour, they lack the compelling evidence found in longitudinal studies in which maternal behaviour and attachment security are both measured repeatedly across time. In one of the few examples of such research, Forbes, Evans, Moran, and Pederson (2007) assessed fluctuations in atypical maternal behaviour and disorganization in a sample of high-risk adolescent mother-child dyads and found that infants who shifted from disorganized to organized attachment relationships had mothers who also shifted from disrupted to not-disrupted patterns of interaction. The reverse was found for infants that shifted from organized to disorganized attachment; however, the high percentage of disorganization in the sample (57.7% at 12 months and 36.6% at 24 months) made it impossible to examine the theorized link between maternal sensitivity and change in organized attachment classifications (secure, avoidant, and ambivalent/resistant). This limitation prompted the authors to conclude that replications of this work, but in low-risk samples, are needed.

In summary, theory suggests that children's experiences of maternal sensitivity over time shape their patterns of stability and change in attachment quality. Although results from attachment based interventions and studies of high-risk samples are suggestive of this developmental link, they lack the compelling evidence provided by longitudinal studies in which maternal sensitivity and attachment security are both repeatedly assessed. Therefore, the first purpose of this study is to examine both maternal sensitivity and attachment security longitudinally during specific periods in infancy, toddlerhood, and preschool years. The second purpose is to assess whether change in maternal sensitivity over time predicts the emergence of different groups of children, each with a distinct pattern of continuity in attachment (see Study 1 of manuscript).

Contribution of Other Maternal Interactive Behaviours to Predicting Children's Trajectories of Attachment Development

Ainsworth et al. (1971) had originally identified four aspects of maternal interactive behaviour: acceptance versus rejection, cooperation versus interference, accessibility versus ignoring, and sensitivity versus insensitivity. However, results from

their Baltimore study indicated that the first three aspects were highly inter-correlated with maternal sensitivity (*r* ranging from .82 to .89), prompting Ainsworth and her colleagues to collapse these aspects into an overarching group of behaviour and to conclude that maternal sensitivity is the key variable associated with attachment security. Maternal sensitivity has since become the primary dimension used to assess the quality of maternal interactions in the attachment literature (De Wolff & van IJzendoorn, 1997).

Meta-analyses of the association between maternal sensitivity and attachment security have, however, indicated that the strength of the association between these two variables is not as strong as initially proposed (Goldsmith & Alansky, 1987; De Wolff & van IJzendoorn, 1997; Atkinson et al., 2000). Goldsmith and Alansky (1987) were among the first to question the strength of the association between maternal sensitivity and attachment security. Based on their meta-analysis of 16 studies, they concluded that the effect size of the predictive power of maternal sensitivity is much smaller than predicted by theory and found in Ainsworth's pioneering research (*r*= .16 in Goldsmith & Alansky, 1987 versus = .78 found by Ainsworth et. al.,1978). Similarly, De Wolff and van IJzendoorn found only a medium effect size linking maternal sensitivity and attachment security (*r*=.24) in a meta-analysis of 66 studies. This result prompted De Wolff and van IJzendoorn to conclude that sensitivity is not the only factor influencing attachment security. They argued that the roles of other maternal behaviours on the development of attachment security must be explored. In accordance with this logic, changes in other aspects of the maternal interactive behaviour may predict children's development of different patterns of continuity in attachment, beyond the effect accounted for by maternal sensitivity.

The Question of the Measurement of the Quality of Maternal Interaction: The Maternal Behavioural Q-Sort (MBQS)

In addition to the need to assess other aspects of maternal interactive behaviour, researchers have also acknowledged a need to use more statistically powerful, theoretically driven, and observation-based measures of maternal sensitivity (Atkinson et al., 2000). Atkinson and colleagues (2000) found that researchers often used divergent measures to assess maternal sensitivity. Atkinson et al. (2000) argued that this use of diverse measurement methods has contributed to the variation in reported effect sizes of

the association between attachment security and maternal sensitivity. They further found that studies using the Maternal Behavior Q-Sort (MBQS; Pederson, Moran & Bento, 1999), an observational technique of maternal sensitivity, reported significantly stronger associations with attachment security (r = 0.48 - 0.52) than other available measurement methods (r = 0.19 - 0.21). They concluded that the MBQS is currently the best available vehicle for elucidating the association between maternal sensitivity and attachment security.

The maternal behavioural q-sort (MBQS). The Maternal Behavioral Q-Sort (MBQS; Pederson, Moran & Bento, 1999) is a measure of the quality of the mother's interaction with her child. The MBQS contains item statements that describe attachment-relevant aspects of the mother-child interaction (e.g., "Mom monitors baby's activities during visit"). Each item statement is assigned a score reflecting trained observers' judgments of how characteristic it is of the mother's interactions with her child. Two ways researchers can then choose to organize and analyze the data from the MBQS are: a single measure reflecting maternal global sensitivity as conceptualized within attachment theory, and measures of rationally derived domains of maternal interactive behaviour assessing different aspects of the content of mother-child interaction.

Global maternal sensitivity. Global maternal sensitivity is the most commonly used measure extracted from the MBQS. This measure is a correlation reflecting the similarity of the item-based description of a mother's interaction to that of a prototypically sensitive mother as envisioned by a group of experienced researchers. This measure has been validated by past research, and studies have reported a strong association between this MBQS measure of maternal sensitivity and Ainsworth's maternal behavior ratings scale (Pederson & Moran, 1995).

Other aspects of maternal interactive behaviour. As previously mentioned, researchers have also acknowledged the need to assess aspects of maternal behaviour beyond a global measure of sensitivity (De Wolff & van IJzendoorn, 1995). According to De Wolff & van IJzendoorn (1995), conceptually distinct aspects of maternal behaviour may relate to different qualities of the attachment relationship. Furthermore, assessing maternal behaviour as a single global dimension (i.e., maternal sensitivity) may fail to capture the full variation in the content of maternal behaviour since two mothers

who interact quite differently with their children might receive the same global sensitivity score because their sensitivity scores are derived from the correlation of their interactions with that of a theoretically sensitive mother. To address these concerns, items from the MBQS have been rationally grouped into domains of maternal behaviour that reflect common underlying facets of maternal interaction (e.g., controlling/interfering behaviour). A description of the method involved in the creation of the MBQS domains is provided in Morley, Xue, O'Connor, Moran, Pederson and Bento (2010).

In summary, researchers have acknowledged the importance of moving beyond a single global measure characterization of maternal sensitivity to include more subtle aspects of the content of maternal behaviour. Another purpose of this study is to examine whether these other aspects of maternal behaviour may influence children's development of different patterns of continuity in attachment, beyond the effect already accounted for by maternal sensitivity

Purpose of Present Study

The primary purpose of this study is to investigate the theoretical proposition that children's experiences of maternal sensitivity over time influence their development of different patterns of continuity in attachment quality. The second purpose of this study is to investigate whether specific aspects of maternal interactive behaviour predict patterns of continuity in attachment beyond the effect accounted for by overall maternal sensitivity.

Consistent with much of the current literature on attachment continuity, the current study examines attachment quality using a classification rather than a continuous method (see Bar-Haim, Sutton, Fox, & Marvin, 2000; NICHD, 2001). Furthermore, due to sample size considerations, the current study is interested in examining attachment relationships only characterized as secure or insecure. Specifically, the numbers of children in each of the insecure attachment groups in this sample are too small to permit separate analyses of each insecure group. Consequently, the insecure attachment groups are collapsed into one overarching insecure category and compared to children with secure attachment relationships. This practice is consistent with current research (e.g. Van Ryzin, Carlson, & Sroufe, 2011). The secure versus insecure dichotomy also makes sense in light of the fact that maternal sensitivity, a primary variable of interest in this

study, is considered the key determinant of attachment security (De Wolff & van IJzendoorn, 1997; Atkinson et al., 2000). Given the focus on attachment relationships characterized as simply secure versus insecure, this study also focuses solely on the patterns of attachment continuity that emerged from LCA when this dichotomy was used (See Study 1). The two patterns of continuity that emerged from Study 1 were: (1) children with a pattern of stable secure attachment and, (2) children with a pattern of stable insecure attachment with some shifts toward attachment security (see Study 1).

Research questions. In considering the purposes of this study, three research questions are addressed:

(1) Are there changes in the quality of maternal interactions (i.e., maternal sensitivity and domains of maternal interactive behaviour) from infancy to preschool years?

(2) Does the quality of maternal interactions predict children's development of different patterns of attachment continuity that emerged from Study 1?

(3) What are the associations over time between qualities of maternal interaction and qualities of children's attachment relationships?

Method

To minimize presentation of redundant information, readers are directed to Study 1 of this manuscript for methodology that has been discussed previously. Only new methodology is discussed below in detail.

Participants

This study is part of an ongoing longitudinal investigation of a community sample of mother-child dyads conducted by the Child Development Centre at Western University (see Appendix A for the Ethics Approval). Mothers were recruited from two hospitals in London Ontario shortly after the birth of their infants. All infants were of full term gestation and physically healthy at birth.

The current investigation focuses on three waves of data collected in infancy, toddlerhood, and preschool years. At each wave of data collection, maternal interactive behaviour and attachment security were assessed, resulting in a total of six behavioural assessments. Mother-child dyads with maternal behaviour and concurrent attachment security data at each wave were retained in the data analyses. The present study

employed data from 63 mother-infant dyads during infancy; 60 mother-toddler dyads during toddlerhood; and 46 mother-preschooler dyads during preschool years. There were no significant differences between dyads that completed the study and dyads that withdrew (see Appendix C).

Demographic data were collected during a 3-month home visit and updated at each subsequent visit. Detailed descriptions of demographic data were presented in Study 1 of this manuscript. Correlations between potential demographic covariates and primary variables were examined (see Appendix D). Criteria for inclusion as a covariate were significant associations with both a predictor and outcome variables (Leerkes, Blankson & O'Brien, 2008). None of the demographic variables met criteria for inclusion as covariates and were not retained in further analyses.

Measures

The mini-maternal behaviour q-sort (Mini-MBQS). The Maternal Behavioral Q-Sort (MBQS; Pederson and Moran, 1995) is a validated measure of the quality of the mother's interaction with her child. The MBQS contains 90 item statements describing specific aspects of the mother-child interaction (e.g., "Mom monitors baby's activities during visit"). Trained sorters arrange these item statements into nine piles of ten cards, ranging from pile 1(*least like the mother*) to 9 (*most like the mother*). Each item statement is assigned a score based on which pile it is sorted into. The sorting of the 90 MBQS items is labour intensive and requires approximately an hour to complete.

A condensed version of the 90 item MBQS, the Mini-MBQS containing 25 item statements, was created in response to the time consuming requirements of the 90-item sort. A detailed description of the rationale behind the item selection and the final list of items are presented by Tarabulsy and colleagues (2009). In general, the 25 items were chosen to reflect items that had the lowest and highest scores (e.g. scores of 1 and 9) based on the MBQS sort of the theoretically sensitive mother as envisioned by a group of experienced researchers. The Mini-MBQS has been validated against the full MBQS (Tarabulsy et al., 2009).

In the current study, the Mini-MBQS was completed on the basis of observations made during home visits conducted in infancy (10 months infant age) and toddlerhood (21 months of age), and a laboratory visit conducted during the preschool years (42

months of age). The wording of some item-statements on the 42-month Mini-MBQS was modified to better assess maternal sensitivity during the preschool years in a laboratory setting. For example, overt scolding or criticism were rarely observed in our preschool laboratory assessments, therefore the original Mini-MBQS item "mother scolds or criticizes baby" was changed to "mother annoyed, irritated, or impatient with child" to assess more subtle forms of maternal rejection. Item statements from the original 90-item MBQS (Pederson and Moran, 1995) and Brown's (n.d.) Preschool MBQS, which was adapted from the original 90-item MBQS, were reviewed and considered when adapting the item statements for the 42-month Mini-MBQS used in the current study (for the full list of Preschool Mini-MBQS items see Appendix G or Pederson, Bailey, Bento, Xue, Moran, 2013). After observing mother-child interactions in the home and university laboratory, trained coders sorted the 25 items into five equal piles, ranging from 1 (*least like the mother*) to 5 (*most like the mother*). Three coders, blind to other data regarding the mother-child dyad, completed the Mini-MBQS in infancy, toddlerhood, and preschool years, respectively. Twenty-six Mini-MBQS were selected and independently sorted for reliability. Average item-by-item inter-rater reliability was .69 for the 10-month home visit, .74 for the 21-month home visit, and .74 for the 42-month lab visit.

After sorting, the Mini-MBQS sorts were organized and analyzed in two ways: a single measure reflecting maternal global sensitivity as conceptualized within attachment theory, and conceptually distinct domains of interactive behaviour that reflect aspects of the content of the mother-child interaction. First, maternal global sensitivity is the most commonly used measure extracted from the MBQS. A mother's global sensitivity score is derived by correlating her individual q-sort item scores with the item scores of the criterion sort that describes the interactive behaviour of the prototypically sensitive mother. The higher the correlation between the mother's sort and the theoretically sensitive mother's sort, the more sensitive the observed mother is determined to be.

A second metric involves domains of maternal interactive behaviour that were derived by grouping items from the Mini-MBQS reflecting underlying facets of a mother's interaction with her child. Items from the Mini-MBQS were rationally assigned to one of a set of three conceptually distinct domains of maternal behavior: Controlling/interfering (α = .93, .93, and .86 at 10, 21, and 42 months respectively),

awareness/accessibility (α = .91, .92, and .86) and positive affect (α = .74, .81, and .76; see Appendix H for a description and items within each domain). A mother's score on each domain was calculated by averaging her scores on all items within a domain. The Mini-MBQS was therefore used to produce maternal sensitivity, positive affect, controlling/interfering and awareness/accessibility scores at 10, 21 and 42 months.

Attachment classifications in infancy, toddlerhood, and preschool years: Strange situation, interesting-but-scary paradigm, and preschool strange situation. The quality of children's attachment relationships with their mothers was assessed using the Strange Situation Procedure (SSP; Ainsworth et al., 1978) at 13 months, the Interesting-but-Scary Paradigm (IbS; DeOliviera, 2001) at 27 months, and the Preschool Strange Situation (Preschool-SSP; Cassidy & Marvin, 1992) at 42 months. The attachment relationship at each age was first classified as secure, avoidant, ambivalent/resistant, and disorganized, and then collapsed into a two-way secure versus insecure dichotomy. Detailed descriptions of each of these procedures were provided in Study 1. Coders achieved a 90% agreement in coding the SSP (18 out of 20 reliability tapes, κ = .83, p < .01), 81% agreement in coding the IbS (13 out of 16 reliability tapes, κ = .72, p < .01), and 88% agreement in coding the Preschool-SSP (8 out of 9 reliability tapes, κ = .83, p < .01). Disagreement between coders was resolved by consensus (see Study 1).

Patterns of attachment continuity: Attachment trajectory groups that emerged from Study 1. Following the classification of children's attachment relationships as secure versus insecure in infancy, toddlerhood, and preschool years, latent class analysis (LCA; Collins & Lanza, 2010) was used in Study 1 to uncover distinct groups of children with different patterns of continuity in attachment quality (i.e., attachment trajectories). Two groups of children emerged from LCA (see Study 1). The first group consisted of children with a high probability of secure attachment in infancy, toddlerhood, and preschool years. This trajectory group (n = 45; 71% of the sample) was therefore labeled as "Stable Secure". The second group consisted of children with a moderate to high probability of insecure attachment over time, with evidence of some shifts toward security by preschool years. This trajectory group (n = 18; 29% of the sample) was labeled "stable insecure attachment with some shifts toward security" (See

Study 1). These two groups were used in subsequent analyses examining the link between maternal behaviour and children's membership in different attachment trajectory groups.

Procedure

At three months infant age, mother-infant dyads were visited in the home, at which point demographic data were collected. The larger study of which these participants were part of involved a number of other measures and assessments conducted at this time. These were not utilized in the analyses presented here. At 10 months infant age, mother-infant dyads were visited for approximately two hours in the home. The home visit consisted of an interview to update demographic data, a feeding session, a separation and reunion between mother-child dyads, and "play" interactions which included play with a challenging toy, read a picture book about emotions, free play with toys and play without toys. The quality of maternal interaction was assessed using the Mini-MBQS after the two-hour home observation.

At 13 months infant age, mother-infant dyads visited Western University and participated in the Strange Situation Procedure, which was videotaped and used for the assessment of the attachment relationship in infancy.

At 21 months of age, mother-toddler dyads were again visited in the home for approximately two hours. This visit consisted of an interview to update demographic data, a separation and reunion, and play interactions that included play with a challenging toy, read a picture book about emotions, free play with toys, and play without toys. The quality of maternal interaction was once again assessed with the Mini-MBQS after the home observation.

At 27 months of age, mother-toddler dyads once again visited Western University and participated in the Interesting-but-Scary Paradigm, which was videotaped and used for the assessment of the attachment relationship in toddlerhood.

Lastly, at 42 months of age, mother-infant dyads visited Western University for approximately 2.5 to 3 hours and participated in a number of tasks. The quality of maternal interaction was assessed with the Preschool Mini-MBQS after observations of mother-child dyads during a free play session (5 minutes), two episodes in which mother-child dyads watched five-minute video clips together, and a paradigm involving a slightly scary talking mask (3 minutes). How the mother supports her child's performance during

the mask episode gives important indications of her sensitivity during interaction. Mother-child dyads also participated in the Preschool-SSP during this visit, which was videotaped and used for the assessment of the attachment relationship in preschool years.

Missing Data Analysis

The Missing Value Analysis command in SPSS 20 was used to examine patterns of missing data. Little's MCAR test indicated that the data points were missing completely at random, $\chi 2(96) = 98.7$, $p = .41$. The analyses performed on the data were thus considered unbiased (Howell, 2012). Because the missingness mechanism was random, single imputation using an expectation maximization (EM) algorithm was considered a reasonable and efficient method for handling missing data (Acock, 2005; Graham, 2009). Details of the EM algorithm are given by Graham (2009). EM imputation is the preferred method compared with replacing missing values through case deletion or mean imputation (Scheffer, 2002). EM imputation has also been used in longitudinal studies assessing maternal sensitivity and attachment security (e.g. Jarri-Bimmel, Juffer, van IJzendoorn et al., 2006; Leerkes et al., 2009).

In the current study, missing values (i.e., Mini-MBQS scores) were imputed. The EM imputation model included demographic variables, maternal sensitivity and domains of interactive behaviour scores, quality of children's attachment relationship, children's attachment trajectory class membership, and auxiliary variables theoretically predictive of maternal sensitivity and attachment security (e.g. adult attachment interview classification). Although auxiliary variables are variables within the imputation model that are not part of the planned analysis, research has found that including auxiliary variables in the imputation model improves the accuracy of imputed values (Hippel & Lynch, 2013).

Results

Research Question 1: Does Maternal Interactive Behaviour Change across Early Childhood?

The first research question addressed in the present study was whether the quality of maternal interaction changed from infancy to preschool years. A mother's interactive behaviour was measured and analyzed using two metrics derived from the Mini-MBQS: first, the mother's global sensitivity score, a correlation reflecting the similarity of the

mother's interaction with that of a prototypically sensitive mother; and second, the score on each domain of maternal behaviour providing a better sense of the style of the mother's interaction.

Maternal global sensitivity. Mean maternal sensitivity scores did not change significantly over time, $F(2, 124) = 1.69$, *ns* (see Table 1a). Relative levels of maternal sensitivity were correlated between 10 and 21 months ($r = .49$, $p < .01$), 10 and 42 months ($r = .33$, $p < .01$), and 21 and 42 months ($r = .45$, $p < .01$). In other words, mothers who were more sensitive at 10 months tended to be more sensitive at 21 and 42 months.

Mini-MBQS domain scores. A repeated measures MANOVA was then used to assess change in each domain of maternal interactive behaviour. Mean positive affectivity scores did not change significantly across time ($F(2, 124) = .84$, *ns*); however, mean awareness/accessibility ($F(2, 124) = 7.37$, $p < .01$) and mean controlling/interfering ($F(2, 124) = 3.19$, $p < .01$) scores changed significantly. Pair wise comparisons, controlling for type I error, revealed that mothers were: (1) significantly less aware/accessible in preschool years compared to infancy ($p < .05$) and toddlerhood ($p < .01$), and (2) significantly less controlling during toddlerhood compared to infancy ($p < .05$) and preschool years ($p < .05$; see Table 1b). Correlation analyses further showed that mothers who were more aware/accessible at 10 months were also more aware/accessible at 21 ($r = .38$, $p < .01$) and 42 months ($r = .28$, $p < .05$). Similarly, mothers who were more controlling/interfering at 10 months were more controlling/interfering at 21 months ($r = .35$, $p < .01$); and these mothers were also more controlling/interfering at 42 months ($r = .28$, $p < .05$; See Table 2).

Table 1a.

Mean Maternal Sensitivity Scores Across Time

	Mean (SD)				
Mini-MBQS	10 Months	21 Months	42 Months	*F*	*p*
Sensitivity	.22 (.59)	.35 (.59)	.27 (.41)	1.69	*.18*

Table 1b.

Mean Domains of Maternal Behaviour Scores Across Time

	Mean (SD)				
Mini-MBQS Domains	10 Months	21 Months	42 Months	*F*	*p*
Awareness/Accessibility	3.20 (1.19)	3.42 (1.21)	2.80 (.81)	7.37	.00
Controlling/Interfering	2.71 (1.29)	2.29 (1.17)	2.63 (1.0)	3.19	.04
Positive Affectivity	3.81 (.83)	3.70 (.89)	3.87 (.77)	.84	.44

Note. Correlation between 10 and 21 month accessibility was .38, $p<.01$; between 10 and 42 months was .28, $p<.05$; between 21 and 42 months was .21, $p<.10$. Correlation between 10 and 21 months controlling/interfering behavior was .35, $p<.001$; between 10 and 42 months was .18, *ns*; and between 21 and 42 months was .28, $p<.05$. Correlation between 10 and 21 month positive affect was .36, $p<.01$; between 10 and 42 months was 0.48, *ns*; and between 21 and 42 months was -.05, *ns*.

Table 2.

Correlations between Maternal Interactive Behaviour (i.e. Sensitivity, Awareness/Accessibility, Controlling/Interfering Behaviour, and Positive Affect) at 10, 21, and 42 months

	Maternal Sensitivity		Accessibility/ Awareness		Controlling/ Interfering		Positive Affect	
Months	21	42	21	42	21	42	21	42
10	.49**	.33**	.38**	.28*	.35**	.18	.36**	.05
21		.45**		$.21^{t}$		.28*		-.05

*Note: ** $p < .01$; * $p < .05$; ^{t} $p < .10$*

Research Question 2: Does Maternal Interactive Behaviour Predict Children's Development of Different Patterns of Attachment Continuity?

The second research question addressed in this study was whether change over time in maternal sensitivity and other aspects of maternal behaviour (i.e. maternal awareness/accessibility, controlling/interfering and positive affect) predicted children's development of different patterns of attachment continuity. As noted in the introduction of this study, only the two patterns of continuity that emerged when attachment was measured as secure or insecure were used in the analyses: (1) children with a stable secure attachment trajectory, and (2) children with a stable insecure attachment trajectory with some shifts toward attachment security (see Study 1).

Analyses proceeded in three phases. First, preliminary analysis was conducted to determine how maternal sensitivity and each domain of maternal behaviour differed on average across time between children with a stable secure attachment trajectory versus children with a stable insecure attachment with some shifts toward security. Second, a hierarchical logistic regression analysis was used to examine the relative contribution of maternal sensitivity at each time point to predicting children's development of different attachment trajectories. Hierarchical regression analysis allows for an evaluation of the contribution of a predictor variable (e.g. sensitivity at a later time point) above and beyond previously entered predictors (e.g. sensitivity at earlier time points), therefore providing an assessment of how change in maternal sensitivity over time impacts children's memberships in the two attachment trajectory groups. Finally, three hierarchical logistic regressions were used to evaluate the contribution of each domain of maternal behaviour in predicting children's memberships in the two trajectory groups, once the impact of maternal sensitivity was accounted for.

Maternal sensitivity and style of interactive behaviors differ between the two attachment trajectory groups. A repeated measures ANOVA was used to examine whether children with different attachment trajectories experienced different levels of maternal sensitivity over time. Results showed that children with a stable secure attachment trajectory had mothers who were on average significantly more sensitive over time, $F(1, 61) = 21.29$, $p < .01$ (see Table 3). A repeated measures MANOVA was then used to examine whether children in the two trajectory groups experienced different

levels of each domain of maternal behaviour. Results also showed that children with a stable secure attachment trajectory had mothers who were on average significantly more aware/accessible, $F(1, 61) = 16.71$, $p < .01$, displayed more positive affect, $F(1, 61) = 19.21$, $p < .01$, and less controlling/interfering, $F(1, 61) = 16.69$, $p < .01$ (see Table 3).

Stability in maternal sensitivity predicts children's membership in the stable secure attachment trajectory group. Following the preliminary analysis, a three-step hierarchical logistic regression was used to examine the relative contribution of maternal sensitivity at each time point (i.e. 10, 21, and 42 months) in predicting children's membership in the two attachment trajectories. The order of entry per variable was based on its temporal contingency: 10-month sensitivity was entered in the first block, followed by 21-month sensitivity in the second block, and finally 42-month sensitivity in the third block (see Table 4).

Maternal sensitivity at 10 months, when entered by itself in the first block, significantly increased children's likelihood of a stable secure attachment trajectory ($\chi^2(1) = 4.94$, $p < .05$, Nagelkerke $R^2 = .11$; $b = 1.06$, $Wald = 4.67$, $p < .05$). Maternal sensitivity at 21 months was then added to the logistic regression in the second block ($\chi^2(2) = 8.68$, $p < .05$, Nagelkerke $R^2 = .19$). Results showed that maternal sensitivity at 21 months contributed uniquely to the likelihood of a stable secure attachment trajectory once 10-month sensitivity was accounted for ($b = 1.04$, $Wald = 3.65$, $p = .05$). In other words, an increase in sensitivity at 21 months further increased the likelihood of a stable secure attachment trajectory. Lastly, maternal sensitivity at 42 months was entered into the logistic regression in the third block ($\chi^2(3) = 28.45$, $p < .01$, Nagelkerke $R^2 = .52$). Once again, sensitivity at 42 months contributed uniquely to the prediction, such that an increase in sensitivity at 42 months further increased the likelihood of a stable secure attachment trajectory ($b = 3.96$, $Wald = 13.88$, $p < .05$) even after the effects of maternal sensitivity at 10 and 21 months were accounted for. Thus, these results revealed that maternal sensitivity continued to influence children's patterns of continuity in attachment over time, such that maternal sensitivity at each time point added uniquely to the prediction of a stable secure attachment trajectory (see Table 4).

Table 3.

Differences in Mean Maternal Sensitivity and Domains of Maternal Behaviour Scores Between Trajectory Groups

	Mean (SD)							
	Sensitivity		Awareness/Access.		Controlling/Inter.		Positive Affect	
Time	Stable Secure	Stable Insecure	Stable Secure	Stable Insecure	Stable secure	Stable insecure	Stable secure	Stable Insecure
1	0.32	-0.05	3.37	2.78	2.54	3.16	4.01	3.33
2	0.48	0.14	3.67	2.81	2.03	2.96	3.85	3.31
3	0.44	-0.14	3.08	2.12	2.35	3.35	4.03	3.50
Total	0.41	-0.06	3.37	2.57	2.3	3.16	3.96	3.38

Note. Children with a stable secure attachment trajectory had mothers who were on average significantly more sensitive, $F(1, 61) = 21.29$, $p < .01$, more aware/accessible $F(1, 61) = 16.71$, $p < .01$, less controlling/interfering, $F(1, 61) = 16.69$, $p < .01$, and displayed more positive affect, $F(1, 61) = 19.21$, $p < .01$, than children with a stable insecure trajectory with some tendency to shift towards security.

Table 4.

Hierarchical Logistic Regression: Stable Maternal Sensitivity Predicts the Likelihood of a Stable Secure Attachment Trajectory

Predictors	*b*	*Wald*	*p*
Step 1:			
10 Month Sensitivity	1.06	4.67	.03
Step 2:			
10 Month Sensitivity	.56	.98	.32
21 Month Sensitivity	1.04	3.65	.05
Step 3:			
10 Month Sensitivity	.56	.50	.48
21 Month Sensitivity	.17	.05	.86
42 Month Sensitivity	3.96	13.88	.00

Note 1: Step 1: χ^2 (1) = 4.94, p<.05, Nagelkerke R^2 =.11; correctly classified 73% of cases
Note 2: Step 2: χ^2 (2) = 8.68, p< .05, Nagelkerke R^2 =.19; correctly classified 78% of cases
Note 2: Step 3: χ^2 (3) = 28.45, p<.01, Nagelkerke R^2 =.52; correctly classified 87% of cases

Domains of maternal behaviour do not add to the prediction of different attachment trajectories once the effect of maternal sensitivity is accounted for. Following the above analysis, three separate hierarchical logistic regressions were conducted whereby each domain of maternal interactive behavior was entered to predict children's likelihood of a stable secure attachment trajectory, while controlling for the effect of maternal sensitivity over time. The first hierarchical logistic regression evaluated the relative contribution of maternal awareness/accessibility over time in predicting the likelihood of a stable secure attachment trajectory; the second logistic regression examined the relative contribution of maternal controlling/interfering behaviour over time; and the third logistic regression examined the relative contribution of maternal positive affect over time.

The results of the three logistic regressions are presented in Table 5a-c. Results indicated that maternal awareness/accessibility and controlling/interfering behaviour at 10, 21, and 42 months did not significantly improve prediction of a stable secure attachment trajectory once maternal sensitivity was accounted for. With regard to maternal positive affect, only 10-month maternal positive affect contributed uniquely to the prediction of a stable secure attachment trajectory. Positive affect at 21 and 42 months did not improve the prediction of a stable secure attachment trajectory once maternal sensitivity and positive affect at 10 months were accounted for.

Summary. The results of the hierarchical logistic analyses found that maternal sensitivity at each time point uniquely predicted membership in the stable secure attachment trajectory group. In other words, children's probability of a stable secure attachment trajectory increased with each experience (i.e. at 10 month, 21 month, and 42 month) of sensitive mothering. On the other hand, the domains of maternal interactive behaviour did not further increase children's likelihood of a stable secure attachment trajectory once the effect of maternal sensitivity was accounted for. Given these findings, post-hoc exploratory path analysis was conducted to examine only the longitudinal and concurrent relationships between maternal sensitivity and attachment security. Specifically, we were interested in understanding how stability or change in maternal sensitivity over time influenced children's stability or change in attachment security over time.

Table 5a.

Controlling for Maternal Sensitivity, Awareness/Accessibility Does Not Increase Likelihood of a Stable Secure Attachment Trajectory

Predictors	*b*	*Wald*	*p*
Step 1: Control Variables			
10 Mo. Sensitivity	.56	.50	.48
21 Mo. Sensitivity	.17	.05	.86
42 Mo. Sensitivity	3.96	13.88	.00
Step 2:			
10 Mo. Sensitivity	.79	.38	.54
21 Mo. Sensitivity	.15	.04	.84
42 Mo. Sensitivity	3.98	13.76	.00
10 Mo. Accessibility	-.13	.06	.82
Step 3:			
10 Mo. Sensitivity	.77	.37	.55
21 Mo. Sensitivity	.67	.19	.66
42 Mo. Sensitivity	4.03	13.64	5.24
10 Mo. Awareness/Accessibility	-.12	.05	.89
21 Mo. Awareness/Accessibility	-.28	.15	.76
Step 4:			
10 Mo. Sensitivity	.14	.97	.33
21 Mo. Sensitivity	.49	.10	.75
42 Mo. Sensitivity	3.01	4.59	.03
10 Mo. Awareness/Accessibility	-.39	.39	.53
21 Mo. Awareness/Accessibility	-.18	.07	.80
42 Mo. Awareness/Accessibility	.79	1.31	.25

Note 1: Step 1: χ^2 (3) = 28.45, p<.01, Nagelkerke R^2 =.52; correctly classified 87% of cases
Note 2: Step 2: χ^2 (4) = 28.51, p< .01, Nagelkerke R^2 =.52; correctly classified 89% of cases
Note 3: Step 3: χ^2 (5) = 28.67, p<.01, Nagelkerke R^2 =.52; correctly classified 89% of cases
Note 4: Step 4: χ^2 (6) = 29.99, p<.01, Nagelkerke R^2 =.54; correctly classified 87% of cases

Table 5b.

Controlling for Maternal Sensitivity, Controlling/Interfering Behaviour Does Not Increase Likelihood of a Stable Secure Attachment Trajectory

Predictors	*b*	*Wald*	*p*
Step 1: Control Variables			
10 Mo. Sensitivity	.56	.50	.48
21 Mo. Sensitivity	.17	.05	.86
42 Mo. Sensitivity	3.96	13.88	.00
Step 2:			
10 Mo. Sensitivity	1.32	1.15	.28
21 Mo. Sensitivity	.23	.09	.76
42 Mo. Sensitivity	4.06	14.16	.00
10 Mo. Controlling/Interfering	.44	.64	.42
Step 3:			
10 Mo. Sensitivity	1.53	1.52	.22
21 Mo. Sensitivity	-1.79	1.02	.31
42 Mo. Sensitivity	4.34	13.47	.00
10 Mo. Controlling/Interfering	.45	.66	.42
21 Mo. Controlling/Interfering	-1.10	1.57	.21
Step 4:			
10 Mo. Sensitivity	1.38	1.15	.28
21 Mo. Sensitivity	-1.99	1.20	.27
42 Mo. Sensitivity	3.99	10.29	.00
10 Mo. Controlling/Interfering	.38	.45	.50
21 Mo. Controlling/Interfering	-1.15	1.67	.19
42 Mo. Controlling/Interfering	-.36	.74	.39

Note 1: Step 1: χ^2 (3) = 28.45, p<.01, Nagelkerke R^2 =.52; correctly classified 87% of cases
Note 2: Step 2: χ^2 (4) = 29.12, p< .01, Nagelkerke R^2 =.53; correctly classified 87% of cases
Note 3: Step 3: χ^2 (5) = 30.84, p<.01, Nagelkerke R^2 =.56; correctly classified 87% of cases
Note 4: Step 4: χ^2 (6) = 31.58, p<.01, Nagelkerke R^2 =.57; correctly classified 86% of cases

Table 5c.

Controlling for Maternal Sensitivity, Positive Affect Does Not Increase the Likelihood of a Stable Secure Attachment Trajectory

Predictors	*b*	*Wald*	*P*
Step 1: Control Variables			
10 Mo. Sensitivity	.56	.50	.48
21 Mo. Sensitivity	.17	.05	.86
42 Mo. Sensitivity	3.96	13.88	.00
Step 2:			
10 Mo. Sensitivity	-1.50	1.28	.26
21 Mo. Sensitivity	-.45	.25	.62
42 Mo. Sensitivity	4.88	13.56	.00
10 Mo. Positive Affect	2.00	4.63	.03
Step 3:			
10 Mo. Sensitivity	-1.49	1.25	.26
21 Mo. Sensitivity	-.14	.01	.92
42 Mo. Sensitivity	4.95	13.27	.00
10 Mo. Positive Affect	1.98	4.48	.03
21 Mo. Positive Affect	-.23	.11	.73
Step 4:			
10 Mo. Sensitivity	-1.48	1.27	.26
21 Mo. Sensitivity	-.25	.03	.86
42 Mo. Sensitivity	4.80	10.99	.00
10 Mo. Positive Affect	1.99	4.58	.03
21 Mo. Positive Affect	-.14	.03	.85
42 Mo. Positive Affect	.19	.08	.77

Note 1: Step 1: χ^2 (3) = 28.45, p<.01, Nagelkerke R^2 =.52; correctly classified 87% of cases
Note 2: Step 2: χ^2 (4) = 34.41, p< .01, Nagelkerke R^2 =.60; correctly classified 89% of cases
Note 3: Step 3: χ^2 (5) = 34.53, p<.01, Nagelkerke R^2 =.61; correctly classified 91% of cases
Note 4: Step 3: χ^2 (6) = 34.61, p<.01, Nagelkerke R^2 =.61; correctly classified 91% of cases

Research Question 3: What are the associations over time between maternal sensitivity and attachment security?

Path analysis is an extension of multiple regression that allows researchers to analyze complicated models in which there are several dependent variables or "chains" of influence, e.g., variable A influences variable B, which in turn influences variable C (Streiner, 2005). Path analysis is therefore a powerful tool for determining whether data are consistent with theorized models of causality (Streiner, 2005). In this study, path analysis is used to examine how the two measures of maternal sensitivity and attachment security are concurrently and longitudinally related. In this study, path analysis involved two steps, initial model fitting and model trimming.

Initial model fitting. We used Mplus version 5.0 to test a series of three nested models developed based on theory (see Figure 1). Model 1 is a baseline model, in which concurrent paths from maternal sensitivity to attachment security, and continuity paths from year one to year two and from year two to year three were estimated (See Figure 1: Model1). The concurrent paths between maternal sensitivity and attachment security in the path model tests the theoretical prediction that maternal sensitivity predicts concurrent attachment security. The continuity paths in the path model tests the theoretical predictions that earlier measures of maternal sensitivity predict later measures of maternal sensitivity, and that earlier measures of attachment security predict later measures of attachment security.

Following the above results, diagonally directed paths specifying various cascade effects at both time intervals were added in model 2 (see Figure 1: Model 2). Specifically, model 2 includes two cross-lagged paths from earlier measures of maternal sensitivity to later measures of attachment security. The two cross-lagged paths from maternal sensitivity to attachment security test the theoretical prediction that earlier measures of maternal sensitivity directly predict later measures of attachment security.

Lastly, two cross-lagged paths from earlier measures of attachment security to later measures of maternal sensitivity were added in model 3 (see Figure 1: Model 3). In contrast to model 2, examination of the two cross-lagged paths from attachment security to later maternal sensitivity in model 3 tests the prediction that the quality of the

attachment relationship directly predicts mother's sensitivity in later interactions with her child.

The chi-square statistic, the root mean square error of approximation (RMSEA), and the comparative fit index (CFI) were used to assess the fit of each of the three theorized models (Kline, 2005; McDonald & Ho, 2002). The chi-square is the traditional measure used to evaluate overall model fit (Hu & Bentler, 1999). The chi-square test compares the sample covariance matrix with the model-implied covariance matrix. A significant chi-square test means the hypothesized relationships represented by the hypothesized model are statically unlikely given the data. Therefore, the model should be rejected. In other words, a non-significant chi-square value indicates a good model fit. The RMSEA represents a measure of approximate fit rather than perfect fit, with an attempt to remove the effects of degree of freedom and sample size. Similar to the chi-square statistic, a lower RMSEA value indicates a better fit (Kline, 2005). A RMSEA value less than .08 is considered a good fit and less than .05 is considered a very good fit (Loehlin, 1998). Lastly, the CFI assesses the relative improvement in fit of the researcher's model compared to a baseline model. According to Hu and Bentler (1999), values greater than .95 indicate good fit but a value of 1.0 does not mean the model has a perfect fit. In summary, a non-significant chi-square, accompanied by CFI value of no less than .95 and a RMSEA value of no more than .06, indicates a good fit (Hu & Bentler, 1999); and a non-significant chi-square with a CFI value between .90 to .95 and RMSEA value between .06 to .08 indicates fair fit (Hu & Bentler, 1999).

The bivariate associations between maternal sensitivity and attachment security are presented in Table 6. The fit statistics for the sequence of models that investigated the associations between maternal sensitivity and attachment security from infancy to early childhood are shown in Table 7. Only model 3 showed good model fit statistics (see Table 7). For purposes of completeness, the path regression coefficients of all three models are presented in Table 8, but only the regression coefficients of model 3 are presented in a path diagram (see Figure 2).

Table 6.

Correlations between Maternal Sensitivity and Attachment Security

		Attachment Security	
Sensitivity	*13*	*27*	*42*
10	*.39***	*.34***	*.15*
21	*.29**	*.32**	*.24*[t]
42	*.41***	*.54***	*.40***

*Note: ** p < .01; * p < .05;* [t] *p <.10*

Table 7.

Path Analysis: Model Fit Statistics for Models 1 to 3

Fit Statistics	*Model 1*	*Mode1 2*	*Model 3*
Chi-Square	χ^2 (6) *= 12.84, p=.05*	χ^2 (5) *= 14.55, p =.01*	χ^2 (3) *= 1.56, p = .67*
CFI	*.80*	*.72*	*1.00*
RMSEA	*.13*	*.17*	*.00*

Note. A non-significant chi-square, accompanied by CFI value of no less than .95 and a RMSEA value of no more than .06, indicates a good fit (Hu & Bentler, 1999). Model 3 is a good fit to the data.

Table 8.

Path Analysis: Path Regression Coefficients for Models 1 to 3.

Model 1				Mode1 2				Model 3			
Paths	*Est (b)*	*S.E*	*P*	*Paths*	*Est (b)*	*S.E*	*P*	*Paths*	*Est (b)*	*S.E*	*P*
SS ON				SS ON				SS ON			
10 mo. Sen	.88	.27	.00	10 mo. Sen	.88	.27	.00	10 mo. Sen	.88	.27	.00
21 mo. Sen ON				21 mo. Sen ON				21 mo. Sen ON			
10 mo. Sen	.49	.14	.00	10 mo. Sen	.49	.14	.00	10 mo. Sen	.40	.15	.01
								SS	.09	.08	.25
IBS ON				IBS ON				IBS ON			
SS	.36	.23	.12	SS	.38	.28	.17	SS	.42	.23	.07
21 mo. Sen	1.11	.49	.02	10 mo. Sen	-.02	.43	.95	10 mo. Sen	.27	.32	.39
				21 mo. Sen	1.15	.60	.05	21 mo. Sen	.28	.35	.42
42 mo. Sen ON				42 mo. Sen ON				42 mo. Sen ON			
21 mo. Sen	.45	.15	.00	21 mo. Sen	.45	.15	.00	21 mo. Sen	.18	.09	.05
								IBS	.19	.06	.00
PSS ON				PSS ON				PSS ON			
IBS	.24	.20	.23	IBS	.30	.32	.35	IBS	.11	.30	.71
42 mo. Sen	.93	.32	.00	21 mo. Sen	-.28	.86	.74	21 mo. Sen	.22	.36	.53
				42 mo. Sen	1.17	.74	.11	42 mo. Sen	.87	.59	.13

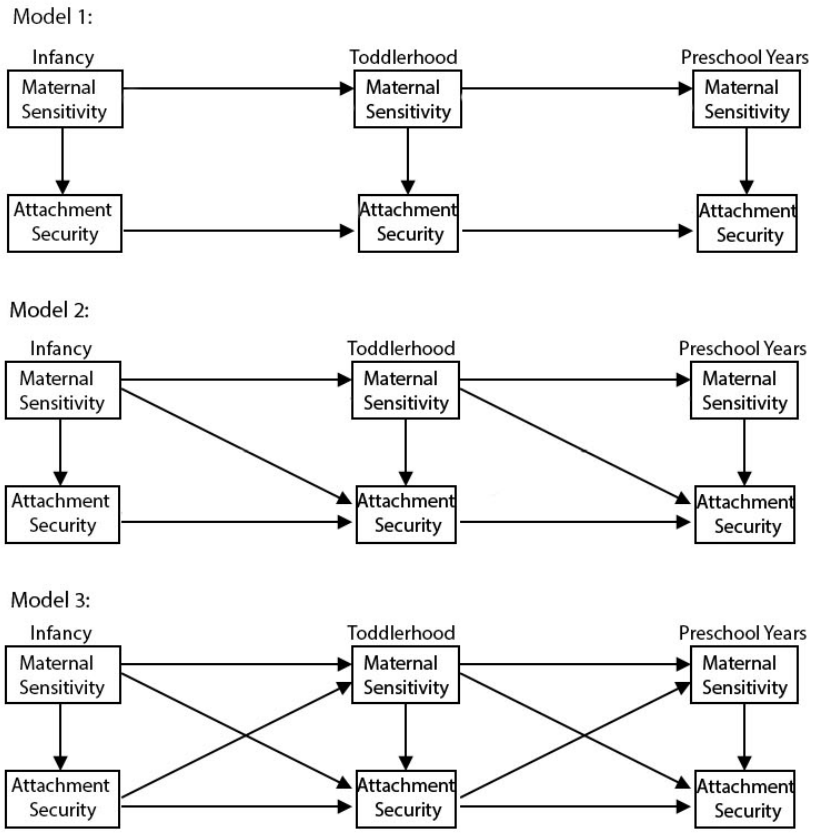

Figure 1. Model 1 to 3 Path Diagrams.

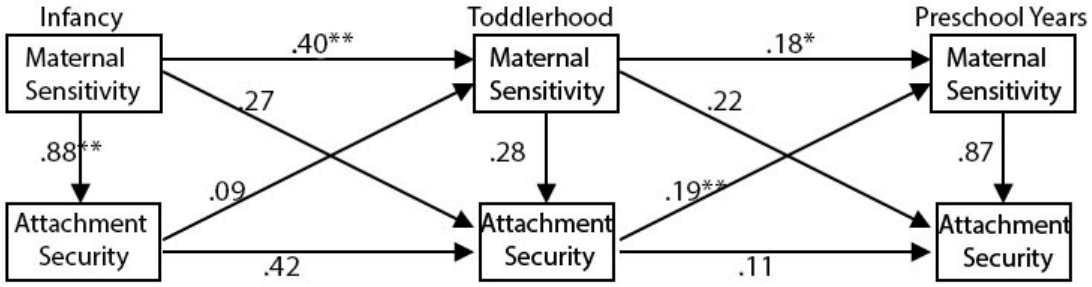

Figure 2. Model 3: Path model of the longitudinal relationship between maternal sensitivity and attachment security. χ^2 (3) = 1.56, p = .67, CFI = 1.00, RMSEA = .00.

Model trimming. Following the above results, model trimming was conducted on model 3. The purpose of model trimming is to find the most parsimonious model that fits the data well (Klein, 2005). In general, models are trimmed according to theoretical or empirical considerations (Klein, 2005). In theory-based re-specification of the model, trimming is guided by researchers' hypotheses, whereas in the empirical based re-specification, paths are deleted according to statistical criteria (Klein, 2005). Given the exploratory nature of this path analysis, model trimming in this study was based on both empirical and theoretical considerations.

Throughout the model trimming process, the chi-square goodness of fit statistic was monitored during each model refitting. The model trimming process was complete when the model chi-square became significant (i.e. poor model fit), or the newer model became a significantly worse fit to the data, or every remaining path became statistically significant (Tan, 2009). In this study, the continuity paths between attachment security and the cross-lagged paths between early maternal sensitivity and later attachment security were removed. All remaining paths in the model were statistically significant (see Table 9). The resulting model fits the data well ($\chi^2(6) = 7.52$, p =.27, CFI =.95, RMSEA =.06). Model 4 was adopted as the final path model (Figure 3).

Direct effects. Examination of the continuity paths in model 4 indicated that early measures of maternal sensitivity directly predicted later measures of maternal sensitivity, but early measures of attachment security did not predict later measures of attachment security (i.e. continuity paths were trimmed). Second, examination of concurrent paths indicated that maternal sensitivity was concurrently related to attachment security, but not directly predictive of later attachment security (i.e. cross-lagged paths between early maternal sensitivity and later attachment security were trimmed). Lastly, cross-lagged paths between earlier attachment security and later maternal sensitivity were significant, suggesting that attachment security may have over time affected the mothers' sensitivities in interaction.

Table 9.

Path Analysis: Path Regression Coefficients for Model 4, the Final Path Model

Paths	*Estimate (b)*	*Estimate (β)*	*S.E*	*P*
SS ON				
10 mo. Sen	*.88*	*.46*	*.27*	*.00*
21 mo. Sen ON				
10 mo. Sen	*.38*	*.42*	*.15*	*.01*
SS	*.17*	*.35*	*.08*	*.03*
IBS ON				
21 mo. Sen	*1.07*	*.49*	*.50*	*.03*
42 mo. Sen ON				
21 mo. Sen	*.31*	*.41*	*.15*	*.05*
IBS	*.15*	*.41*	*.07*	*.03*
PSS ON				
42 mo. Sen	*1.40*	*.49*	*.53*	*.00*

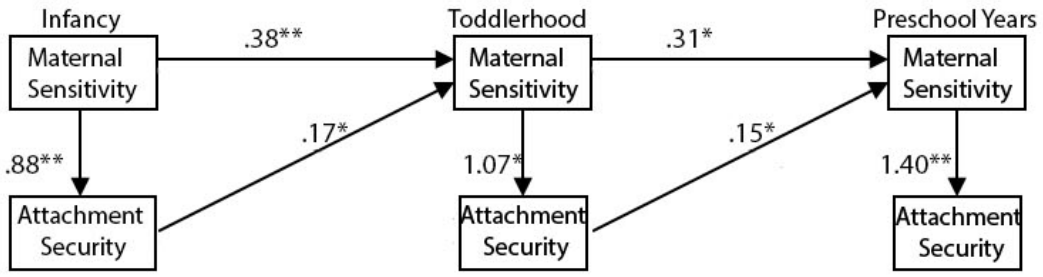

Figure 3. Model 4: Final path model of the longitudinal relationship between maternal sensitivity and attachment security. χ^2 (6) = 7.52, p = .27, CFI = .95, RMSEA = .06.

Indirect effects. Given the non-significant cross-lagged paths from earlier measures of maternal sensitivity to later measures of attachment security and non-significant continuity paths from earlier to later measures of attachment security, indirect paths between these variables were examined (see Table 10). Results indicated that earlier measures of maternal sensitivity had significant indirect effects on later measures of attachment security through their influence on intervening measures of maternal sensitivity and attachment security. Specifically, 10-month sensitivity had an indirect effect on attachment security in toddlerhood through attachment security in infancy and 21-month sensitivity (*b= .57, S.E = .29, p = .03*), and 21-month sensitivity had an indirect effect on attachment security in preschool years through its influence on attachment security in toddlerhood and 42-month sensitivity (*b= .65, S.E = .25, p = .06*). Similarly, early measures of attachment security had marginally significant indirect effects on later measures of attachment security through their influence on intervening measures of maternal sensitivity. Attachment security in infancy indirectly predicted attachment security in toddlerhood through its influence on maternal sensitivity at 21 months (*b= .18, S.E = .10, p = .08*), and attachment security in toddlerhood predicted attachment security in preschool years through its influence on maternal sensitivity at 42 months (*b = .20, S.E = .12, p = .10)*.

Summary. In summary, examination of the direct effects within model 4 revealed that: (1) early measures of maternal sensitivity were directly predictive of later measures of maternal sensitivity; (2) early measures of attachment security did not directly predict later measures of attachment security; (3) maternal sensitivity was concurrently related to attachment security, but not directly predictive of later attachment security, and (4) earlier measures of attachment security directly predicted later measures of maternal sensitivity.

Further examination of the indirect effects within model 4 indicated that: (1) earlier measures of maternal sensitivity predicted later measures of attachment security through intervening measures of maternal sensitivity and attachment security; and similarly, (2) earlier measures of attachment security predicted later measures of attachment security through its influence on intervening measures of maternal sensitivity.

Table 10.

Model 4: Indirect Effects

Paths	*Estimate (b)*	*Estimate (β)*	*S.E*	*P*
From 10 mo. Sensitivity to IBS				
10 mo. Sen → 21 mo. Sen → IBS	.41	.21	.23	.07
10 mo. Sen → SS → 21 mo. Sen → IBS	.16	.08	.10	.11
Total indirect effect	.57	.29	.26	.03
From 21 mo. Sensitivity to PSS				
21 mo. Sen → 24 mo. Sen → PSS	.43	.20	.28	.12
21 mo. Sen → IBS → 42 mo. Sen → PSS	.22	.10	.16	.17
Total indirect effect	.65	.30	.35	.06
From SS to IBS				
SS → 21 mo. Sen → IBS	.18	.18	.10	.08
Total indirect effects	.18	.18	.10	.08
From IBS to PSS				
IBS → 42 mo. Sen → PSS	.20	.20	.12	.10
Total indirect effects	.20	.20	.12	.10

Discussion

Study 1 of this dissertation found two groups of children with distinct patterns of attachment continuity. These included a group of children with a stable secure attachment trajectory and another group whose attachment trajectory is characterized by stable insecurity with some shifts toward security. Attachment theory suggests that systematic differences in maternal interactions over time are factors that may lead to the development of different attachment trajectories (Bowlby, 1973; Ainsworth et al., 1978), such that continuous sensitive maternal interaction predicts the development of a stable secure attachment trajectory; that continuous insensitive maternal interaction predicts the development of a stable insecure attachment trajectory; and that a change in the quality of maternal interaction predicts a shift in the attachment relationship in the parallel direction. The primary purpose of this study was to investigate in detail this proposition that children's experiences of maternal sensitivity over time may influence their development of different patterns of stability and change in attachment quality. The second purpose of this study was to investigate whether particular aspects of maternal behaviour (i.e., accessibility, controlling/interfering behaviour, and positive affect) predicted children's development of different patterns of attachment continuity beyond the effect accounted for by maternal sensitivity. In the sections that follow, we will first summarize and discuss the key findings related to the developmental link between change in maternal sensitivity and variation in children's patterns of attachment continuity, then subsequently address whether change in other aspects of maternal behaviour predicted children's patterns of attachment continuity when the effect of maternal sensitivity was already taken into account, and finally present the limitations and directions for future work.

The Influence of Maternal Sensitivity on Children's Patterns of Attachment Continuity

The current study found that the average level of sensitivity displayed by mothers across the whole sample did not change between infancy, toddlerhood, and preschool years. Furthermore, mothers who were relatively more sensitive in infancy tended to be more sensitive in toddlerhood and preschool years. When maternal sensitivity was examined in the context of the two attachment trajectory groups, results showed that

mothers of children with a pattern of stable secure attachment were consistently more sensitive than mothers of children with a pattern of stable insecure attachment with some shifts toward security.

Logistic regression analysis was then conducted to examine how maternal sensitivity at each age influenced children's likelihood of developing a pattern of stable secure attachment over a pattern of stable insecure attachment with some shifts toward security. Results revealed that maternal sensitivity in infancy, toddlerhood, and preschool years, each uniquely contributed to the prediction of a stable secure attachment trajectory. Specifically, the likelihood of developing a pattern of stable secure attachment increased with each experience of sensitive care. In other words, a pattern of stable secure attachment developed from consistent sensitive maternal interaction at all three ages, and not solely from sensitive maternal interaction at a single time point. This finding offers preliminary support for the theoretical prediction that children's patterns of continuity in attachment are shaped by their repeated experiences of maternal sensitivity over time.

Path Analysis: The Longitudinal Relationship between Maternal Sensitivity and Attachment Security

Given the above results, exploratory path analysis was then conducted to examine the longitudinal relationship between maternal sensitivity and attachment security. The aim of the path analysis was to uncover how measures of maternal sensitivity and children's attachment securities mutually influenced each other over early childhood, leading to the emergence of the two groups of children with distinct patterns of continuity in attachment.

Based on theoretical predictions that continuity in attachment quality results from continuity in care-giving (Ainsworth et al., 1978) and children's internal working models of attachment (Bowlby, 1973), a path model was developed with: 1) continuity paths between measures of maternal sensitivity over time, 2) continuity paths between measures of attachment security over time, and 3) concurrent paths between maternal sensitivity and attachment security at each age. The significance of each theorized path was examined.

Path analysis found continuity paths between mothers' sensitivities over time. In other words, mothers who were more sensitive in their interactions with their children

during infancy tended to be more sensitive in their interactions during toddlerhood. These mothers were also, in turn, more sensitive in their interactions during the preschool years. Path analysis also found that maternal sensitivity predicted concurrent attachment security, such that at each age, mothers who were more sensitive tended to have children who were correspondingly more secure. However, no significant continuity paths between children's attachment security statuses over time were found. Specifically, when the effect of maternal sensitivity was taken into account, the quality of children's attachment relationships in infancy did not affect the quality of their attachment relationships in toddlerhood. The quality of their attachment relationships in toddlerhood also did not influence the quality of their attachment relationships during preschool years. The continuity paths between children's attachment relationships were therefore removed from the path model. The resultant path model suggests that continuity in maternal sensitivity underlies continuity in the quality of children's attachment relationships. Specifically, the two groups of children, each with a distinct pattern of stability in attachment, emerged from the two groups' experiences of distinct patterns of continuity in maternal sensitivity. The results do not support the notion that later attachment quality in this developmental period is an outcome of attachment security at an earlier stage.

The lack of any significant continuity paths between children's attachment classifications across early childhood in the path analysis was surprising since children's attachment classifications are considered the behavioural manifestations of their internal working models (Ainsworth et al., 1978), and internal working models are thought to be relatively stable over time (Bowlby, 1973). A review of Bowlby's (1969/1982) theory indicates that children's internal working models of attachment are thought to consolidate in late childhood, at which point their social environments become increasingly less influential in determining the quality of their relationships, and in parallel, their attachment relationships become increasingly resistant to change. The lack of direct paths between the quality of children's attachment relationships may reflect this argument that children's internal working models have yet to consolidate in early childhood resulting in less direct stability between attachment classification when the effect of environmental influences (i.e, maternal sensitivity) are controlled for. Consistent with this argument, Howe (2011) also noted in his review of the literature on continuity of attachment that,

"between ages of one to four, attachments are a little more inconsistent", whereas "after the age of four, continuity of attachment becomes more robust".

Given theoretical suggestions that patterns of attachment continuity in early childhood may be influenced more by environmental changes, whereas patterns of continuity in later childhood may be influenced to a greater extent by internal working models of attachment, the transactional process between maternal sensitivity and attachment security observed in the current study may thus be different than the process that may occur in later childhood and adolescence. Extending the current longitudinal examination of maternal sensitivity and attachment security into late childhood and early adolescence is needed to examine this specific prediction.

Although we found no evidence that children's earlier attachment relationship qualities directly determined their later relationship qualities, path analysis found an indirect relationship between these variables. Specifically, children with more secure attachment relationships tended to have mothers who were subsequently more sensitive, and these mothers were in turn more likely to have secure attachment relationships with their children at a later time point. This finding indicates that the absence of direct pathways between children's attachment classifications over time does not mean that children's histories of attachment relationships are insignificant in determining the qualities of their later relationships. Their relationship histories indirectly affect later attachment relationships by influencing their mothers' abilities to provide subsequent sensitive care. This is consistent with other studies that have examined the effect of a secure relationship on later parenting (see review by Vaugh, Bost, & van IJzendoorn, 2008). Matas and colleagues (1978) found that secure attachments in infancy predicted smoother and more harmonious parent-child interactions during the toddler period (Matas et al., 1978; Waters et al., 1979), and Booth-LaForce and Oxford (2008), in a study of 1092 children from the NICHD study of Early Child Care and Youth Development, found that mothers of children who were securely attached at 24 months were significantly more sensitive at 54 months than mothers with children who were insecurely attached at 24 months. Studies assessing continuity in attachment security have tended to focus solely on direct effects between attachment variables; however, the current finding suggests that indirect effects are also important considerations for future investigations.

Contribution of Other Aspects of Maternal Behaviour on Children's Patterns of Continuity in Attachment

In their meta-analysis of 66 studies looking at parental antecedents of attachment security, De Wolff and van IJzendoorn (1997) compared the effects of maternal sensitivity versus eight other domains of maternal interactive behaviour: contiguity of response, physical contact, cooperation, synchrony, mutuality, emotional support, positive attitude, and stimulation. The investigators found that several domains of maternal interactive behaviour showed effect sizes similar to maternal sensitivity (i.e., r = .32 between mutuality and attachment security; r = . 26 between synchrony and attachment security) and that sensitivity was only moderately correlated with these other aspects of parenting (average r = .34). Based on these results, De Wolff and van IJzendoorn argued that, "the original concept of sensitivity may not capture the only mechanism through which the development of attachment is shaped and studies combining other promising measures may provide more insight into the additional explanatory value of these alternative approaches over and above sensitivity".

The current findings do not support the prediction that other aspects of maternal interactive behaviour further distinguished children's patterns of continuity in attachment. Specifically, we found that maternal sensitivity was the only variable that uniquely predicted children's trajectories of attachment when maternal sensitivity and each aspect of maternal interactive behaviour (i.e. accessibility, controlling/interference, and positive affect) were examined in the logistic regression analysis. However, it must be noted that the domains of maternal behaviour assessed in this study were different than the domains within De Wolff and van IJzendoorn's meta-analysis (1997). Aspects of maternal behaviour assessed in the current study were more similar to Ainsworth's four rationally constructed dimensions. For example, Ainsworth's accessibly versus ignoring dimension encompass the concepts of awareness and accessibility assessed in this study, and her cooperation versus interference dimension encompasses the concepts of controlling and interfering behaviour assessed in this study. Ainsworth and colleagues found that their dimensions of maternal behaviour were highly correlated with maternal sensitivity (r ranging from .82 to .89). We similarly found that other aspects of maternal interactive

behaviour (maternal awareness/accessibility, controlling/interfering behaviour, and positive affectivity) assessed in this study were also highly correlated with maternal sensitivity (*r* ranging from .51 to .92). Given the high inter-correlations between sensitivity and these other aspects of maternal behaviour, it was not surprising that maternal sensitivity emerged as the only significant predictor in this study. Future studies interested in assessing the influence of other aspects of maternal interactive behaviour may benefit from assessing aspects of maternal behaviours that are more distinct from maternal sensitivity and more similar to the domains reported by De Wolff and van IJzendoorn (1997).

Although we did not find that other aspects of maternal behaviour predicted children's attachment trajectories above and beyond the effect of maternal sensitivity, of particular interest is the finding that the patterning of the content of maternal interactions does change with age. Specifically levels of maternal awareness/accessibility and controlling/interfering behaviours changed significantly over early childhood. This contrasts with overall levels of maternal sensitivity that remained stable over time. This contrast suggests that the specific behaviours that comprise sensitive parenting changes over time and sensitive mothers may adjust the content of their interactions to fit changes in their children's developmental levels and needs. This finding therefore suggests added value to assessing the content of maternal behaviour beyond a global dimension, such as maternal sensitivity.

Implications and Directions for Future Work

Attachment researchers have argued that the developmental link between maternal sensitivity and attachment security follows a nonlinear, transactional process in which "both history and present circumstances are important, but also that established patterns of adaptation may be transformed by new experiences while, at the same time, new experiences are framed by, interpreted within, and even in part created by prior history of adaptation" (Sroufe, 2005). This complex transactional process was empirically illustrated in the findings of this study and was possible because we employed a longitudinal design in which maternal sensitivity and attachment security were both repeatedly assessed across early childhood. Furthermore, theoretical models of the concurrent and longitudinal relationships between maternal sensitivity and attachment

security were developed and systematically tested using path analysis. The longitudinal design and statistical analyses used are significant strengths of the current study.

A limitation of this study, however, relates to the size of the current sample. A small sample size can diminish power to detect statistically significant longitudinal and concurrent paths between maternal sensitivity and attachment security in the path analysis (Button, Loannidis, Mokrysz et al., 2013). Klein (2005) recommended 10 cases for every parameter estimated in a path analysis. The path model presented in the current study is therefore considered preliminary given the sample size. A future study with a larger sample size is needed to replicate the path analytic findings.

Furthermore, due to sample size considerations, the current study examined factors underlying change in the attachment relationships when the relationships were classified only as secure or insecure. Consequently, the links between changes in maternal behaviour and changes in avoidant, resistant/ambivalent, and disorganized attachment relationships were not examined. This question needs to be addressed in future studies.

Although the current study showed that change in maternal sensitivity predicts children's trajectories of attachment development, many attachment researchers have suggested a need to attend to influences beyond the mother-child interaction. One suggestion has been to assess change in the broader social environmental context in which mothers and their children are embedded (Belksy, 1999). This suggestion reflects Bronfenbrenner's (1979) ecological systems argument that some critical aspects of what transpires between a caregiver and child have to do with contextual factors. Although we have preliminary evidence from high-risk samples (Vaughn et al., 1979; Vondra et al., 1999) that suggests changes in the broader family ecology may influence children development of different trajectories of attachment continuity, researchers have acknowledged that more studies that examine these longitudinal links are needed (McConnell & Moss, 2011). This is a logical direction for future research.

Belsky (1997, 2005), in considering additional factors beyond maternal interaction in influencing variation in the quality of children's attachment relationships, have also suggested the need to examine an individual's "susceptibility" to environmental influences. Specifically, Belsky (1997, 2005) proposed that children vary in their

reactions to the same rearing environments (e.g. parenting), such that the more susceptible children would not only do relatively poorly under inadequate care-giving but also relatively better under optimal parenting than their less susceptible counterparts. This theory, when applied to the development of attachment, suggests that children's levels of susceptibility may moderate the effect of maternal sensitivity on children's trajectories of attachment development over time. This novel proposition has not been systematically studied in the attachment literature. An interesting direction for future research is to assess the moderating role of differential susceptibility in the relationship between change in maternal interaction and change in attachment security.

Conclusion

The findings from the current study offer a significant contribution to the current longitudinal attachment literature because they not only support the central tenet of attachment theory, that maternal sensitivity predicts children's attachment security, but also empirically illustrate for the first time the complex transactional process by which maternal sensitivity and attachment security reciprocally influence each other over early childhood. This is an important first step in the direction of elucidating the processes underlying variation in children's patterns of continuity in attachment development. In considering the mechanisms underlying variation in children's patterns of continuity in attachment quality, researchers have also argued for a need to consider factors beyond maternal interaction, such as the broader contextual environment in which the family is embedded (Bronfenbrenner, 1979) and differences in children's levels of susceptibility to parental effects (Belsky, 1997/2005). Belsky's differential susceptibility theory, which suggests that children's levels of susceptibility moderate the effects of maternal sensitivity on their trajectories of attachment development, is a novel proposition that has not been adequately studied. This will be the focus of the next study of this dissertation.

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Chapter 4

Study 3: Unique Characteristics of the Child

The Differential Susceptibility Hypothesis

A number of researchers have advanced the idea that children are differentially affected by the same environmental experiences. For example, the organismic specificity model proposes that individual characteristics, such as sex or temperament, mediate the impact of the environment on development (Wachs & Gandour, 1983). The diathesis-stress model, widely applied to the development of psychopathology (Zuckerman, 1999), also proposes that some individuals are more vulnerable to the adverse effects of negative experiences than others as a result of their biological predisposition. More recently, Belsky (1997/2005) proposed a model, the differential susceptibility hypothesis, that similarly argues that children vary in their reactions to the same rearing environments (e.g. parenting) for genetic reasons or as a result of very early experience (e.g. in the womb). The differential susceptibility hypothesis is, however, distinguished from the above noted models because: 1) differential susceptibility is likened to a "plasticity" trait, such that "plastic" individuals are more susceptible than others to the effects of both positive and negative experiences, and correspondingly, less plastic individuals are less susceptible to both positive and negative environments, and 2) an evolutionary rationale for differential susceptibility to parenting efforts is emphasized (Belsky, 1997/2005).

Theoretical Basis of Differential Susceptibility: An Evolutionary Argument

According to Belsky (1997), parents can not anticipate which child-rearing practices were the most successful in increasing the reproductive fitness of their children, and in turn their own fitness. Consequently, they may unconsciously and unintentionally direct their children down development paths that prove to be maladaptive. Belsky (2005) referred to the Cambodian genocide of thousands of intellectuals (Totten, Parsons & Charny, 2004) as one such illustration in which a particular parenting approach (i.e. encouraging intellectual curiosity and educational attainment) proved maladaptive to future environments. Belsky (2005) theorized that natural selection must have shaped children to vary in their susceptibilities to rearing efforts to protect against such parental "mistakes in guidance". In this way, only children who were more responsive to parental socialization would pay the cost of parental misdirection, whereas those who were less

susceptible would likely survive and procreate. In other environmental conditions, children who were more susceptible to parental socializations would benefit the most while the less susceptible children would suffer the costs.

Evidence of Differential Susceptibility

Belsky delineated five criteria for establishing the presence of differential susceptibility: 1) children's levels of susceptibility moderate the association between the rearing influence and the developmental outcome; 2) a cross-over interaction in which children who are more susceptible, compared to those who are less susceptible, fare worse under poor environmental conditions and fare better under enriching conditions is found; 3) the susceptibility trait and the rearing influence are independent, which rules out the possibility of a gene-environment correlation where children's genotype evoked the rearing experience; 4) the susceptibility trait and the developmental outcome are uncorrelated, which rules out the possibility of a vulnerability-stress effect; and 5) the specificity of the effect is not replicated when other susceptibility traits and developmental outcomes are used (Belsky, Bakermans-Kranenburg & van IJzendoorn, 2007). Belsky (2005) reviewed the empirical literature on child temperament-parenting interaction and gene-environment interaction and found a range of studies that met the above criteria. He argued that these studies provided evidence for the differential susceptibility hypothesis.

The moderating role of temperament. Belsky's conceptualization of differential susceptibility was first informed by studies of child temperament-parenting interaction (Belsky & Pluess, 2009). He observed a trend in some research findings in which children considered "temperamentally difficult"(e.g. high levels of negative emotionality, fearfulness, and irritability), and therefore assumed to be more vulnerable to negative developmental outcomes according to the diathesis-stress model (Zukerman, 1999), actually evidenced the best outcomes when coupled with supportive environments (for a review of studies see Belsky, 2005). For example, Kochanska, Aksan, and Joy (2007) examined the moderating role of child temperamental fearfulness in the association between parenting and childhood obedience and found that highly fearful infants were less obedient than all others when paternal reliance on power assertion was high, whereas these children were most obedient when paternal reliance on power assertion was low.

Furthermore, Bradley and Corwyn (2008) examined the associations between infant difficult temperament, parenting, and behavioural problems in grade one, and found that the quality of parenting significantly affected levels of externalizing problems, but only among temperamentally difficult children. Children with difficult temperament showed the lowest level of externalizing behaviour when exposed to highly sensitive parenting and highest level of externalizing behaviour when exposed to insensitive parenting.

More recently, Pluess and Belsky (2009), using the data from the NICHD Study of Early Child Care and Youth Development, found that children with difficult temperaments, as indicated by high levels of negative emotionality, had more behavioural problems in kindergarten than children with easy temperaments when they were exposed to low quality child care during infancy, but they evidenced the fewest problems when exposed to high quality child care. Pluess and Belsky (2009) concluded that negative emotionality moderated the association between early child care influences and later developmental outcomes in a "for better and for worse" manner that was consistent with the differential susceptibility hypothesis. They also concluded, from their review of the literature on parent-child temperament interaction, that negative emotionality is a valid behaviour marker of differential susceptibility (Belsky, 2005).

The moderating role of genetic polymorphisms. Belsky then reviewed the literature on gene-environment interaction and similarly found that in some studies, children with certain "vulnerable" polymorphisms were at greater risk for internalizing (Taylor, Way, Welch, Hilmert, Lehman & Eisenberger, 2006) and externalizing (Bakermans-Kranenburg & van IJzendoorn, 2006) problems when reared in adverse environments, but were at reduced risk when reared in supportive environments. They argued that these "vulnerable" polymorphisms may be more accurately conceptualized as genetic markers of differential susceptibility.

The 5HTTLPR is a polymorphism of the promoter of serotonin transporter gene. Two variants of this polymorphism have been studied by researchers, those homozygous for the long allele (*l/l*) and those carrying at least one short allele (*s/s, s/l*) (Taylor et al., 2006). The presence of the (*s*) allele is associated with greater risk for depression, particularly for those who have and/or are undergoing stress (Caspi, Sugden, Moffitt et al., 2003). Taylor et al. (2006) studied the associations between 5HTTLPR (*s/s, s/l, l/l*),

stressful family environment, and depressive symptoms and found that early familial stress was associated with depressive symptoms but only in participants with *s/s* allele. *s/s* participants were at greater risk for depressive symptoms if they lived in an adverse environment and at reduced risk if they lived in a supportive environment. No such relationship was found for the *s/l* and *l/l* participants. These authors concluded that the "*s/s* genotype is not a risk factor for depression so much as it reflects a sensitivity to environmental influence; and in benign environments, this sensitivity assumes a protective form".

Another commonly studied polymorphism in gene-environment interaction studies is the DRD4-7-repeat allele (Bakermans-Kranenburg & van IJzendoorn, 2006). The DRD4-7-repeat allele is a polymorphism of the DRD4 gene which codes for the D4 subtype of the dopamine receptor. This variant is considered a vulnerability factor because it is associated with a number of maladjustments in childhood and adulthood, including impulsive behaviour, high novelty seeking, substance abuse, and attention deficit hyperactivity disorder (Kluger, Siegfried & Ebstein, 2002; Faraone, Doyle, Mick & Biederman, 2001). Bakermans-Kranenburg and van IJzendoorn (2006) studied the associations between the DRD4 polymorphism, maternal sensitivity, and problem behaviour in preschoolers and found a moderating effect of DRD4 such that maternal sensitivity was associated with externalizing problems but only among children with the 7-repeat allele. Low levels of maternal sensitivity contributed to an increase in the number of externalizing behaviours, and high levels of maternal sensitivity contributed to low numbers of externalizing behaviours in children with the 7-repeat allele. In contrast, levels of maternal sensitivity did not affect children who did not have the 7-repeat allele. The authors concluded that their result supported the differential susceptibility hypothesis.

The moderating role of the stress response systems. Boyce and Ellis (2005) have also brought attention to physiological markers of differential susceptibility. They termed this the biological sensitivity to context theory. They identified a number of empirical studies indicating that children with heightened reactivity to either or both of the autonomic or adrenocortical systems appeared to develop the worst or the best of physical and mental health outcomes, depending on the level of adversity or support in

their rearing environment (see review by Boyce & Ellis, 2005 and Ellis, Boyce, Belsky, Bakermans-Kranenberg, & van IJzendoorn, 2011).

In one such study, Boyce and colleagues (2006) found that children's levels of autonomic reactivity, assessed at age 7, moderated the association between adverse family environments (lack of father involvement and maternal depression) in infancy and mental health outcomes assessed at age 9. Among children with uninvolved fathers, those with high autonomic reactivity and depressed mothers evidenced the highest levels of mental health problems. In contrast, children with high autonomic reactivity but mothers without depression evidenced the lowest mental health severity scores.

In another study, Ellis, Shirtcliff, Boyce, Deardorff and Essex (2011) found that children's levels of stress reactivity moderated the effect of early family environment on pubertal timing and pubertal tempo. Specifically, they found that among children with high reactivity, a supportive parent-child relationship forecasted slower initial pubertal timing and pubertal tempo, whereas an unsupportive parent-child relationship predicted earlier pubertal timing and faster pubertal tempo. No association between quality of parent-child relationship and pubertal timing and tempo was found among less reactive children. Early pubertal maturation is considered a risk factor for several later physical (i.e., breast cancer; Bernstein, 2002) and mental health problems (i.e., anxiety; Weingarden & Renshaw, 2012). Ellis and colleagues concluded that their results offered additional evidence supporting the differential susceptibility hypothesis.

Differential Susceptibility and Attachment

Recently, there has been a marked increase of interest in the application of the differential susceptibility hypothesis to the development of attachment (see Velderman, Bakermans-Kranenburg, Juffer, and van IJzendoorn, 2006; Spangler, Johann, Ronai & Zimmermann, 2009; De Schipper, Oosterman & Schuengel, 2012). Traditional attachment theory predicts that the quality of mother-child attachment relationship is determined primarily by the quality of parenting. The differential susceptibility hypothesis, however, suggests that there is variability in children's susceptibilities to parental care which moderates the effect of maternal sensitivity on attachment quality. According to this model, children who are more susceptible to parental care, as evidenced by either high levels of negative emotionality (i.e. temperamental marker), stress

reactivity (i.e. physiological marker), or the presence of certain genetic polymorphisms (i.e. genetic marker), are more likely to evidence secure attachments given sensitive parenting, and in parallel, they are also more likely to evidence insecure attachments given insensitive parenting. In contrast, children who are less susceptible to the effects of parenting are less likely to evidence secure attachments when exposed to sensitive interactions, and in parallel, are also less likely to evidence insecure attachments when exposed to insensitive parenting. This hypothesis adds another dimension to the traditional tenet of attachment theory and warrants further investigation.

Several research groups have begun to test the differential susceptibility hypothesis in the development of attachment. These studies have investigated the moderating roles of negative emotionality and genetic polymorphisms in the association between maternal sensitivity and attachment security. Results supporting the differential susceptibility hypothesis are mixed.

Negative emotionality moderates the association between maternal sensitivity and attachment security. Velderman and colleagues (2006) conducted the first study designed to explicitly test the differential susceptibility effect in children's attachment development. Eighty-one mother-infant dyads were randomly assigned to a control group or one of two intervention groups that received video-feedback to increase maternal sensitivity. Infant negative emotionality was assessed from maternal reports at 6 months of age, maternal sensitivity was assessed from free play at 6, 11, and 13 months of age, and infant attachment classification was assessed at 13 months of age. Velderman and colleagues (2006) found a positive correlation between attachment security at 13 months and change from pre- to post-intervention maternal sensitivity among highly reactive infants (r = .57, p =.02, n =17; includes both intervention and control group infants). In contrast, the correlation was not significant among less reactive infants (r = .08, p =.53, n = 64). Furthermore, highly reactive intervention infants, with mothers that increased in maternal sensitivity over time (n =11), were found to evidence the highest levels of attachment security at 13 months. In contrast, highly reactive control infants, with mothers that evidenced decreases in sensitivity (n = 6), evidenced the lowest levels of attachment security at 13 months. The authors concluded that their results supported the differential susceptibility hypothesis.

Cassidy, Woodhouse, Sherman, Stupica, and Lejuez (2011) were also interested in testing the differential susceptibility hypothesis in an intervention study designed to increase attachment security. At 6 months infant age, 169 dyads were randomly assigned to a control group or intervention group using a modified Circle of Security intervention protocol (Powell, Cooper, Hoffman & Marvin, 2014). Newborn infant irritability was assessed using the NBAS (Brazelton & Nugent, 1995). Maternal attachment style was obtained at one-month infant age using a self-report measure of adult attachment (ECT, Brenna, Clark & Shaver, 1998). Infant attachment was assessed at 12 months infant age. Cassidy and colleagues found that among dyads that received the intervention, significantly more of highly irritable infants were secure at 12 months compared to the less irritable infants. They concluded that only the highly irritable infants benefited from the intervention, whereas the less irritable infants did not benefit from the intervention. However, there was no difference in attachment outcomes between highly irritable and less irritable infants in the control group. Cassidy and colleagues concluded that their findings support only one component of the differential susceptibility hypothesis: that highly irritable children do better than less irritable children when reared in a supportive environment, but they do not evidence worse outcomes when reared in an unsupportive environment.

Cassidy and colleague then conducted exploratory analysis to examine whether infant irritability-by treatment group interaction differed across levels of maternal attachment style. They found that when mothers had a more secure attachment style, beneficial effects of the intervention emerged for only the highly irritable infants. For mothers with a dismissing style, the results revealed support for both predictions of the differential susceptibility hypothesis: highly irritable infants compared to less irritable infants were not only more likely to be secure when in the intervention group, but also less likely to be secure when in the control group. However, for mothers with a preoccupied style, highly irritable infants did not show beneficial or adverse effects compared to less irritable infants in either the treatment or control group. In other words, there did not seem to be a differential susceptibility effect in infants with preoccupied mothers. Cassidy and colleagues' concluded that their results provided some support for the presence of differential susceptibility in the development of attachment.

Most recently, De Schipper, Oosterman and Schuengel (2012) examined whether temperamental shyness moderated the association between maternal sensitivity and attachment quality in a foster care sample of 59 foster parent-child dyads. Foster children ranged from 26 to 88 months (*M* = 57 months) and have lived with their foster parents for 3 to 76 months (*M* = 35 months). Mother-child dyads participated in a laboratory visit in which maternal sensitivity was assessed from free play, attachment classification from a modified strange situation, and child temperament was assessed from a questionnaire. De Schipper and colleagues found that temperamentally shy children were more likely to have a secure relationship with their foster mothers compared to less shy children when reared in a sensitive environment. In contrast, no association between foster parent sensitivity and children's attachment security was found for children who were temperamentally less shy. However, they also noted that temperamentally shy children with insensitive parents did not evidence worse outcomes as predicted by the differential susceptibility theory. Consistent with Cassidy and colleague's results, De Schipper and colleagues concluded that their results supported only the "for better part" of the differential susceptibility prediction.

While the above studies offered some support for the differential susceptibility effect in the development of attachment, past studies examining parenting-by-temperament interaction on attachment security have failed to provide support for this effect. Crockenberg (1981) conducted one of the first studies that examined the associations between infant irritability, maternal responsiveness to crying, social support, and attachment security. Forty-eight mothers and their infants participated in this study. Temperamental irritability was assessed using the Neonatal Behavior Assessment Scale in newborn infants. Home visit was conducted at three months during which maternal responsiveness was coded from observations and level of social support was derived from interview. Attachment security was then assessed in the strange situation procedure at one year. Crockenberg found that while highly irritable infants were more susceptible than less irritable infants to the effect of unsupportive environment, evidencing more anxious attachments, they were equally as susceptible to the effects of positive environments, evidencing the same proportion of secure attachments. Crockenberg

concluded that these results were consistent with a vulnerability-stress model of development.

Similarly, Susman-Stillman, Kalkoske, Egeland, and Waldman (1996) examined the association between infant temperament, maternal sensitivity and attachment security in a high-risk sample of 212 infants. Infant temperament data and maternal sensitivity were collected from maternal reports and observations at three and six months, and attachment security was assessed at 12 months using the strange situation procedure. They found that at three months infant age, high levels of maternal sensitivity increased the likelihood of secure attachment, but only among the less irritable group. In other words, the theoretically more susceptible group (i.e. highly irritable infants) did not benefit more from maternal sensitivity. Furthermore, this moderating effect disappeared at the second assessment of maternal sensitivity, suggesting that the infants were not differentially susceptible to the effects of maternal sensitivity at six months.

Genetic polymorphism moderates the association between maternal sensitivity and attachment security. Similar to the above literature, studies that have examined the moderating effect of genetic polymorphisms on the association between maternal sensitivity and attachment security have also reported mixed support for the differential susceptibility hypothesis. Bakermans-Kranenburg and van IJzendoorn (2006, 2007) conducted the first study examining the association between the DRD4-7-repeat allele, adverse rearing environments, and disorganized attachment. Here, the DRD4-7-repeat allele was conceptualized as the differential susceptibility marker, adverse rearing environments (unresolved loss and frightening/frightened maternal behavior) the predictors, and disorganized attachment the outcome. In a sample of 63 mothers, unresolved loss was assessed with the AAI, frightening/frightened maternal behaviour was coded from home observations conducted when infants were 10 months of age, and level of infant disorganization was assessed in the strange situation procedure between 14 to 15 months. They found a moderating role of the DRD4 gene in the association between maternal unresolved loss and infant disorganization, such that unresolved loss was associated with infant disorganization but only in the presence of the DRD4-7-repeat polymorphism. For children with the DRD4-7-repeat allele, unresolved maternal state of mind led to the highest level of infant disorganization, whereas resolved maternal state of

mind led to the lowest level of infant disorganization. Conversely, for children without the DRD4-7-repeat allele, maternal state of mind did not have a significant effect on infant disorganization. They argued that this result supported the differential susceptibility hypothesis. Interestingly however, the DRD4 polymorphism did not moderate the association between frightening/frightened maternal behaviour (the more proximal determinant of mother-child attachment relationship) and disorganized attachment.

Several studies have since attempted to replicate the results from Bakermans-Kranenburg and van IJzendoorn. Gervai et al. (2007) examined the associations between DRD4-7-repeat allele, disrupted maternal affective communication, and disorganized attachment in a sample of 138 mother-infant dyads (96 from Hungarian sample and 42 from US sample). Disorganized attachment was assessed in the strange situation at 12 months of age (for Hungarian sample) and 18 months (for US sample) and disrupted maternal communication was assessed in the strange situation using the AMBIANCE coding scheme. They found a significant association between maternal disrupted communication and infant disorganization, but only in infants who did not carry the DRD4-7-repeat allele. There was no association between maternal disrupted communication and infant disorganization in those who did carry the allele. This was inconsistent with Bakermans-Kranenburg and colleagues's results. Gervai et al. (2007) concluded that their findings seemed to point to the muting rather than the enhancement of infant responsiveness to care in those who carried the allele. In other words, children with the allele were less susceptible to the effects of maternal disruptive communication, which was counter to the predictions of the differential susceptibility hypothesis.

Lastly, Spangler et al., (2009) examined the associations between three genotypic polymorphisms (7 repeat allele of the D4 dopamine receptor, -521 C/T single nucleotide polymorphism in the regulatory region of the DRD4 gene, and 5HHTLPR serotonin transporter gene), maternal sensitive responsiveness, and attachment security and disorganization. The sample consisted of 106 parent-infant pairs. Attachment was assessed at 12 months using the strange situation procedure, and maternal behaviour was observed in a 30-minute free play session post strange situation. They found only one significant genotype by parenting interaction. The 5TTLPR polymorphism (*ss, sl, ll*)

moderated the association between maternal responsiveness (high vs. low) and disorganized attachment, such that low maternal responsiveness was associated with infant disorganization but only among those with the short allele. However, infants with short allelic variations who were exposed to high levels of maternal responsiveness did not show lower levels of disorganization compared to infants with the long allele. Spangler and colleagues concluded that their result was consistent with a genetic vulnerability rather than a differential susceptibility model.

Differential Susceptibility Moderates the Association between Change in Maternal Sensitivity and Change in Attachment Security

While studies have begun to examine the moderating role of children's level of susceptibility in the association between maternal sensitivity and attachment security, few researchers have applied the differential susceptibility hypothesis to the study of attachment stability and change. The differential susceptibility hypothesis offers a parallel revision of the causal association between change in maternal sensitivity and change in children's patterns of attachment by suggesting that children are not equally affected by stability and change in maternal sensitivity over time.

According to Stupica (2009), the literature on attachment stability and change is limited in three ways: (1) by largely failing to investigate whether infant classifications change or remain stable in relation to changes in the care-giving environment, (2) by a lack of attention to the role that infant characteristics has in shaping attachment stability outcomes, and (3) an assumption that all children are equally affected by change in their environments. Stupica attempted to address these concerns by investigating the moderating effect of infant irritability on the link between change in maternal psychosocial functioning (i.e., maternal depressive symptoms, maternal life satisfaction, and maternal parenting self-efficacy) and change in infant attachment security between 12 and 18 months. Stupica predicted that infants with high levels of irritability would be more susceptible to change in their care-giving environments, resulting in more change in attachment classifications. This is the only study that we are aware of that has examined the association between change in care-giving environment and change in attachment security from a differential susceptibility perspective.

Stupica (2009) found, contrary to predictions, that: (1) change in each of the maternal psychosocial functioning variables was not related to change in attachment security, and (2) infants were not differentially susceptible to the impact of changes in maternal psychosocial variables. Despite these results, the author argued that it remained possible that infant irritability moderates the link between change in aspects of the care-giving environment that were not assessed in their study and change in infant attachment. Stupica concluded that examining change in aspects of the care-giving environment that are theoretically more powerful predictors of change attachment security, such as change in maternal sensitivity, are needed in future longitudinal attachment research.

Purpose of Present Study

Attachment theory predicts that the quality of maternal interaction determines the quality of the attachment relationship, and consequently, stability or change in a maternal interaction would predict a parallel stability or change in the quality of attachment relationship. This proposition was examined in the second study of this manuscript. The differential susceptibility hypothesis, however, suggests that this association may be moderated by variability in children's sensitivity to parenting influences. That is, the attachment trajectories of highly susceptible children are more powerfully affected by the patterns of stability and change in maternal sensitivity than the attachment trajectories of less susceptible children. This hypothesis adds another dimension to the central tenet of attachment theory that warrants investigation. The purpose of the current study is to investigate whether children's patterns of continuity in attachment development over early childhood are differentially affected by their experiences of maternal sensitivity over time.

Research questions. Two research questions are addressed: (1) whether negative emotionality, a behaviour indicator of level of susceptibility (Belsky, 2005), moderates the association between patterns of stability and change in maternal sensitivity and patterns of stability and change in attachment classification, and (2) whether negative emotionality moderates each of the concurrent associations between maternal sensitivity and attachment security in infancy, toddlerhood, and preschool years, respectively.

In accordance with the differential susceptibility hypothesis, we predict that the attachment trajectories of children with high levels of negative emotionality are more

influenced by maternal patterns of stability and change in sensitivity than children with lower levels of negative emotionality. Consequently, highly emotionally reactive children are more likely to change in attachment quality following a change in maternal sensitivity, and they are also more likely to retain their attachment quality given stability in maternal sensitivity. We also predict that, at each age, highly emotionally reactive children are more likely than the less emotionally reactive children to evidence secure attachments when exposed to sensitive parenting and insecure attachments when exposed to insensitive parenting.

Method

To minimize presentation of redundant information, readers are directed to previous studies of this manuscript for methodology that has been discussed before. Only new methodology is provided in detail below.

Participants

The current study focuses on three waves of data collected in infancy, toddlerhood, and preschool years from a middle class community sample of mothers and children in London, Ontario, Canada. Sixty-three mother-child dyads participated in this study in infancy, 60 in toddlerhood, and 46 in preschool years (see Appendix A for Ethics Approval). Demographic data are presented in Study 1. There were no significant differences between dyads that completed the study and dyads that withdrew (see Appendix C).

Measures

Behaviour marker of differential susceptibility: Negative emotionality.

Belsky (2005) considers negative emotionality to be a behaviour marker of differential susceptibility. The current study assessed infant negative emotionality using the Infant Negative Affect Rating Scale (derived from Cox & Crnic, 2003; Weinfield, Egeland, & Ogawa, 1998). Two coders completed the Infant Negative Affect Rating Scale following a review of the videotaped observation of a 2-hour home visit at 10 months infant age. Infants were assigned a global score on a 7-point scale denoting the frequency and intensity of negative affect (e.g., frowns, negative vocalizations, crying). A 1 on this scale represents very low negative affect and a 7 represents very high negative affect (See Appendix I). Eleven infants (17.5% of the sample) were randomly selected and

independently coded for the purpose of reliability, ICC = .95 (95% CI ranges from .84 - .98).

Attachment classifications in infancy, toddlerhood, and preschool years. The quality of children's attachment relationships with their mothers was assessed using the Strange Situation Procedure (SSP; Ainsworth, Blehar, Waters & Wall, 1978) at 13 months, the Interesting-but-Scary Paradigm (IbS; DeOliviera, 2001; Forbes et al., 2007) at 27 months, and the Preschool Strange Situation (Preschool-SSP; Cassidy& Marvin, 1992) at 42 months. Attachment relationship at each age was first classified as secure, avoidant, ambivalent/resistant, and disorganized, and then collapsed into a two-way secure versus insecure dichotomy (see Study 1 for a detailed description of these assessment procedures). Twenty SSPs, 16 IbS, and 9 Preschool-SSPs were randomly selected and independently coded for the purpose of reliability. The coders agreed on the SSP classifications 18 out of 20 times (90% agreement, $\kappa = .83$, $p<.01$); on the IbS attachment classifications 13 out of 16 times (81% agreement, $\kappa = .72$, $p < .01$); and on the Preschool SSP classifications 8 out of 9 times (88% agreement, $\kappa = .83$, $p<.01$). Disagreements between coders were resolved by consensus.

Patterns of continuity in attachment: Attachment trajectory groups that emerged from Study 1. Following the classification of children's attachment relationship as either secure or insecure during infancy, toddlerhood, and preschool years, latent class analysis (LCA; Collins & Lanza, 2010) was used to uncover distinct groups of children with different patterns of continuity (i.e., trajectories) in attachment security in Study 1 of this manuscript. Two groups of children, each with a distinct pattern of stability emerged from LCA. The first group of children ($n = 45$; 71% of the sample) displayed a pattern of stable secure attachment across time. The second group of children ($n = 18$; 29% of the sample) displayed a pattern of stable insecure attachment with some shifts toward security (See Study 1 of manuscript). These two attachment trajectory groups were used in subsequent analysis examining the moderating role of negative emotionality in the association between patterns of continuity in maternal sensitivity and patterns of continuity in attachment security.

Maternal sensitivity in infancy, toddlerhood, and preschool years. Trained coders assessed maternal sensitivity using the Mini-Maternal Behaviour Q-Sort (Mini-

MBQS; Pederson & Moran, 1995) following 2-hour home visits at 10 and 21 months, and a 2.5 hour lab visit at 42 months. After observing mother-child interactions in the home and laboratory, two coders sorted the 25 Mini-MBQS items into five equal piles, ranging from 1 (*least like the mother*) to 5 (*most like the mother*). A mother's sensitivity score was derived by correlating her individual q-sort item scores with the items scores of the criterion sort that described the interactive behaviors of the prototypically sensitive mother. The higher the correlation between the mother's MBQS sort and the theoretically sensitive mother's sort, the more sensitive the observed mother is determined to be. Average item-by-item inter-rater reliability was .69 for the 10-month home visit, .74 for the 21-month home visit, and .74 for the 42-month lab visit. A detailed description of the Mini-MBQS is presented in Study 2.

Patterns of continuity in maternal sensitivity: Maternal sensitivity trajectory groups. Latent Profile Analysis (LPA), an extension of latent class analysis (LCA; Collins & Lanza, 2010) using continuous variables, was conducted in this study to uncover underlying patterns of continuity in maternal sensitivity scores across all three time-points (infancy, toddlerhood, and preschool years). In general, LPA clusters together persons who share similar behaviours into mutually exclusive groups or classes (Collins & Lanza, 2010). In this way, LPA can be used to identify distinct subgroups (i.e. classes) of mothers with homogenous patterns of stability and change in their levels of sensitivity over time. A one-class solution indicates no association in patterns of continuity in maternal sensitivity across time, and therefore all mothers are categorized into one group. A two- or more class solution, in contrast, indicates distinct subgroups of mothers that have similar patterns of continuity in sensitivity across time. An increasing number of classes are applied to the data in LPA until the association between the measures of maternal sensitivity is no longer significant (Collins & Lanza, 2010). The statistical fit of different models is then compared. The best fitting model has the lowest AIC, BIC, and adjusted BIC values, and a significant Bootstrap Likelihood Ratio (Collins & Lanza, 2010).

In this study, LPA found that a two-class model fits the data well (see Table 1). The bootstrap LRT indicated that the two-class model fit the data significantly better than the one-class model (p <.01), and the two-class model had lower AIC, BIC, and Adjusted

BIC values. In the two-class model, 33% (n = 21) of mothers were assigned to class one, a group with low Mini-MBQS scores at 13 (M = -.20), 27 (M = -.42) and 42 months (M = .00). The first group of mother, therefore, displayed a pattern of "stable insensitive responsiveness" in interaction with their children over time. In contrast, 66% (n = 42) of mothers were assigned to class two, a group with high Mini-MBQS scores at each of the three time points (M = .42, .73, and .41, respectively). In other words, this group of mothers displayed "stable sensitive" interaction with their children over time. These two groups of mothers, each with a distinct pattern of stability in their interaction over time, are used in subsequent analysis examining the moderating role of negative emotionality in the association between patterns of continuity in maternal sensitivity and patterns of continuity in attachment security.

Table 1.

Model Fit Indices for 2-Way Secure and Non-Secure Attachment across 13, 27, and 42 Months

Classes	**1**	**2**
AIC	302.94	234.82
BIC	315.79	256.25
Sample Size Adjusted BIC	296.31	224.78
Bootstrapped LRT	n/a	1 vs 2 classes *p* =.00
n in each class	C1= 63 (100%)	C1 = 21 (33%) C2 = 42 (67%)

Note: the two-class model had lower AIC, BIC, SABIC values and a significant Bootrapped LRT, indicating a better model fit.

Procedure

At three months infant age, mother-infant dyads were visited in the home, at which point demographic data were collected. The larger study of which these participants were part of involved a number of other measures and assessments conducted at this time. These were not utilized in the analyses presented here.

At 10 months infant age, mother-infant dyads were visited for approximately two hours in the home. The home visit consisted of an interview to update demographic data, a feeding session, a separation and reunion between the mother and child, and "play" interactions between the mother and infant which included play with a challenging toy, read a picture book about emotions, free play with toys and play without toys. Home visitors coded maternal sensitivity using the Mini-MBQS immediately after the home observation. Two independent coders, blind to the Mini-MBQS data, then assessed children's level of negative emotionality using the Infant Negative Affect Rating Scale from videotaped observation of this home visit.

At 13 months infant age, mother-infant dyads visited Western University and participated in the Strange Situation Procedure, which was videotaped and used for the assessment of the attachment relationship in infancy.

At 21 months of age, mother-toddler dyads were again visited in the home for approximately two hours. This visit consisted of an interview to update demographic data, a separation and reunion between the mother and child, and play interactions between the mother and child which included play with a challenging toy, read a picture book about emotions, free play with toys, and play without toys. Immediately after the home visit, home-visitors assessed maternal sensitivity using the Mini-MBQS.

At 27 months of age, mother-toddler dyads once again visited Western University and participated in the Interesting-but-Scary Paradigm, which was videotaped and used for the assessment of the attachment relationship in toddlerhood.

Lastly, at 42 months of age, mother-infant dyads visited Western University for approximately 2.5 to 3 hours and participated in a number of tasks. The quality of maternal interaction was assessed using the Mini-MBQS based on observations of mother-child dyads during a free play session (5 minutes), two episodes in which mother-child dyads watched five-minute video clips together, and a paradigm involving a slightly

scary talking mask (3 minutes). How the mother supported her child during the mask episode gave important indication of her sensitivity in interaction. Mother-child dyads also participated in the Preschool SSP in this visit, which was videotaped and used for the assessment of the attachment relationship in the preschool years.

Missing Data Analysis

The Infants Negative Affect Rating Scale was the only measure introduced in this study that was not used and described in previous studies in this series. There were no missing values for this scale, therefore the missing value analysis and method for handling missing data were the same as those presented in Study 2.

Results

Preliminary Analysis

Infant negative emotionality. Observer ratings of the amount and intensity of infant negative affect displayed during the 10-month home visit ranged from 1 to 6 (*M* =2.63, *SD* =1.09). The majority of infants (87%) displayed little negative affect (i.e., scored below a 4), while only 13% of infants scored a 4 (i.e., moderate amount of negative affect) or above.

Maternal sensitivity scores. Maternal sensitivity scores ranged from -.90 to .92 (*M*=.22, *SD*=.59) at 10 months, -.86 to .90 (*M*=.35, *SD*=.59) at 21 months, and -.70 to .74 (*M*=.27, *SD*=.41) at 42 months, reflecting wide variability in sensitivity across mothers.

Infant attachment security. At 13 months, 57% of infants were classified as secure and 43% were classified as insecure; at 27 months, 68% of toddlers were classified as secure and 32% were classified as insecure; and at 42 months, 70% of preschoolers were classified as secure and 30% were classified as insecure.

Correlations between negative affect, maternal sensitivity, and attachment security. According to Belsky (2005), the following two criteria need to be established prior to testing for differential susceptibility: 1) the susceptibility trait and the rearing influence are independent so to rule out the possibility of a gene-environment correlation where genotype evoked the rearing experience, and 2) the susceptibility trait and the outcome are unrelated so to rule out the possibility of a vulnerability-stress effect. Correlations between negative emotionality (susceptibility factor) and maternal sensitivity (predictor) and attachment security (outcome) are presented in Table 2. *P*

value was adjusted to .006 (.05/8) to control for multiple correlations. Negative emotionality was not significantly associated with any predictors or outcome variables when the significance level was adjusted. Negative emotionality and attachment security at 42 months was significantly correlated when the *p* value was not adjusted for multiple correlations (r =-.35, p<.05).

Research Question 1: Does Negative Emotionality Moderate the Association between Patterns of Continuity in Maternal Sensitivity and Patterns of Continuity in Attachment?

A hierarchical logistic regression analysis was used to examine whether children's levels of negative emotionality moderated the association between patterns of continuity in maternal sensitivity and patterns of continuity in attachment security. Baron and Kenny's (1986) method for testing moderation was followed. According to Baron and Kenny (1986), the predictor and moderator variables are first entered into the regression model predicting the criterion variable. The multiplicative product or interaction term is then entered into the model in the next step. A moderating effect is supported when the interaction term is significant. Baron and Kenny (1986) suggested that while the main effects (i.e., predictor and moderator) may be significant, their significance adds no additional information to the test of moderation.

In this study, patterns of continuity in maternal sensitivity were entered in the first block of the regression model predicting children's patterns of continuity in attachment. Results showed that children's likelihood of having a stable secure attachment trajectory increased with stable sensitive maternal interaction (b = 1.70, *Wald* = 8.02, p<.01). Negative emotionality was then entered into the second block of the regression. In the second block, children's negative emotionality did not add to the prediction of a stable secure attachment trajectory, whereas stable sensitive maternal interaction continued to predict children's likelihood of stable secure trajectory (b = 1.70, *Wald* = 7.78, p<.01). Following these results, the interaction between patterns of continuity in maternal sensitivity and negative emotionality was entered in the third block of the regression. The interaction term was not significant (b = -.24, *Wald* = .17, *ns*), indicating that negative emotionality did not moderate the association between patterns of continuity in maternal sensitivity and children's patterns of continuity in attachment (see Table 3).

Table 2.

Correlations between Negative Emotionality, Maternal Sensitivity, and Attachment Security

	Maternal Sensitivity				Attachment Security			
	Months			Stable Maternal	Months			Stable Secure
	10	21	42	Sensitivity	12	27	42	Attachment
NE	.12	.08	-.08	-.06	-.09	.03	-.35*	-.18

Note. Negative emotionality was not significantly associated with any predictors or outcome variables when the significance level was adjusted to .006 (.05/8) to control for multiple correlations. Negative emotionality and attachment security at 42 months was significantly correlated when the *p* value was not adjusted for multiple correlations ($p = .015$).

Table 3.

Stable Sensitivity Predicts Stable Secure Attachment: Negative Emotionality Did Not Moderate the Association between Patterns of Continuity in Maternal Sensitivity and Children's Trajectories of Attachment Development

Predictors	*B*	*Wald*	*p*
Step 1:			
Stable Sensitivity	1.70	8.02	.01
Step 2:			
Stable Sensitivity	1.72	7.78	.01
Negative Emotionality	-.38	1.85	.17
Step 3:			
Stable Sensitivity	2.38	1.87	.17
Negative Emotionality	.02	.00	.98
Stable Sensitivity X Emotionality	-.24	.17	.67

Note 1. Step 1: χ^2 (1) = 8.47, p<.01, Nagelkerke R^2 =.18; correctly classified 73% of cases
Note 2. Step 2: χ^2 (2) = 10.32, p< .01, Nagelkerke R^2 =.22; correctly classified 73% of cases
Note 2. Step 3: χ^2 (3) = 10.49, p<.05, Nagelkerke R^2 =.22; correctly classified 71.4% of cases

Research Question 2: Does Negative Emotionality Moderate the Association Between Maternal Sensitivity and Attachment Security in Infancy, Toddlerhood, and Preschool Years?

Following the above results, three separate logistic regressions were conducted to examine whether children's negative emotionality moderated each of the association between maternal sensitivity and attachment security in infancy, toddlerhood, and preschool years. The results of the three logistic regressions are presented in Table 4a-c.

The first logistic regression assessed whether negative emotionality moderated the association between maternal sensitivity at 10 months and children's attachment security at 13 months. Maternal sensitivity at 10 months was first entered into the regression model and was associated with secure attachment at 13 months (b = 1.45, *Wald* = 8.88, p < .01). Negative emotionality was then added to the regression model but was not associated with attachment security at 13 months (b = -.22, *Wald* = .72, *ns*). Maternal sensitivity at 10 months continued to predict children's likelihood of a secure attachment at 13 months (b = 1.53, *Wald* = 9.22, p < .01) in the second block. The interaction term between maternal sensitivity at 10 months and children's negative emotionality was then entered into the regression model in the third block. The interaction term (b = -.84, *Wald* = 2.82, *ns*) was not significant, indicating that children's levels of negative emotionality did not moderate the association between maternal sensitivity and attachment security in infancy (see Table 4a).

The second regression then assessed whether negative emotionality moderated the association between maternal sensitivity at 21 months and children's attachment security at 27 months. Similar to the results from the last regression, maternal sensitivity at 21 months predicted attachment security at 27 months (b =1.12, *Wald* = 5.54, p <.05) in the first block. Negative emotionality was then entered into the model in the second block and was found to be not significant in predicting attachment security at 27 moths (b= -.15, *Wald* = .29, *ns*). Maternal sensitivity at 21 months, in contrast, continued to predict secure attachment (b =1.14, *Wald* = 5.67, p <.05) in the second block. The interaction term between maternal sensitivity at 21 months and children's level of negative emotionality was then entered into the third block, and was once again not significant (b = -.82, *Wald*=2.46, *ns*), indicating that negative emotionality did not moderate the

association between maternal sensitivity and attachment security in toddlerhood (see Table 4b).

Lastly, the third logistic regression assessed whether children's levels of negative emotionality moderated the association between maternal sensitivity at 42 months and attachment security at 42 months. Maternal sensitivity at 42 months when entered by itself in the first block significantly predicted attachment security (b = 2.04, *Wald* = 6.68, p =.01). Negative emotionality was then added to the regression model in the second block. Maternal sensitivity (b = 2.06, *Wald* = 6.26, p = .01) and negative emotionality (b = -.77, *Wald* = 4.46, $p < .05$) were both uniquely significant in predicting attachment security at 42 months. However, the interaction term between maternal sensitivity at 42 months and negative emotionality was not significant (b =.47, *Wald* =.30, *ns*), indicating yet again that children's negative emotionality did not moderate the association between maternal sensitivity and children's attachment security in the preschool years (see Table 4c). In summary, the results of the three regression analyses indicated that children's negative emotionality did not moderate the association between maternal sensitivity and attachment security in infancy, toddlerhood, or preschool years.

Table 4a.

Infancy: Negative Emotionality Does Not Moderate the Link between Maternal Sensitivity and Attachment Security

Predictors	*b*	*Wald*	*p*
Step 1: 10-month Sensitivity	1.45	8.88	.00
Step 2: 10-month Sensitivity	1.53	9.22	.00
Negative Emotionality	-.22	.72	.39
Step 3: 10-month Sensitivity	1.58	9.07	.00
Negative Emotionality	-.08	.07	.78
10-month Sensitivity X Emotionality	-.84	2.82	.09

Note 1. Step 1: χ^2 (1) = 10.11, p<.01, Nagelkerke R^2 =.20; correctly classified 73% of cases; Step 2: χ^2 (2) = 10.83, p< .01, Nagelkerke R^2 =.21; correctly classified 73% of cases; Step 3: χ^2 (3) = 13.82, p<.05, Nagelkerke R^2 =.26; correctly classified 70% of cases

Table 4b.

Toddlerhood: Negative Emotionality Does Not Moderate the Link between Maternal Sensitivity and Attachment Security

Predictors	*b*	*Wald*	*p*
Step 1: 21-month Sensitivity	1.12	5.54	.02
Step 2: 21-month Sensitivity	1.14	5.67	.02
Negative Emotionality	-.15	.29	.59
Step 3: 21-month Sensitivity	1.15	5.32	.02
Negative Emotionality	-.09	.10	.75
21-month Sensitivity X Emotionality	-.82	2.46	.11

Note. Step 1: χ^2 (1) = 5.81, p<.05, Nagelkerke R^2 =.13; correctly classified 75% of cases; Step 2: χ^2 (2) = 6.12, p< .05, Nagelkerke R^2 =.14; correctly classified 73% of cases; Step 3: χ^2 (3) = 8.84, p<.05, Nagelkerke R^2 =.19; correctly classified 72% of cases

Table 4c.

Preschool Years: Negative Emotionality Does Not Moderate the Link between Maternal Sensitivity and Attachment Security

Predictors	*b*	*Wald*	*p*
Step 1: 42-month Sensitivity	2.04	6.68	.01
Step 2: 42-month Sensitivity	2.06	6.26	.01
Negative Emotionality	-.77	4.46	.04
Step 3: 42-month Sensitivity	1.97	5.40	.02
Negative Emotionality	-.79	4.27	.04
21-month Sensitivity X Emotionality	.47	.30	.58

Note. Step 1: χ^2 (1) = 7.52, p<.01, Nagelkerke R^2 =.21; correctly classified 80% of cases; Step 2: χ^2 (2) = 12.80, p< .01, Nagelkerke R^2 =.34; correctly classified 80% of cases; Step 3: χ^2 (3) = 13.13, p<.01, Nagelkerke R^2 =.35; correctly classified 80% of cases

Discussion

Bowlby's (1973) railway system metaphor illustrates how the development of attachment can proceed along an array of pathways wherein change is always possible but constrained by paths previously taken. Early in childhood, children's patterns of continuity are thought to be highly influenced by their mothers' patterns of continuity in sensitivity (Ainsworth et al., 1978). Specifically, stable sensitive maternal interactions would predict stable secure attachment trajectories, stable insensitive interactions predict stable insecure attachment trajectories, and changes in sensitivity predict changes in the attachment relationships in parallel directions.

The differential susceptibility model (Belsky, 1995/2001) adds another dimension to the traditional tenet of attachment theory and proposes that children are predisposed to vary in their susceptibility to parental influences and, consequently, their trajectories of attachment development result not from maternal patterns of sensitivity but from the interaction between their levels of susceptibility and their mothers' patterns of behaviour. The purpose of this study was to investigate the differential susceptibility proposition in attachment development. In the sections below, we will first summarize the key findings and discuss whether children's levels of negative affectivity, a behaviour indicator of susceptibility (Belsky, 2005), moderated the association between patterns of continuity in maternal sensitivity and patterns of continuity in children's attachment security. We will then discuss whether children's levels of susceptibility moderated each of the concurrent associations between maternal sensitivity and attachment security in infancy, toddlerhood, and preschool years. A discussion of several gaps in the differential susceptibility theory, limitations in this study, and directions for future research will lastly be presented.

Predicting Attachment Continuity: Are Children Differentially Susceptible to Their Mothers' Patterns of Continuity in Sensitive Responsiveness?

The current results found that children's patterns of continuity in attachment security followed their mothers' patterns of continuity in sensitivity regardless of their negative emotionality levels. This result is inconsistent with prediction based on the differential susceptibility hypothesis but is consistent with attachment theory and with the result from the only other study that has examined whether children's patterns of change

in attachment are differentially affected by changes in their care-giving environment (i.e., Stupica, 2009)

Stupica (2009) addressed two questions in her study: whether highly irritable infants were differentially susceptible to changes in maternal psychosocial functioning compared to less irritable infants; and whether this interaction would lead to different patterns of change in attachment classification between 12 to 18 months of age. Contrary to prediction, Stupica found no difference between highly irritable and less irritable infants in their patterns of change in attachment; however, she noted that she did not use maternal variables that were powerful enough to predict change in attachment security. Stupica argued that it remained possible that children's patterns of change in attachment are due to their differential susceptibility to change in aspects of maternal behaviour not measured in her study and urged future studies to examine differential susceptibility in the context of a more powerful and theoretically driven predictor of change in infant attachment security, such as change in maternal sensitivity. The current study carried forth this suggestion but did not find an interaction between children's negative emotionality levels and patterns of continuity in maternal sensitivity. Thus, the current result is consistent with Stupica's (2009) result and do not support the differential susceptibility prediction.

Predicting Attachment Security in Infancy, Toddlerhood, and Preschool Years: Are Children Differentially Susceptible to Maternal Sensitivity at Each Time Point?

Given the above results, follow up analyses were then conducted to examine whether children's levels of negative emotionality moderated each of the concurrent associations between maternal sensitivity and attachment security in infancy, toddlerhood, and preschool years. Maternal sensitivity predicted concurrent attachment security at each time point regardless of children's levels of negative emotionality. These results, once again, do not support the presence of differential susceptibility in the development of attachment security.

A review of the literature indicates that while some studies have reported support for the differential susceptibility hypothesis in the development of attachment (see Velderman et al., 2006, Cassidy et al., 2011, De Schipper et al., 2012, and Bakermans-Kranenburg et al., 2006), an equal number of studies have also failed to find support for

this process (e.g., Crokenberg, 1981, Gervai et al., 2007, Spangler et al., 2009). Susman-Stillman et al. (1996), for example, investigated the association between infant irritability, maternal sensitivity at 3 and 6 months and attachment security at 12 months and found that maternal sensitivity distinguished infant secure versus insecure attachment regardless of infant's level of irritability. They concluded that infant irritability did not moderate the relationship between maternal sensitivity and attachment security. Further analysis indicated that maternal sensitivity mediated the relationship between infant irritability and attachment security. Susman-Stillman et al. argued that infant irritability influences attachment security by leading mothers to respond to their infants in less sensitive ways.

A second study that did not support the differential susceptibility hypothesis found that highly irritable infants were more likely than less irritable infants to develop an anxious attachment when reared in an insensitive environment, but evidenced the same proportion of secure attachments when reared in a sensitive environment (Crockenberg, 1981). This result is more consistent with a vulnerability-stress model than the differential susceptibility model.

Lastly, Spangler and colleagues (2009) examined the association between three genetic polymorphisms, maternal sensitive responsiveness, and attachment security and disorganization. They found only one significant genotype by parenting interaction in the development of disorganized attachment. Specifically, infants with the short allele of the 5HTTLPR polymorphism were more likely to evidence a disorganized attachment relationship when reared in an insensitive environment, but displayed similarly low levels of disorganization when reared in a sensitive environment. These results are once again more consistent with a vulnerability-stress model than a differential susceptibly model.

A Need for Greater Conceptual Clarity: Global Versus Specific Susceptibility and Developmental Outcomes

A possible reason for the mixed support for the differential susceptibility hypothesis relates to the lack of clarity regarding the operative nature of differential susceptibility – i.e., are children differentially susceptible to all aspects of parenting or only to specific parental practices? And do highly susceptible children develop "for better and for worse" outcomes across all developmental areas or only within specific domains?

Given the lack of specific guidelines, researchers have examined children's susceptibility to a range of parental variables. These include maternal sensitivity, disrupted maternal communication, power assertion, consistent discipline, maternal state of mind, parent self-report attachment style, maternal depressive symptomatology, parental self-efficacy, marital conflict, life satisfaction, and more (e.g. Bradley & Corwyn, 2008; Finzi-Dottan, Manor & Tyano, 2006; Ipsa, Fine & Thornburg, 2002; Wong, Brown, Mangelsdorf et al., 2009; see review by Pluess & Belsky, 2009). The implicit assumption with assessing various parenting variables is that differentially susceptibility operates in a global manner. Results from some studies have however suggested that the interaction between children's levels of susceptibility and parenting behaviour may be more specific.

Mangelsdorf, Gunnar, Kestebaum, Lang and Andreas (1990), for example, found that while infant proneness to distress moderated the association between maternal restraint and attachment security, it did not moderate the associations between maternal warmth, support, and positive affect and attachment security. Barkermans-Kranenburg and van IJzendoorn (2007) also found that the while the DRD4-7 repeat allele moderated the association between maternal state of mind and infant disorganized attachment, it did not moderate the association between frightening/frightened maternal behaviour and disorganized attachment. Laslty, Braungart-rieker, Garwood, Powers and Wang (2001) found that infant negative affect moderated the association between maternal sensitivity and mother-child attachment security, but not the association between paternal sensitivity and father-child attachment relationship. These results suggest that children may not be differentially susceptible to all aspects of parenting, and their attachment relationships may be determined by an interaction between their susceptibility marker and specific aspects of parenting behaviour.

Researchers have also compared a range of developmental outcomes between highly susceptible versus less susceptible children. These include internalizing and externalizing behaviour, moral self development, rule compatible behaviour, and attachment security and disorganization (Bradley & Corwyn, 2008; Kochasnka, Askan & Joy, 2007; De Schipper et al., 2012; Bakermans-Kranenburg & van IJzendoor, 2006).

Results from some studies have, however, once again suggested that children show for-better-or-for-worse outcomes not in all developmental areas but in specific domains.

Belsky and colleagues (1998), for example, found a moderating role of negative emotionality in the association between negative maternal behaviour and children's externalizing behaviours, but not in the association between negative maternal behaviour and children's levels of inhibition. Similarly, Bakermans-kranenurg and van IJzendoorn (2006) found that the DRD4-7 repeat allele moderated the association between maternal sensitivity and children's externalizing behaviours, but not the association between maternal sensitivity and internalizing behaviours. Lastly, Spangler et al. (2009) found that the 5HTTLPR polymorphism moderated the association between maternal responsiveness and disorganized attachment but not maternal responsiveness and attachment security. These results suggest yet again that the relationship between predictor, susceptibility factor, and outcome may be more specific and not across all domains.

Lastly, various markers for differential susceptibility (i.e. behaviour and genetic) have been used in the research; however, the implications of using different markers have not been addressed – i.e., should the same moderating relationship emerge regardless of the differential susceptibility marker used? Are children with high levels of negative emotionality equivalent to those with the 5HTT allelic polymorphism or the DRD4-7 repeat allele? In a meta-analysis of 26 studies and 7657 subjects, Schinka, Busch, & Robichaux-Keene (2004) found an effect size of .10 between 5-HTTLPR and temperamental anxiety. They concluded that the relationship between 5-HTTLPR and temperamental anxiety is reliable but small. Similarly, studies examining aspects of temperamental reactivity to the dopaminergic system have reported inconsistent results (see review by White, Lamm, Helfinstein & Fox, 2012). Based on these findings, researchers have argued that the contribution of children's genetic predispositions to the development of temperamental reactivity is not clear cut and likely influenced by their experiences with the environment (White et al., 2012). In a related study, Pauli-Pott, Friedel, Hinney and Hebebrand (2009) examined the interaction between 5HTTLPR and the mother-child attachment relationship and found that children with the short allele (i.e. risk allele) were more likely to demonstrate low levels of negative emotionality in

infancy when reared in a secure attachment relationship (Pauli-Pott et al., 2009). This result suggests that children's allelic variation interacts with their environment to influence their expression of negative emotionality. Consequently, children with low levels of negative emotionality in later childhood, and therefore considered less susceptible when classified using the presence of a temperamental marker of susceptibility, may actually be highly susceptible children (i.e. presence of risk allele) who were reared in a supportive environment. Misclassification of children into more versus less susceptible groups may have contributed to the inconsistent support for the differential susceptibility hypothesis.

In summary, we argue that the mixed support for the differential susceptibility hypothesis may be due in part to the heterogeneity of parenting variables, outcomes, and differential susceptibility markers used across studies. Being more systematic in delineating the specific predictor, susceptibility factor, and outcome of interest is an important direction for future attachment studies investigating the presence of differential susceptibility. The model of differential susceptibility also needs to address these issues. Refinement of the theory would provide a framework for choosing the markers, predictor and outcomes upon which to focus.

Directions for Future Research

Although we did not find statistical support for the differential susceptibility hypothesis, the results need to be qualified by the theoretical limitations noted above and methodological limitations within this study. First, the majority of infants (87%) in this study displayed little signs of negative affect; therefore, it is possible that too little variability in this measure obscured the presence of any statistical difference. It may be that infants did not perceive the two-hour home visit as particularly stressful and therefore displayed little negative affect. Future studies may address this issue by attempting to evoke negative affect by presenting novel or slightly stressful stimuli (e.g. bright light or loud sound) to the infant. Researchers have argued that this reaction is likely to be more reflective of an infant's threshold for expression of distress (Marshall & Fox, 2005).

Furthermore, and as noted earlier, expressions of negative affect measured in later infancy may not be an accurate reflection of children's levels of susceptibility given that

their expressions of negative affect are influenced by their relationships with caregivers (Pauli-Poot et al., 2009). Consequently assessing infant negative affect at an earlier time point and in conjuncture with a genetic or physiological marker may more accurately capture their levels of susceptibility.

Although the differential susceptibility theory predicts that children with more negative affect would show more secure attachments given sensitive parenting and more insecure attachments given insensitive parenting, the theory does not address why this may be so. One possible reason may be that temperamentally difficult infants tend to direct more attachment behaviours towards their caregivers than less difficult infants (Stupica, 2009). By increasing the frequency with which they direct attachment behaviours, these infants may be more likely to: (1) receive sensitive parenting from a sensitive mother, resulting in an increase likelihood of a secure attachment, and (2) receive insensitive parenting from an insensitive mother, resulting in an increase likelihood of insecure attachment. Evidence from some research studies investigating infant temperament and attachment indicates that temperamentally difficult infants direct more attachment behaviours towards their mothers (see review by Vaugn, Bost, & van IJzendoorn, 2008). An important direction for future research is to investigate this proposed mechanism by indexing the frequency that infants direct their attachment behaviours towards their caregivers.

Lastly, a review of the literature indicates that few studies have investigated the differential susceptibility hypothesis within a family context. The differential susceptibility hypothesis suggests that siblings within a family should vary in their susceptibility to parenting. Consequently, it would be extremely interesting to follow siblings longitudinally within a family and examine whether parents actually have children who vary in their susceptibilities and whether this variation moderates the association between parenting and attachment security of each child across time.

Conclusion

The current study found that maternal sensitivity predicted concurrent attachment security at each time point, regardless of children's level of negative emotionality. This study also found that children's patterns of continuity in attachment security followed their mothers' patterns of continuity in sensitivity, regardless of their levels of negative

emotionality. These results, acknowledging some methodological limitations of the study, do not support the presence of differential susceptibility in the development of attachment security. Several directions for future research were discussed to further explore the role, if any, played by differential susceptibility in attachment development.

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Chapter 5

Study 4: Patterns of Continuity in a High-Risk Sample of Adolescent-Mothers and Their Children

Most of the seminal research on attachment in infancy was conducted with low-risk middle class families (Ainsworth, Blehar, Waters, & Wall, 1978; Waters, 1978; Main & Weston., 1981). These studies mostly reported a moderate to high proportion of secure attachment relationships (e.g., 66 to 73%) and, conversely, a low proportion of insecure attachment relationships. They also generally reported moderate to high levels of stability in attachment classifications over time (e.g., 96% stability in Waters, 1978; 73% stability in Main & Weston., 1981; and 78% in Owen, Easterbrooks, Chase-Lansdale & Goldberg 1984). The reader is referred to Study 1 of this manuscript for a detailed review of this literature. Based on these early results, researchers initially concluded that attachment is relatively stable in low-risk, economically advantaged families (Waters, 1978).

Attachment in High-Risk Samples

The first study to examine stability in attachment classifications in economically disadvantaged families began as part of the Minnesota Mother-Infant Interaction Project. Two hundred and sixty-seven low income (below the poverty level) mothers and their first-born infants were recruited. Vaughn, Egeland, Sroufe and Waters (1979) studied the first 100 subjects recruited into the sample and found that the proportion of secure attachment was lower (54%) than in previously reported low-risk samples and stability in attachment classification across infancy was also noticeably lower (62% stability).

Vaughn and colleagues (1979) conducted further analyses with the same high-risk sample and found a relationship between the number of maternal reported stressful life events and changes in the quality of children's attachment relationships. Specifically, they found that mothers of infants that changed from secure to anxious attachment reported significantly more intervening stressful events than mothers of infants with secure attachment relationships at both assessment time points. Based on this data, Vaughn and colleagues hypothesized that high levels of stress and instability in living situations, characteristics that are prevalent within high-risk low-income families, interfered with maternal sensitive responsiveness and resulted in both higher incidences of insecure attachment and more instability in attachment relationships.

Higher levels of insecure attachment. A number of studies have since examined the distribution and stability of attachment qualities in various high-risk populations, including families with known incidences of maltreatment (e.g., Schneider-Rosen, Brunwald, Carlson, & Cicchetti, 1985), adolescent-motherhood (e.g., Forbes, Evans, Moran, & Pederson, 2007), mothers with severe mental illness (e.g., Radke-Yarrow, Cummings, Kuczynski & Chapman, 1985; Radke-Yarrow, McCann, DeMulder et al., 1995), and families with high social risk defined as having few resources in terms of education, income, and social support (e.g., Egeland & Farber, 1984). On average, these studies have reported a higher incidence of insecure attachments in high-risk families relative to low-risk families (see review by Spieker & Booth, 1988). For example, Lyons-Ruth, Connell, Grunebaum, Botein, and Zoll (1984) conducted the second study examining attachment in a high-risk sample as part of the Family Support Project at Cambridge Hospital in Massachusetts and found that the majority of infants with a history of maltreatment (64%) had an insecure attachment relationship; in contrast, the majority of infants in the comparison community group had a secure attachment (70%). Similarly, the Child-Rearing Study at the National Institute of Mental Health also found more insecure attachment relationships in a high-risk sample characterized by maternal depression than in a comparison low risk sample (Radke-Yarrow et al., 1985). While 29% of infants of non-depressed mothers had insecure attachment relationships, 79% of infants whose mothers suffered from bipolar depression and 47% of infants whose mothers suffered from uni-polar major depression had insecure attachment relationships.

Higher levels of insecure-disorganized attachment. Since the identification of the insecure-disorganized attachment classification (Main & Soloman, 1990), studies have also repeatedly found a higher incidence of disorganized attachment relationships in high-risk samples compared to low-risk samples (see meta-analysis by van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). In a meta-analysis of disorganized attachment in early childhood, van IJzendoorn et al., (1999) found that the percentage of children in middle-class non-clinical groups in North America was 15% (n = 2104). In contrast, the percentage of disorganized attachment in low-SES families was 25% (n = 586), which was significantly higher than that of the middle class samples; 23% in groups of children with teenage mothers (n = 282); 43% in groups of children with mothers with

alcohol and drug abuse (*n* =144); and 48% in groups of children with maltreating parents (*n* =165). Consistent with these rates of disorganization, a study of a high-risk group of adolescent-mother infant dyads by the current research group found that 58% of infants were classified as insecure-disorganized, whereas 8% were insecure-organized (i.e., avoidant or resistant), and only 34% were classified as having secure attachment relationships (Forbes et al., 2007).

Higher levels of instability in attachment relationships. In addition to having a different distribution of attachment classifications, specifically higher incidences of insecure-organized and disorganized attachment relationships, a lower degree of stability in attachment classifications is also consistently reported in high-risk samples. A detailed review of the longitudinal literature on attachment in both low- and high-risk samples was provided in Study 1 of this manuscript. In general, among low-risk samples, reported level of stability in attachment relationships across early childhood ranged from low (46% in Belsky, Campbell, Cohn, & Moore, 1996) to high (96% in Waters, 1978), while stability in high-risk samples tended to be lower, ranging from 30% (i.e., Lyons-Ruth, Repacholi, McLeod & Silva, 1991) to 60% (Edward, Eiden, & Leonard, 2004).

Patterns of Continuity versus Degree of Stability in Attachment Quality

Empirical results clearly show that the distribution of attachment classifications and stability levels in high- versus low-risk samples of mother-child dyads are different; however, few studies have compared the underlying patterns of continuity in attachment quality between a high-risk versus low-risk populations. This may be partly due to a tendency by the majority of current longitudinal studies to examine attachment continuity using a test-retest coefficient or a single degree of stability between two time points. These measurement approaches are examples of variable-oriented approaches, which assume that a single developmental trajectory is adequate in describing the development of all children in the sample or population (Laursen & Hoff, 2006). Attachment theory (Ainsworth et al., 1978; Bowlby, 1969/1982) has however argued that children vary in their patterns of continuity in attachment depending on their unique care-giving experiences. Thus, variable-oriented approaches, while able to describe the average trajectory of attachment development in sample, often overlook how children may develop different patterns of continuity in attachment quality (Andruff, Carraro,

Thompson, Gaudreau & Louvet, 2009). As a result, researchers have argued that, "the methods that are typically used to answer questions about continuity and change are, paradoxically incapable of doing so" (Fraley, Vicary, Brumbaugh, & Roisman, 2011).

To address the aforementioned limitation, Study 1 of this manuscript used a person-oriented method, Latent Class Analysis (LCA; see Colins & Lanza, 2010), to examine how children differ in their patterns of attachment development (see Study 1). Consistent with the above noted criticisms of variable-oriented techniques, Study 1 found that variable-oriented techniques, such as an average degree of stability between two time points, was unable to discover any clear patterns of continuity in the quality of children's attachment relationships; however, LCA, a person-oriented approach, was able to identify distinct groups of children, each with a separate trajectory of attachment continuity. The contrasting results that emerged from the two methodological approaches suggest a need to move beyond reports of a single average stability coefficient to a more detailed exploration of how children vary in their underlying patterns of continuity in attachment, and that LCA is a useful technique in which this may be achieved.

Purpose of Present Study

The current study is designed as a replication and extension of Study 1 with two major objectives. The first is to replicate the use of LCA in examining patterns of continuity in attachment over early childhood but in a new sample of children from a different population. The second objective is to compare the patterns that emerged from this new sample of high-risk low-SES children of adolescent-mothers with those that emerged from the low-risk middle-class community-sample of children of adult-mothers that were examined in Study 1 to Study 3.

We predict that LCA would uncover groups of children with distinct patterns of attachment continuity in this high-risk sample; however, these patterns of continuity are likely to differ from the trajectories that emerged from the low-risk sample. Given that greater instability exists in the care-giving environment of high-risk adolescent-mother child dyads, which is theoretically related to lower quality of care-giving and greater instability in maternal sensitivity, we hypothesize that the high-risk sample of children would exhibit: (1) more distinct patterns of attachment development, reflecting more variability in development, and (2) a greater proportion of these children will exhibit

patterns of stable insecure attachment, a trajectory towards attachment insecurity, and a trajectory characterized by change in attachment quality.

Method

Participants

Participants in the present study were mothers and their children who were recruited into a longitudinal intervention study conducted by the Child Development Centre at Western University (See Appendix A for Ethics Approval). A detailed description of this intervention can be found in Moran, Pederson, and Krupka (2005). Mothers who met the following criteria were originally approached during their postpartum stay in a London, Ontario hospital: (1) under 20 years of age, (2) living in London, (3) full-term birth without complications, and (4) an uneventful delivery. Those who indicated that they were interested in participating were contacted again when their infants were five months of age.

The initial recruitment phase resulted in 99 participants (50 girls and 49 boys) at 12 months of age. Nine mothers subsequently withdrew from the study. Lost data and technical difficulties during coding then reduced the available data to 69 dyads by 24 months infant age (see Forbes et al., 2007). By the third laboratory visit at 45 months of age, eight mothers withdrew from the study, five could not be contacted, ten had moved away from the London area, three continually cancelled appointments, two did not participate for other reasons, and five could not be coded due to technical difficulties. As a result, complete data were available for 59 mothers and their children by the four year visit (see Roche, 2005). The current study focuses on the 69 mother-child dyads with data at 12 and 24 months. Missing data at 45 months were imputed using an expectation maximization (EM) algorithm (see missing data analysis section below). EM imputation is the preferred method for handling missing data compared with replacing missing values through case deletion or mean imputation (Graham, 2009). There were no significant demographic differences between dyads that completed the study and dyads that withdrew (see Appendix C).

Demographic information was obtained during the 6-month home visit. Mean age of mothers at the time of the infant's birth was 18.42 (*SD* = 1.01), with a range from 15.97 to 19.98 years. Average maternal education was 11.13 years (*SD* = 1.15).

Approximately 81% of the sample were Caucasian; the remaining mothers were of Native American, middle Eastern, Latin American, Caribbean, and Asian ethnic backgrounds. Fifty-seven percent were single/never married, 28% were living in common law, and 15% were married. Annual personal household income was recorded on a scale from 1 to 8, with 1 being = < $5000 CAD, and 8 being >= $60, 000 CAD. The average personal household income fell in the $5, 000 to $9, 999 range, below the Canadian standard of poverty (Canadian Council on Social Development, 2004). The majority of the sample (over 70%) reported being unemployed or was a full time student.

Measures

To minimize presentation of redundant information, readers are directed to previous studies of this manuscript for measures that have been presented before. Detailed descriptions for only new measures are provided in detail below.

Mini-AQS: Attachment quality in infancy, toddlerhood, and preschool years. Mother-child dyads visited Western University and participated in a laboratory assessment of the quality of their attachment relationships at 12, 24, and 45 months of age. At 12 months of age, dyads participated in the Strange Situation Procedure (SSP, Ainsworth et al., 1978); at 27 months, they participated in the Interesting-but-Scary Paradigm (IbS, De Oliviera, 2001; see study 1 of this manuscript for a detailed description of the SSP and IbS); and at 45 months, they participated in a laboratory procedure involving a separation and reunion, a free play, a snack session, and a clean-up (see Roche, 2005).

Although attachment classifications (i.e., secure, insecure-avoidant, insecure-ambivalent/resistant, and disorganized) were obtained for the 12 and 24-month visit, they were not obtained for the 45-month visit given that no attachment classification coding system was available for the assessment procedure used in this study. The Mini-Attachment Q-sort (see Study 1) adapted from the 90-item AQS (Waters & Deane, 1985), is a measure that can be used in a number of different settings to assess the degree of attachment security in children ages one to five (Waters, nd). See Carlson and colleagues (2014) for application of AQS methodology in a laboratory setting involving a modified SSP. Consequently, the Mini-AQS was used to assess attachment quality in laboratory settings across all three ages in this study to ensure comparability over time.

A detailed description of the Mini-AQS is presented in Study 1. In brief, the Mini-AQS contains 30 item statements with specific reference to children's attachment behaviour. Trained coders sort the 30 item statements into five equal piles of six cards, ranging from 1 (*least like the child*) to 5 (*most like the child*). Several item statements on the 45-month Mini-AQS were modified to better assess attachment security during the preschool years (see Roche, 2005). The full list of items is also presented in Appendix J.

Three coders, blind to other data regarding the mother-child dyad, completed the Mini-AQS after watching videotaped observations of the 12-month SSP, 24-month IbS, and 45-month laboratory visit, respectively. Seventeen Mini-AQS were randomly selected and independently sorted for the purpose of reliability. Average item-by-item inter-rater reliability was .69. Furthermore, correlations between attachment classification (Secure versus Insecure) and Mini-AQS scores at 12 months was .42 ($p < .01$), and at 24 months was .84 ($p < .01$) in this study. These correlations suggest that the Mini-AQS is a valid method for assessing the quality of the attachment relationship in this study.

Procedure

At six months infant age, mother-infant dyads were visited in the home, at which point demographic data were collected. The larger study of which these participants were part of involved a number of other measures and assessments conducted at this time. These were not utilized in the analyses presented here.

Mother-infant dyads then visited Western University and participated in the SSP at 12 months, the IbS at 24 months, and a preschool laboratory assessment of the quality of their attachment relationship at 45 months. The interactions between mothers and children during the SSP, IbS, and preschool visit were videotaped and used for the assessment of the quality of their attachment relationships at each time point.

Overview of Data Analysis

Latent profile analysis. The underlying patterns of stability and change in Mini-AQS scores across all three time-points were examined with Latent Profile Analysis (LPA; Collins & Lanza, 2010), an extension of LCA using continuous variables. Similar to LCA, overall model fit in LPA is determined by the AIC, BIC, Sample Size Adjusted BIC and Bootstrap Likelihood Ratio Test (Collins & Lanza, 2010; see Study 1). A one-class model indicates no distinct patterns of continuity in Mini-AQS scores across the

three time points, while a two- or more class solution indicates distinct subgroups of children with similar patterns of continuity in Mini-AQS scores across time.

Missing Data Analysis. The Missing Value Analysis command in SPSS 20 was used to examine patterns of missing data. Little's Missing Completely at Random (MCAR) test indicated that the data points were missing completely at random, $\chi 2(37) = 31.71$, $p = .71$. Therefore, the analyses performed on the data were unbiased (Howell, 2012). Given that the missingness mechanism was ignorable, single imputation was considered a reasonable and efficient method for handling missing data (Graham, 2009). Continuous missing Mini-AQS scores at 45 months were imputed using an expectation maximization (EM) algorithm (Acock, 2005; Graham, 2009). Details of the EM algorithm are given by Graham (2009). EM imputation has also been used in longitudinal studies assessing maternal sensitivity and attachment security (e.g. Jarri-Bimmel, Juffer, van IJzendoorn et al., 2006; Leerkes, Blankson, & O'Brien, 2009). The EM imputation model used in the current study included demographic variables, quality of children's attachment relationship, and auxiliary variables theoretically predictive of attachment security (e.g. maternal sensitivity at all three time points). Research has found that including auxiliary variables in the imputation model improves the accuracy of imputed values (Hippel & Lynch, 2013).

Results

Change in Mean Mini-AQS Scores

Mini-AQS scores at 12, 24, and 45 months were .26 ($SD = .47$), .08 ($SD = .49$) and .21 ($SD = .35$), respectively. A one-way repeated-measures ANOVA revealed significant change in mean Mini-AQS scores across time, $F(2, 136) = 3.99$, $p < .05$. Pair-wise comparisons with bonferonni adjustment indicated a significant decrease in mean Mini-AQS scores from 12 to 24 months ($p < .05$). This was followed by a non-significant increase in mean Mini-AQS scores from 24 to 45 months. The difference in mean Mini-AQS scores between 12 and 45 months was also not significant.

Correlation in Relative Levels of Mini-AQS Scores

Correlation analyses were then conducted and revealed stability in relative levels of Mini-AQS scores over time. Specifically, infants with higher Mini-AQS scores at 12 months were significantly more likely to have higher scores at 24 months ($r = .34$, $p <$

.01). Toddlers with higher Mini-AQS scores at 24 months were also more likely, at a marginally significant level ($p < .10$) to have higher scores at 45 months ($r = .21$, $p = .07$). The correlation in Mini-AQS scores between 12 month and 45 month ($r = .08$, *ns*) was not significant.

Latent Profile Analysis

Underlying patterns of continuity in Mini-AQS scores were then examined with LPA. Four LPA models (i.e. one-, two, three-, and four-class) were tested. Selection of the best-fitting model was based on the smallest of AIC, BIC, and SABIC values and a significant bootstrapped LRT test (Muthén, 2004). Substantive interpretation was also used to guide model selection (Muthén, 2004).

Examination of statistical indices revealed two models with adequate fit: the two-class and four-class model. The two-class model had the lowest BIC value and fit the data significantly better than the one-class model (i.e., significant bootstrap LRT). The four-class model, on the other hand, evidenced the lowest AIC and Adjusted BIC values and fit the data significantly better than the three-class model (See Table 1). Results from recent Monte Carlo studies suggest that the SABIC compared to the BIC is more likely to identify the correct number of latent classes when testing latent class models with small sample size and unequal class sizes (Nylund, Asparouhov, & Muthén, 2007). The current study therefore relied more heavily on the SABIC. Based on the SABIC, the four-class model is a slightly better statically fitting model. Furthermore, substantive interpretation, as noted earlier, was an important criterion used to guide model selection. Detailed examination of the two-class and four-class model indicated that the four-class model explained more about the patterning of change across time in attachment security scores than the two-class model. The four-class model was therefore of greater theoretical interest and selected as the final LPA model in this study (See Table 2).

In the four-class model (see Table 2), 13% of children were assigned to class one, a group of children with low Mini-AQS scores at 12 ($M = -.45$), 24 ($M = -.48$) and 45 months ($M = -.04$). Although there was a slight increase in mean Mini-AQS score at 45 months, this change was not significant $F(2, 16) = 2.71$, $p = .10$, and this mean Mini-AQS score (-.04) is consistent with an insecure attachment. Class one was therefore labelled as “Stable Insecure”.

Class two, in contrast, consisted of 16% of children with initial low Mini-AQS scores at 12 months (M = -.23) but subsequent increases in Mini-AQS scores at 24 and 45 months (M=.37, and .29, respectively). The increases in mean Mini-AQS scores from 12 to 24 months ($p < .01$) and 12 to 45 months ($p < .01$) were significant, F (2, 20) = 18.21, $p < .01$. Class two was therefore labelled as "Insecure Shifting towards Security".

Class three, consisting of 33% of the sample, consisted of children with high Mini-AQS scores across time (M = .65, .55, and .28, respectively). There was, however, a decrease in mean Mini-AQS score at 45 months ($F(2, 44) = 18.45$, $p< .01$). The mean Mini-AQS score at 45 months was significantly lower than those at 12 months ($p < .01$) and 24 months ($p < .01$). Although AQS methodology is not designed to discern between attachment classifications, researchers have attempted to convert continuous AQS scores to a secure/insecure dichotomy (Waters, n.d). Waters (n.d.) and Carlson et al. (2014) have argued for an AQS cut-off score of .30 to designate a secure versus insecure classification. Furthermore, studies looking at the AQS scores of different attachment classifications have reported mean AQS scores around the .30 cut-off for children with secure attachment. For example, van Bakel and Riksen-Walraven (2004) reported a mean of .32 and Siefer et al. (1996) reported a mean of .43 for children with secure attachment. In the current study, the mean Mini-AQS score was .50 (SD = .28) for children with secure attachment at 12 and 24 months. A mean Mini-AQS score of .28, which is around the .30 cut off for a secure/insecure dichotomy, suggests some shift towards insecurity at 45 months in Class three. Class three was therefore labelled as "Stable Secure with Some Shift towards Insecurity".

Lastly, Class four, consisting of 38% of the sample, was characterized by instability in Mini-AQS scores, $F(2,50) = 31.19$, $p < .01$. These children had a moderately high Mini-AQS score at 12 months (M = .34), followed by a very low score at 24 months (M = -.26), which was then followed by an increase at 45 months (M = .18). A Mini-AQS score of .18, however, is still within the range of insecure attachment. The changes in mean Mini-AQS scores between 12 and 24 months ($p < .01$) and 24 and 45 months ($p < .01$) were statistically significant. Class four was therefore labelled as a group of children with a trajectory of "Unstable Attachment Security".

Table 1.

Model Fit Indices for Mini-AQS scores across 12, 24, and 45 Months

Classes	2	3	4
AIC	238.03	237.73	233.30*
BIC	260.37*	269.01	273.52
Adjusted BIC	228.87	224.92	216.83*
Bootstrapped LRT	1 vs 2 classes p <.01*	2 vs 3 classes p =.33	3 vs 4 classes p < .01*
n in each class	C1 = 33 (48%) C2 = 36 (52%)	C1 = 25 (36%) C2 = 10 (14%) C3 = 34 (49%)	C1 = 9 (13%) C2 = 11 (16%) C3 = 23 (33%) C4 = 26 (38%)

Note. * lower AIC, BIC, and Sample-Size Adjusted BIC values indicate better model fit.

Table 2.

Four-Class Solution: Mean Mini-AQS Scores at 12, 24, and 45 Months by Latent Class Membership

Latent Class	Mean Mini-AQS Scores			Change Over Time	
	12-Month	24-Month	45-Month	*F*	*P*
Class I:					
Stable Insecure *n* = 9 (13%)	-.45	-.48	-.04	2.71	.10
Class II:					
Insecure Shifting Towards Security *n* = 11 (16%)	-.23	.37	.29	18.21	.00
Class III:					
Stable Secure with Some Shift towards Insecurity *n* = 23 (33%)	.65	.55	.29	18.54	.00
Class IV:					
Unstable Attachment Security *n* = 26 (38%)	.34	-.26	.18	31.19	.00

Discussion

The current study was designed as a replication and extension of Study 1 of this manuscript and had two major objectives: first, to replicate in a different sample of children the use of LCA (Collins & Lanza, 2010) in examining underlying patterns of continuity in attachment quality over early childhood; and second, to compare the underlying patterns of continuity that emerged from a high-risk low-SES sample of adolescent mother-child dyads with those that emerged from a low-risk middle class community sample of adult mother-child dyads. Here, we will first summarize the patterns of continuity that emerged in the high-risk adolescent mother-child sample, then discuss the implication of these patterns, contrast these patterns with those that emerged in the low-risk community adult mother-child sample, and lastly present limitations and directions for future work.

Patterns of Attachment Continuity in a High-Risk Sample of Adolescent Mother-Child dyads and their Associated Implications

A primary purpose of this study was to examine the patterns of attachment continuity across early childhood in a sample of high-risk low SES adolescent mothers and their children. Four separate groups of children, each with a distinct trajectory of attachment development, emerged from the LCA: a group with stable insecure attachment trajectory, a group with initial insecure attachment with shifts toward security, a group with stable secure attachment with some shifts towards insecurity, and a group with unstable attachment security.

The emergence of four separate trajectories has important methodological implications. As previously noted, a common criticism of the existing longitudinal attachment literature is that studies tend to examine attachment continuity through the almost exclusive use of variable-oriented approaches, such as a single degree of stability (Fraley & Brumburgh, 2004). Variable-centered approaches assume that the population is homogenous and a central tendency or an average developmental trajectory, can adequately describe the pattern of development for a sample (Laursen & Hoff, 2006). Attachment theory has, however, argued that children vary in their trajectories over time depending on environmental experiences (Bowlby, 1973; Ainsworth et al., 1978). As a result, the use of degrees of stability or test-retest coefficients fails to fully test the

principles of attachment theory because it overlooks how developmental trajectories may differ between children. A person-oriented approach, which seeks to describe inter-individual differences in developmental patterns (Bergman & Magnusson, 1997), arguably offers a more precise test of attachment theory. In Study 1, we used LCA/LPA, a person-oriented approach, to identify three distinct patterns of attachment continuity when attachment was assessed using a continuous measure (i.e., Mini-AQS) in a low-risk community sample of mother-child dyads. The current study used LPA to identify distinct groups of children with different attachment trajectories. The emergence of four groups of children, each with a distinct trajectory, from LPA indicates that this methodology can also be used in high-risk samples of adolescent mother-child dyads.

Furthermore, the few existing studies that have attempted to identify patterns of attachment continuity have relied mostly on subjective interpretations of the data. In other words, the attachment trajectories were derived mostly based on researchers' unique interpretations of the data (see Van Ryzin, Carlson & Sroufe, 2011). A limitation of this approach is that two researchers may arrive at different trajectories depending on their own interpretations. The attachment trajectories in the current study are unique because they were empirically derived. Specifically, the correct number of trajectory groups and the description of each trajectory group were based on statistical indices, which then allows for verification by independent researchers (Colins & Lanza, 2010). The current study's use of LPA to identify groups of children with distinct trajectories is a novel approach to the study of attachment continuity and adds unique value to the existing literature. The emergence of naturally occurring trajectories from LPA also provides the critical empirical basis for asking questions related to antecedents of individual differences in patterns of attachment development. In the following section, we will explore the manner in which the patterns of continuity that emerged with this sample are consistent with theoretical models of the development of attachment when compared with those found in the lower risk sample.

Patterns of Attachment Continuity in High-Risk Versus Low-Risk Samples

The second purpose of this study was to compare the patterns of continuity that emerged from a high-risk versus low-risk sample of mothers and their children. We hypothesized that children in the high-risk sample will exhibit: (1) more patterns of

continuity in attachment quality, and (2) show qualitatively different and theoretically predicted trajectories than children of a sample of low-risk community adult mothers.

First, we predicted a greater number of distinct patterns of attachment continuity in children of adolescent mothers because past studies have consistently found that high-risk populations, especially adolescent mothers, tend to be more variable in their interactions with their children than seen in low-risk samples of adult mothers (Culp, Culp, Osofsky & Osofsky, 1991; Jaffee, Caspi, Moffitt, Belsky & Silva, 2001). In an especially relevant study, Bailey, Waters, Pederson and Moran (1999) used a person-oriented approach, Q-factor analysis, to empirically derive interactive profiles of adolescent mothers versus adult mothers. They found that three behaviour profiles were necessary to describe the interactive behaviour of a group of adolescent mothers, whereas the behaviour of adult mothers was best described with one profile. Interestingly, the current results parallel those of Bailey and colleagues and found that more distinct patterns of continuity were needed to characterize the attachment development of children of adolescent mothers than children of adult mothers (see Study 1). Greater variability in the behavioural profile of adolescent mothers is likely to lead to more variability in their children's trajectories of attachment development. The current results are suggestive of this link.

Secondly, and consistent with prediction, we also found that the attachment trajectories of children of adolescent mothers were qualitatively different than those of adult mothers. While the trajectories of children of adult mothers were characterized by stability and a high percentage of attachment security (i.e., 70% of children evidenced a "stable secure" trajectory, 13% showed "stable insecurity", and only 17% evidenced "some shifts from insecurity to security"; see Study 1), the trajectories of children of adolescent mothers were characterized by change and heterogeneity. Out of the four attachment trajectories evidenced by children of adolescent mothers, the "unstable attachment trajectory" (38%) contained the largest proportion of children, indicating a high level of instability in attachment quality in this population. The next largest trajectory group contained 33% of children with a "stable secure attachment with some shifts towards insecurity", followed by 16% of children that showed a trajectory of "insecurity shifting towards security", and finally 13% of children with a trajectory of

"stable insecurity". Although we did not forecast these specific trajectory groups, they are consistent with theoretical predictions.

Specifically, adolescent mother are theoretically a heterogeneous group with relatively higher levels of mal-adaption in their behaviour, adverse developmental histories, low levels of social support, and instability in living conditions (Jaffee et al., 2001; Palacios, Strickland, Chesla, Kennedy, & Portillo, 2013). These factors are likely to lead to relatively higher levels of attachment insecurity and more diversity in their children's patterns of attachment continuity (Bailey et al., 1999; Bailey et al., 2007; Jaffee et al., 2001). Consequently, it is not surprising that the two patterns, stable insecure attachment and unstable attachment trajectory, emerged from a high-risk sample of children of adolescent mothers. While the combination of youth, early motherhood, adverse childhood experiences, and environmental stress often place young mothers at risk for insensitive parenting and insecure attachment (Jaffee et al., 2001), researchers have also found that early childrearing can be a positive force for some adolescent mothers to develop goals, engage in responsible activities, curb risky behaviours, and work with supportive models to become responsive caregivers (Smithbattle & Leonard, 2006). These adolescent mothers may show trajectories of stable sensitivity or increasing sensitivity in their interactions over time. Thus, it is also not surprising that some children evidenced trajectories characterized by a shift from insecurity to security and relatively stable attachment security.

Directions for Future Research

While we were able to replicate the use of latent class analysis to examine attachment quality measured continuously with Mini-AQS scores, we did not examine the trajectories that would emerge for attachment quality measured categorically (i.e., attachment classifications). Children of adolescent mothers evidence not only higher incidences of insecure attachment relative to children of adult mothers (see review by Spieker & Booth, 1988), they have also been found to evidence higher incidences of disorganized attachment (see meta-analysis by van IJzendoorn et al., 1999). Disorganized attachment is considered orthogonal to the organized secure, insecure-avoidant and insecure-ambivalent/resistant classifications (Main & Solomon, 1990) and therefore cannot be captured with the Mini-AQS, a measure designed to assess children only on the

continuum of security (Waters & Deane, 1985). It would be important to observe the attachment trajectories that emerge in this high-risk low-SES sample when both organized and disorganized attachment classifications are assessed using LCA.

A second limitation of this study relates to the size of the sample used (n = 69). A small sample diminishes the statistical power needed to detect other distinct patterns of attachment continuity. A study with a larger sample may detect addition groups of children with patterns of attachment continuity that were not observed in this study. The trajectories that emerged in this study are thus considered preliminary and replication with a larger sample is recommended.

Lastly, emergence of distinct patterns of attachment continuity begs the question of antecedents of these trajectories. We discussed the role of changes in maternal behaviour, which was not directly measured in this study, but was found in Study 2 to influence children's patterns of attachment continuity. It would be interesting to replicate Study 2's investigation of the associations between changes in maternal behaviour and changes in attachment security but with this high-risk adolescent mother-child sample.

It has been acknowledged that adolescent mother-child dyads are situated in contexts that place them at risk for insensitive parenting and insecure attachment (Jaffee et al, 2001). These contextual factors include mother's developmental history, psychological resources, contextual support, environmental stress and more (Palacios et al., 2013). Another important direction for future study is to examine the role these environmental and psychosocial factors play in influencing adolescent maternal interactive behaviour and the attachment trajectories of children of adolescent mothers.

Conclusion

The current study was able to replicate the use of LPA to examine the patterns of continuity in attachment across early childhood in a high-risk sample of adolescent mother-child dyads. Four groups of children, each with a distinct trajectory emerged. These trajectories contrast strikingly with the trajectories that emerged from the low-risk community sample of adult mothers and their children, but are equally compelling because of their theoretical coherence. The current results, once again, highlight a need for longitudinal studies to move beyond pre-post assessments of attachment quality to more nuanced explorations of children's diverse patterns of continuity in attachment.

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Chapter 6

General Discussion

This dissertation, in a series of four inter-related studies, aimed to identify children's patterns of continuity in attachment quality across early childhood and to examine the theoretical processes that may predict the development of distinct patterns of continuity. In the following sections, a review of the key findings from each of the four studies and their implications are provided, followed by a general discussion of the central contributions of this dissertation, and lastly a presentation of areas for future research.

Study 1: Results and Their Implications

The first study of this dissertation used Latent Class Analysis (LCA) to identify the patterns of continuity in attachment quality from infancy to early childhood in a low-risk community sample of mother-child dyads. Attachment quality was examined using categorical and continuous measures of attachment because the two approaches assessed different aspects of change in attachment quality (see Ainsworth, Blehar, Waters & Wall 1978; Cummings, 1990; Fraley & Spieker, 2003). Specifically, while longitudinal research with a categorical measure assessed change in attachment group membership, longitudinal research with a continuous measure assessed change in the degree of attachment security (Zachrisson, 2008). Consequently, it was hoped that the combined use of both measurement approaches would yield more information about children's patterns of continuity in attachment than either measure could yield by itself (Colin, 1996).

Two groups of children, each with a distinct pattern of continuity, emerged from LCA when attachment was assessed categorically. The first group, consisting of 71% of children, showed a pattern of stable secure attachment. In contrast, the second group, consisting of 29% of children, showed a pattern of stable insecure attachment with some shifts toward security. LCA of attachment measured continuously revealed the same underlying patterns, but the approach's greater power separated the children into three statistically and conceptually distinct groups. The first group, consisting of 70% of children, showed a pattern of stable secure attachment; the second group, consisting of 13% of children, showed a pattern of stable insecure attachment; and, the third group,

consisting of 17% of children, showed a pattern with shifts from attachment insecurity towards security.

The emergence of distinct groups of children, each with a different pattern of continuity in attachment, has significant theoretical implications. The central tenet of attachment theory is that children's patterns of continuity in attachment classifications are tied to their environmental experiences (Bowlby, 1973). In this way, children may maintain their attachment classifications when raised in stable care-giving environments, or they may change their attachment classifications when faced with repeated disruptions in their care-giving environments. To examine this theoretical proposition, researchers must first empirically identify the patterns of attachment continuity that naturally occur in a sample or population. This objective had not previously been achieved in the literature because most studies have tended to describe attachment stability using a single measure that describes the average degree of stability in the sample, such as a single stability coefficient between two time points (see review by Thompson, 2000). The emergence of different attachment trajectory groups found in Study 1 provided, for the first time, the empirical basis to then ask questions related to predictors that lead to these different patterns of attachment continuity. Correspondingly, the aim of subsequent studies in this dissertation was to investigate factors related to children's development of these distinct trajectories.

Study 2: Results and Their Implications

The second study of this manuscript built upon the results from Study 1 and examined the links between changes in maternal behaviour and children's distinct attachment trajectories. Ainsworth asserted that maternal sensitivity is the principal determinant of the security of children's attachment relationships (Ainsworth et al., 1978). By the same logic, children's experiences of their mothers' sensitivities in interaction over time should be the key processes that determine their patterns of continuity in attachment. In this way, children who experience consistent sensitive care-giving over time are likely to develop a pattern of stable secure attachment, whereas children who experience consistent insensitive care-giving over time are likely to develop a pattern of stable insecure attachment. Children who experience a change in their mothers' sensitivities over time are, in contrast, likely to evidence a change in their

attachment relationships in the parallel direction. The current study investigated these predictions.

Logistic regression was first conducted to examine how maternal sensitivity in infancy, toddlerhood, and preschool years predicted children's memberships in different attachment trajectory groups. Results revealed that the likelihood of developing a pattern of stable-secure attachment increased with each experience of sensitive care. In other words, stable-secure attachment developed from consistent sensitive care-giving at all three ages, and not solely from sensitive maternal interaction at a single point in time. This finding offers preliminary support for the theoretical prediction that children's patterns of attachment continuity are shaped by their experiences of maternal sensitivity over time.

Given these results, exploratory path analysis was then conducted to examine the longitudinal relationship between maternal sensitivity and attachment security. The aim of the path analysis was to uncover how mothers' sensitivities and their children's attachment classifications mutually influenced each other over early childhood, leading to the emergence of different groups of children, each with a distinct pattern of continuity.

Path analysis revealed a path model (see Figure 3 in Study 2) in which mothers who were more sensitive at each time point tended to have children who were more secure at the concurrent assessment time point. Secondly, mothers who were more sensitive in infancy tended to be more sensitive in toddlerhood, and in turn, they were also more sensitive in the preschool years. However, there were no significant direct associations between attachment classifications in this path model, indicating that when the effect of maternal sensitivity was controlled for, the quality of children's attachment relationships in infancy did not influence the classification of their future attachment relationships that were then examined in toddlerhood and in preschool years. These results suggest that continuity in maternal sensitivity underlay continuity in children's attachment classifications in this sample of children.

Although direct links between attachment classifications were not supported in this path model, the emergence of indirect associations between these variables is noteworthy. Specifically, children with secure attachment relationships tended to have mothers who were subsequently more sensitive in interaction, and these mothers were in

turn more likely to have secure attachment relationships with their children at a later time point. This finding indicates that children's histories of attachment relationships continue to influence their attachment trajectories through its effect on their mothers' tendencies to continue to provide subsequent sensitive care.

Overall, findings from Study 2 addressed a significant gap in the literature. Not only did the results support the foundational tenet of attachment theory, that children's experiences of maternal sensitivity over time are linked to their patterns of attachment continuity, they also illustrated empirically for the first time the complex transactional process by which maternal sensitivity and attachment security reciprocally influenced each other during early childhood. Since the beginning, the developmental link between maternal sensitivity and attachment security has been described as a nonlinear transactional process in which "both history and present circumstances are important, but also the established patterns of adaptation may be transformed by new experiences while, at the same time, new experiences are framed by, interpreted within, and even in part created by prior history of adaptation" (Sroufe, 2005). The current findings are wholly consistent with this description.

Study 3: Results and Their Implications

The third study of this manuscript aimed to build further upon the results from Study 1 and Study 2 and assessed, from a differential susceptibility perspective (Belsky, 1997), the moderating effect of children's levels of negative emotionality in the longitudinal association between maternal sensitivity and attachments security. According to the differential susceptibility hypothesis, children vary in their levels of susceptibility to environmental influences and thus are not equally affected by changes in maternal sensitivity (Belsky, 1997/2005). Negative emotionality is considered by Belsky (2005) to be a behavioural indicator of susceptibility level. Consequently, children with high levels of susceptibility, as evidenced by high levels of negative emotionality, are more likely to show stability in attachment following stable sensitive care-giving. These children are also more likely to evidence changes in their attachment trajectories following changes in maternal sensitivity. In contrast, this association is less likely to occur in children with low levels of susceptibility. The results of Study 3, however, did not support these predictions. Specifically, Study 3 found that children's patterns of

attachment continuity followed maternal levels of sensitivity regardless of children's negative emotionality levels. The failure to find these associations may be related not only to some methodological limitations within this study but also to more general limitations within the differential susceptibility theory (see Study 3). Addressing both the methodological and theoretical limitations noted in Study 3 will be necessary in future studies of this topic.

Study 4: Results and Their Implications

The fourth and final study was designed as a systematic replication and extension of Study 1 of this dissertation and had two major objectives. The first was to replicate the use of LCA in examining patterns of continuity over early childhood in a new sample of high-risk low-SES children of adolescent mothers. The second objective was to compare the patterns that emerged from this sample of high-risk children with those that emerged from the low-risk middle-class community sample of children of adult mothers that were examined in Study 1 to 3 of this dissertation.

In the high-risk adolescent-mother sample, four groups of children, each with a distinct pattern of continuity, emerged from LCA: 38% of children showed a pattern of unstable attachment; 33% of children showed a pattern of stable secure attachment with some shifts toward insecurity; 16% of children showed a pattern of initial insecure attachment shifting towards security; and lastly, 13% of children showed stable insecure attachment. As predicted, these trajectories contrast strikingly with the trajectories that emerged from the low-risk community sample of children of adult mothers. While the attachment trajectories of children of adult mothers were characterized by stability and a high degree of attachment security (see Study 1), the trajectories of children of adolescent mothers were characterized by change and variability in attachment trajectories. This difference between the two samples bears a striking parallel to research that has found that high-risk populations, especially adolescent mothers, tend to be more variable in their interactions with their children than typically seen in low-risk community samples of mothers (Bailey, Waters, Pederson, & Moran, 1999; Jaffee, Caspi, Moffitt, Belsky, & Silva, 2001). Bailey and colleagues (1999) for example found that three behaviour profiles were necessary to describe the interactive behaviours characteristic of a group of adolescent mothers, whereas the behaviour of adult mothers was best described with only

one profile. Such results suggest that adolescent mothers are a heterogeneous group with relatively higher levels of mal-adaptation and variability in their behaviours, possibly related to more diverse experiences of motherhood, developmental history, social support, and instability in living conditions (Jaffee et al., 2001; Bailey et al., 1999). Their high levels of variability and mal-adaptive behaviours are in turn more likely to lead to relatively higher levels of attachment insecurity and greater diversity in their children's patterns of attachment continuity (Jaffee et al., 2001; Bailey et al., 2007). The high prevalence of unstable attachment found in this study is consistent with this perspective and suggests perhaps a greater volatility in maternal sensitivity in this sample of mothers that, in turn, drove unstable attachments over time.

Of additional significance is that these diverse patterns of attachment continuity would likely have been undetected with a single measure characterization of attachment continuity. Consequently, the findings from this study support not only the existing theoretical conceptualization that adolescent mother-child dyads are considerably more variable than adult mother-child dyads, but also Study 1's conclusion that future studies need to move beyond a single measure characterization of stability to a more nuanced exploration of groups of children with distinct trajectories' of attachment continuity. Study 4 also supports the use of LCA as one such methodology that can achieve this.

General Discussion and Directions for Future Research

In addition to the aforementioned contributions to the literature on attachment theory, there are a number of general strengths across all of the studies in this dissertation that warrant discussion. First, this dissertation's focus on identifying patterns of continuity among children and the use of relatively novel methodologies, such as LCA (Collins & Lanza, 2010), are notable strengths. Most longitudinal attachment studies to date have aimed to determine the typical level of stability in attachment classifications (Thompson, 2000). From the beginning, however, attachment theory has suggested that children vary in their patterns of attachment continuity depending on their unique ongoing environmental experiences (Bowlby, 1973). Consequently, any attempt to describe attachment continuity for an entire sample using an average level of stability is likely to obscure the distinct patterns of attachment continuity that exist between groups of children. Consistent with this argument, this manuscript found that when attachment

continuity was characterized using a single measure, such as a single stability rate, no clear picture of continuity emerged (see Study 1). In contrast, when LCA was used to classify children into different groups, distinct patterns of continuity emerged within each group of children. This was found for both the sample of low-risk and sample of high-risk children (see Study 1 and Study 4). These findings suggest that future studies would benefit from a focus on identifying patterns of continuity in conjunction with the average degree of stability in the sample, and from a use of appropriate methodologies, such as LCA, to achieve this.

The second notable strength of this study was the use of multiple measures of attachment security over infancy, toddlerhood, and preschool years in this dissertation. There are a number of benefits to such use of longitudinal data. First, a two-wave pre-post assessment of attachment classifications increases the risk of confounding true change in attachment with measurement error (Fraley & Roberts, 2005). For example, if assessment error renders the attachment classification insecure instead of secure at the second assessment, researchers might erroneously conclude that there was a change in attachment when a longer temporal view would suggest otherwise (Rogosa, Brandt, Zimowski, 1982). Secondly, two-wave data restricts developmental trajectories to a linear shape and therefore obscures the processes of change. Thus, researchers have argued that at least three waves of attachment data are required to examine developmental trajectories of change (Singer & Willet, 2003). Collecting multiple waves of attachment data is an important consideration for future attachment continuity studies.

Similarly, this dissertation also assessed maternal sensitivity repeatedly and at concurrent time points with attachment security. This allowed for an examination of the link between change in maternal sensitivity and change in attachment security. Repeated assessments of both variables also allowed for the use a path analysis to map out the longitudinal and concurrent associations between maternal sensitivity and attachment security. The resulting path model (see Study 2) supported Ainsworth's (1978) predicted link between maternal sensitivity and attachment continuity, and also illustrated the complex transactional process by which maternal sensitivity and attachment security reciprocally influenced each other over early childhood. The longitudinal design of this

dissertation and the use of path analysis are therefore strengths that warrant replication in future longitudinal attachment research.

While the current dissertation addressed a number of gaps in the existing literature, a number of intriguing questions also arose from the results. The first relates to children's patterns of continuity in attachment beyond early childhood. An interesting finding from Study 2 was the lack of direct significant associations in the path model between measures of attachment security over early childhood. This finding does not support the notion that later attachment quality in this developmental period is directly affected by attachment security at an earlier stage. This result is surprising since children's attachment classifications are considered the behavioural manifestations of their internal working models (Ainsworth et al., 1978), and internal working models are theorized to be relatively stable over time (Bowlby, 1973). A review of Bowlby's theory indicates that children's internal working models of attachment are thought to consolidate in late childhood, at which point their social environments become increasingly less influential in determining the qualities of their relationship and in parallel, their attachment securities become increasingly resistant to change. In other words, children's patterns of attachment continuity in early childhood are influenced more by environmental changes, whereas their patterns of continuity in later childhood are influenced to a greater extent by internal working models of attachment. The current findings provide support for the first part of this theoretical proposition. A valuable direction for future studies would be to extend the current longitudinal examination into later childhood and adolescence to fully examine the role of internal working models in shaping children's patterns of attachment continuity.

While the current dissertation supports the proposition that changes in maternal sensitivity are linked to children's trajectories of attachment development, we also acknowledge a need for studies to attend to influences beyond the mother-child interaction. According to Bronfenbrenner's (1979) ecological systems theory, some critical aspects of what transpires between a caregiver and child have to do with contextual factors. This suggests that changes in the broader social environmental context may influence children's patterns of attachment continuity directly or indirectly through their mothers' sensitivities in interaction. Preliminary evidence from high-risk samples

suggests that broader environmental contexts affect children's patterns of attachment continuity (Vaughn, Egeland, Sroufe, & Waters, 1979; Vondra, Hommerding & Shaw1999) but the processes by which they affect attachment continuity are unclear. A second important direction for future research is to examine the relationships between changes in broader social-environmental variables, maternal sensitivity, and children's patterns of attachment continuity.

In addition to raising questions regarding predictors of different patterns of continuity in attachment, the current findings also have implications for studies examining the sequelae of attachment. Since its inception, attachment theory has been concerned with the developmental implications of different patterns of attachment (Deklyen & Greenberg, 2008). While early attachment experiences are not considered direct causes of psychopathology, they serve as initiating conditions that establish tendencies and expectations that shape subsequent development (Sroufe, 2005). The relationship between early attachment relationships and future socio-emotional development has been documented by a number of researchers (see review by Deklyen & Greenberg, 2008); however, some studies have failed to confirm the expected link, leading reviewers to conclude that the association between attachment and later behavior is "modest" or "weak" (see reviews by Belsky & Cassidy, 1994). Thompson (1999) noted that many of these investigations, however, involved analyses in which the attachment relationship was assessed at only a single point in time and implicitly assumed continuity in attachment classification over time. He argued that intervening events may have altered the developmental processes initiated by a secure or insecure attachment resulting in a weak predictive association on later socio-emotional outcomes. In order to accurately predict the association between attachment and later socio-emotional outcomes, researchers need to examine the patterns of attachment continuity in attachment, not simply a single analysis of the relationship (Sroufe et al., 1999). A third important avenue for future research is therefore to examine the socio-emotional consequences of different trajectories of attachment.

A fourth area that the current findings have important implications for is the "transmission gap" (van IJzenndoorn, 1995). Research has consistently reported links between parents' attachment statuses and their infants' attachment classifications, such

that infants of mothers with autonomous states of mind (i.e, secure attachment) develop secure attachments, and conversely, infants of mothers with non-autonomous states of mind develop insecure attachments (van IJzendoorn, 1995). Theory suggests that maternal sensitivity mediates the link between parent's attachment representation and infant's attachment quality (van IJzendoorn, 1995). Research on this model of inter-generational transmission has, however, found that maternal sensitivity alone cannot fully explain the transmission of attachment from parent to infant because maternal sensitivity accounts for only a small proportion of the link (van IJzendoorn, 1995). van IJzendoorn (1995) termed this the "transmission gap". We argue that a possible reason for the transmission gap may be that existing studies have focused exclusively on predicting children's attachment classifications at one time point, rather than on children's patterns of continuity in attachment. A single analysis of the relationship can increase measurement error and can miss information about the attachment relationship that is more accurately captured by an assessment of children's trajectories of attachment. To more accurately predict the mediating effect of maternal sensitivity on the link between maternal attachment security and infant attachment security, researchers may need to examine the patterns of continuity in attachment, not simply a single analysis of the relationship. An interesting avenue for future research may be to assess the link between maternal states of mind and children's patterns of continuity in attachment, and examine whether maternal sensitivity mediates this link.

Lastly, while the sample sizes used in the current dissertation (n = 63 in the low-risk community sample and n = 69 in the high-risk sample) are respectable among studies using complex attachment measures repeated across time, they are small by the standards of multivariate statistical procedures. A small sample size can diminish statistical power to detect different patterns of continuity in attachment and statically significantly longitudinal and concurrent associations between maternal sensitivity and attachment security in the path analysis (Button, Loannidis, Mokrysz et al., 2013). The patterns of continuity in attachment presented in Study 1 and 4 and the path model between maternal sensitivity and attachment security presented in Study 2 are considered preliminary given the sample size limitation. A future study with a larger sample size is needed to replicate these findings. Furthermore, it is important to note that Study 4 used LCA to identify

only patterns of continuity in attachment quality measured using a continuous measure of security (i.e., Mini-AQS) and thus could not explore the existence of patterns of continuity in attachment classifications. The assessment of attachment using a continuous versus categorical measure is especially relevant in a high-risk low SES adolescent-mother child sample because children of adolescent mothers evidence significantly higher insecure and disorganized attachment classifications than children of low-risk adult mothers (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). Disorganized attachment is considered orthogonal to the organized attachment classifications (Main & Solomon, 1990) and therefore cannot be theoretically captured fully with a continuous measure of attachment security such as the Mini-AQS. It would be important for future studies to observe the attachment developmental trajectories that emerge in high-risk low SES samples when both organized and disorganized attachment classifications are assessed using LCA.

Concluding Comments

Attachment is a dynamic process that is aptly described by Bowlby (1973) as lasting "from the cradle to the grave". Bowlby (1973) conceptualized children's development of attachment as proceeding along pathways wherein change is always possible, but constrained by paths previously taken. In Bowlby's view, the key goals of developmental science are to map the pathways by which children develop and to uncover the processes that either keep children on a specific course or allow them to deviate from paths previously traveled (Fraley & Brumburgh, 2004). The findings of the current dissertation mapped out empirically, for the first time, some of the attachment pathways by which children traveled during early childhood and the role of maternal sensitivity in influencing children's development along these different pathways. This dissertation took important steps toward increasing understanding of children's continuity in attachment.

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Appendix A: Ethics Approval

Study 1 to 3

01/10/2005 11:56 FAX 519 850 2466 UWO RESEARCH ETHICS 001

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.c
Website www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. G. Moran
Review Number: 10390S
Revision Number: 1
Protocol Title: Exploring the Nature and Origins of Parent Child Relationships

Department and Institution: Psychology, University of Western Ontario
Sponsor:
Approval Date 07-Jan-05
End Date: 30-Apr-08
Documents Reviewed and Approved: Revised Letter of Information, Revised Visit 2 Interview

Documents Received for Information:

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

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

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

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

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

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

Chair of REB: Dr. Jerry Paquette

Karen Kueneman, BA (Hons), Ethics Officer REB
E-mail: kueneman@uwo.ca

Faxed: Y/N
Date: Jan. 10/05

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

UWO REB Ethics Approval 10390S Page 1 of 1

Appendix A: Ethics Approval

Study 4

The UNIVERSITY of WESTERN ONTARIO

Vice-Provost • Health Sciences • Health Sciences Centre

REVIEW BOARD FOR NON-MEDICAL RESEARCH INVOLVING HUMAN SUBJECTS

1994-95 CERTIFICATION OF APPROVAL OF HUMAN RESEARCH

ALL NON-MEDICAL RESEARCH INVOLVING HUMAN SUBJECTS AT THE UNIVERSITY OF WESTERN ONTARIO IS CARRIED OUT IN COMPLIANCE WITH THE SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL GUIDELINES (1981).

1994-95 REVIEW BOARD MEMBERSHIP

1. A.K. McDougall, Chairman (Political Science)
2. S. Hoddinott, Assistant Director of Research Services (Epidemiology)
3. D. Allison, Faculty of Education
4. A.J. Schneider, Faculty of Kinesiology
5. M. Kinnucan, Library & Information Sciences
6. J.B. Forster, Department of History
7. N. Kuiper, Department of Psychology
8. L. Zarbatany, Department of Psychology
9. R. Calhoun, Community Representative (Community)
10. R. Yohnicki, Administrative Officer

Alternates are appointed for each member

THE REVIEW BOARD HAS EXAMINED THE RESEARCH PROJECT ENTITLED:
"The teen parenting project."

REVIEW NO: 34845

AS SUBMITTED BY: Prof. W.R. Avison, Health & Well-Being, Engineering Science Building

AND CONSIDERS IT TO BE ACCEPTABLE ON ETHICAL GROUNDS FOR RESEARCH INVOLVING HUMAN SUBJECTS UNDER THE CONDITIONS OF THE UNIVERSITY'S POLICY ON RESEARCH INVOLVING HUMAN SUBJECTS.

APPROVAL DATE: 23 June 1995

AGENCY: HEALTH CANADA, STRATEGIC FUND FOR CHILDREN'S MENTAL HEALTH

TITLE: Promoting resilience through secure attachment: A brief intervention for adolescent mothers and their infants.

A.K. McDougall, Chairman

Appendix B: Letter of Information and Consent Form

Study 1 to 3
Exploring the Nature and Origins of Parent Child Relationships

Dear Parent

We are conducting a study with new mothers and their firstborn babies to learn more about how babies develop social and emotional relationships with their mothers. We want to understand how a mother's past and present experiences influence the growing relationship with her baby. We will be asking parents about many different types of experiences which may or may not apply. You are always free to not answer any questions should you not feel comfortable.

Our study will last 2 years and will involve 6 visits. Some of the visits will be in your home; others will be at the university. We are interested in your opinions about why your baby behaves as he/she does in different situations with you. We are also interested in the demands and rewards of parenting.

If you agree to participate in the study:

- Visit One: The first visit will be about two hours in your home when your baby is about 3 months old. At that time we will interview you, asking questions about your childhood experiences, your early relationship with your parents, any experiences of major separation, loss, or trauma, and your thoughts about how these experiences have affected your role as a mother. Some mothers may find aspects of the interview sad or upsetting because some of the questions are about sad or stressful events. Should you feel uncomfortable with any of the questions, you will not have to answer them. The interview will be audiotaped and later transcribed. We would also like to videotape you and your baby playing. After this we have a questionnaire about parenting experiences for you to fill out.

- Visit Two: When your baby is 3-4 months of age, (maximum 2 hours in total): We will visit you and your baby when your baby is awake. For about 20 minutes, we will ask you to play with your baby. The play session will be videotaped. After the play session we will have you watch the video and ask you about what you think your baby is feeling. Afterwards, we will ask you to fill out questionnaires about your experiences as a parent, any stresses associated with being a mother and the people you turn to for help and support. We would also like to ask you specific questions about your parenting experience so far, what your baby can do and who is helpful to you. This interview will be audiotaped.

- Visit Three: When your baby is between 9 and 10 months old, (maximum 2 hours): We will again visit you at home. We will give the baby some activities to do with the visitor to observe how your baby interacts with strangers and observe how he/she plays with you. We will arrange this visit to take place at a feeding time so that we will be able to see how your baby communicates his/her wants. Certain parts of this visit will be videotaped. Once again we will ask you questions about why your baby behaves as he /she does in these different situations as well as ask you about your early experiences in other relationships. This interview will be audiotaped. Once again we have questionnaires about your experiences as a parent.

- Visit Four: When your baby is 13 months old, (about 1 hour): You will visit us at the Child Development Centre at UWO. For this visit, we are interested in how your baby plays in new surroundings both when you are with your baby and when you are away. We will ask you to leave your baby for two brief periods (no more than 3 minutes each) during this part of the procedure. If your baby becomes upset, we will send you back in immediately. This visit will be videotaped. Parking costs at the university will be covered, or we can provide transportation for you and your baby.

- Visit Five: When your baby is about 21 months of age, (maximum 2 hours): We will visit you at home. We will give the baby some activities to do with the visitor to observe how your baby interacts with strangers and observe how he/she plays with you. We will interview you about your experiences as a mother (the interview will take about one hour, and will be audiotaped). Certain parts of this visit will be videotaped. We will also ask you to fill out questionnaires about your experiences.

- Visit Six: When your baby is 24 months of age, (maximum 90 minutes): You will visit us at the Child Development Centre at UWO. We will observe how your toddler interacts and plays in different surroundings and how he/she reacts to an interesting but unusual remote-controlled toy. This visit will be videotaped. We will ask you about your experiences with your toddler since we last saw you and ask you to fill out some questionnaires.

All information collected from you for the study will be kept confidential. All written, audiotaped, and videotaped records and questionnaires will be assigned numbers to maintain confidentiality. Audiotapes are erased after transcription. Any identifying information such as names and place of birth will be changed to maintain confidentiality. Only those directly involved in the study will see the transcripts and videotapes unless you agree that fragments can be used for professional training. The family names will only be available to direct members of the research group. Absolute confidentiality cannot be guaranteed as we may have to disclose certain information as required by law according to provisions under the Child and Family Services Act. This includes any suspicion that a child under the age of 16 years is or has been abused or if you are in imminent danger of hurting yourself or another person. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published.

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time. Even if specific questionnaires request that you answer every question you do not have to do so. There are no known risks associated with any of the procedures. This study will not result in any direct benefit to you or your baby but may help us to further understand factors that may have an impact on the social and emotional development of infants and how relationships develop. In appreciation for your assistance with the study you will receive $25.00 for each visit or $150.00 over the course of the study.

If you wish, you will have the opportunity to receive the results of the study. You may receive a copy of the videotape of the home visits if you wish. Throughout the study we will ask you if you have any questions about any of the procedures. We would also appreciate any ideas or advice about your experience as a participant. We hope that participating in this study will be an interesting time for you and your baby. If at any time you have questions or concerns, please do not hesitate to let the researcher know or you can contact the principal investigators or research coordinator listed below:

Dr. Greg Moran
Department of Psychology
University of Western Ontario

Dr. David Pederson
Department of Psychology
University of Western Ontario

Sandi Bento
Research Coordinator
Child Development Centre

Dr. Heidi Bailey
Department of Psychology
MacKinnon Building, University of Guelph

If you have questions about the conduct of this study or your rights as a research subject you may contact:

The Director
Office of Research Ethics
The University of Western Ontario
519-661-3036 Or email at: ethics@uwo.ca

Appendix C

Comparison of Study Participants and Drop-outs

Community Sample (Study 1 to 3 of Manuscript)

	Study participants (n = 46)	Drop outs (n = 17)	P
Demographics (collected at the 3 mo. visit)			
- Sex of child	Male = 22 (48%) Female = 24 (52%)	Male = 11 (65%) Female = 6 (35%)	.27
- Maternal age	M=30.53, SD = 4.68	M = 29.46, SD = 5.69	.45
- Martial Status	Married/Common-law = 43 (93%) Single =3 (7%)	Married/common-law = 9 (88%) Single =2 (12%)	.60
- SES	M = .18, SD = 1.74	M = -.50, SD = 1.73	.17
- Hours/week away from home	M = 2.07, SD = 4.59	M = 3.15, SD = 6.94	.48
- Work Status	Full time = 2 (4%) Part time = 2(4%) Not working = 42 (91%)	Full time = 1(6%) Part time = 1(6%) Not working = 15 (88%)	.45
Attachment classifications			
- 13 month	Avoidant = 6 (13%) Secure = 21 (47%) Resistant = 1 (2%) Disorganized = 18 (39%)	Avoidant = 4 (24%) Secure = 9 (53%) Resistant = 0 (0%) Disorganized = 4 (24%)	.55
- 27 month	Avoidant = 6 (13%) Secure = 29 (63%) Resistant = 0 (0%) Disorganized = 11 (24%)	Avoidant = 1 (7%) Secure =10 (71%) Resistant = 1 (7%) Disorganized = 2 (14%)	.48
Attachment Q-Sort			
- 13 month	M = .19, SD = .47	M = .36, SD = .49	.21
- 27 month	M = .32, SD = .45	M = .24, SD = .56	.60
Maternal Sensitivity			
- 10 month	M = .24, SD = .63	M = .14, SD = .50	.57
- 21 month	M = .35, SD = .57	M = .25, SD = .71	.57

Comparison of Study Participants and Drop-outs

High-Risk Adolescent Mother Sample (Study 4 of Manuscript)

	Study participants (n = 59)	Drop outs (n = 10)	P
Demographics			
- Sex of child	Male = 28 (47%) Female = 31 (53%)	Male = 5 (55%) Female = 5 (55%)	1.00
- Maternal age	M = 18.55, SD = .97	M = 18.23, SD = .71	.34
- Martial Status	Single/Never Married = 33 (56%) Separated/Divorced/ Widowed = 1 (2%) Living together but not married = 14 (24%) Married = 8 (15%) Missing = 3 (5%)	Single/Never Married = 4 (40%) Separated/Divorced/ Widowed= 0 (0%) Living together but not married = 1 (10%) Married = 2 (20%) Missing = 3 (30%)	.75
- Income	M = 2.93, SD = 1.28 (within the $5,000 to $10,000 range)	M = 2.67, SD = 1.03 (within the $5, 000 to $10, 000 range)	.63
- Hours/week away	M = 13.83, SD = 15.70	M = 18.33, SD = 19.14	.51
- Work Status	Full time = 3 (5%) Full time & going to school = 0 (0%) Part time = 5 (8%) Part time, and going to school = 3 (5%) Not working = 17 (29%) Student full time = 23 (40%) Other = 4 (7%) Missing = 4 (7%)	Full time = 0 (0%) Full time & going to school = 1 (10%) Part time = 0 (0%) Part time, and going to school = 0 (0%) Not working = 1 (10%) Student full time = 2 (20%) Other = 2 (20%) Missing = 4 (40%)	.10
Attachment classifications			
- 12 month	Avoidant = 5 Secure = 19 Resistant = 0 Disorganized = 35	Avoidant = 2 Secure = 3 Resistant = 0 Disorganized = 5	.53
- 24 month	Avoidant = 8 Secure = 24 Resistant = 2 Disorganized = 22	Avoidant = 2 Secure =2 Resistant = 0 Disorganized = 3	.61
Attachment Q-Sort			
- 12 month	M = .23, SD = .51	M = .44, SD = .31	.21
- 24 month	M = .08, SD = .50	M = -.06, SD = .53	.60
Maternal Sensitivity			
- 10 month	M = .09, SD = .64	M = .10, SD = .60	.96
- 21 month	M = .31, SD = .64	M = .28, SD = .73	.91

Appendix D

Tests of Demographic Confounding Variables

A test for potential confounding demographic variables was undertaken. Potential confounding variables measured were: child's sex (coded as 1 = male; 2 = female), maternal age (in years), maternal education (in years), family income (coded as 1 = less than $10, 000 to 9 = greater than $80, 000), SES (composite measure between household income and education), work status (coded as 1 = working full time; 2 = working part time; 3 = not working outside the home; 4 = other/student), and marital status (coded as 1 = married; 2 = single; 3 = common-law; 4 = separated; 5 = divorced).

A correlation matrix was generated to test the relationship of these demographic variables to the variables of interest in study 1: attachment classifications and mini -Attachment Q-Sort scores at 13, 27, and 42 months. In order to reduce the probability of Type I error due to multiple correlations, type I error was controlled family-wise at 5% of each variable by diving .05 by the total number of correlations involving that variable. For example, attachment classification (coded as 1 = Secure; 2 = Non-Secure) at 13 months was analyzed in terms of its correlation with the demographics measured concurrently at 13 months. The correlation significance level for the attachment classification and demographics at 13 months was .05/7 = 0.007. There were no significant correlations between the demographic variables, attachment classifications and mini-Attachment Q-Sort scores.

A correlation matrix was generated to test the relationship of demographic variables to the variables of interest in study 2: maternal sensitivity at 13, 27, and 42 months. In order to reduce the probability of Type I error due to multiple correlations, type I error was controlled family-wise at 5% of each variable by diving .05 by the total number of correlations involving that variable. There were no significant correlations between the demographic variables and maternal sensitivity scores.

A correlation matrix was generated to test the relationship of demographic variables to the variables of interest in study 3: negative emotionality. There were no significant correlations between the demographic variables and negative emotionality score.

Appendix E

The Interesting but Scary Paradigm: Failure to Engage Caregiver Scale

Assessment of the attachment relationship in the toddler years needs to take into account the child's changing competencies, negotiation of autonomy, and emerging "goal corrected partnership" with his mother. The Interesting-but-Scary paradigm (IbS; De Oliveira, 2001) allows researchers to explore the quality of the mother-child attachment relationship at 24 months (Forbes et al., 2007). Although, the IbS retains many of the procedural elements of Ainsworth's Strange Situation Procedure (Ainsworth, Blehar, Waters & Wall, 1978), it does not parallel the SSP's second separation/reunion episode.

The IbS paradigm involves a separation (10 minutes), followed by a reunion/free play session (5 minute), and the introduction of a potentially interesting but at the same time, modestly scary, remote controlled toy spider (3 minutes). The toy spider is both interesting and potentially anxiety provoking; and in most cases, both the child's exploratory and attachment systems are activated. The spider is introduced while the mother and child are in the room together. The mother's behaviours are not constrained, allowing her to respond in a naturalistic fashion to her child's cues. The child's endeavours for autonomous function and his use of the mother as part of his strategy for coping with the two conflicting systems of interest and wariness give important indications of the organization of his attachment relationship with her.

The "Failure to Engage Caregiver" scale is an elaboration of the Strange Situation Proximity Avoidance scale and concept. This scale incorporates the notion of "goal corrected partnership" (Bowlby, 1969) that is becoming key to the attachment relationship at this developmental age. Across the second year, certain social cognitive abilities develop within the child that facilitates a change in their interactions with their mothers. They become aware of the standards set by their mothers, and are motivated to achieve these standards. They begin to grasp language and are better able to sustain conversations with their mothers and communicate their wants vocally. They start to represent, monitor, elicit, and regulate their own and their parent's behaviors relative to theirs to achieve a single common goal (Jennings, 2004). The Failure to Engage Caregiver scale takes into consideration the child's changing competencies and appraises the deficits in his social interactive strategies to enlist his mother's attention, behaviour and assistance in managing the IbS conflict subsequent to the entrance of the toy spider. There is no designated timeline that denotes the child's "avoidance" or "failure to engage", but particular attention is paid to the periods during which the balance between interest and wariness of the spider tilts in favour of the latter. This scale assesses the child's lack of desire, ability and efforts to engage the caregiver for support during periods of difficulty. The "Failure to Engage Caregiver" scale considers physical avoidance, inhibition of affective involvement, and lack of social interaction and assistance seeking from the mother.

A low score on the scale is assigned to a child that when wary of the spider, promptly and intentionally utilizes the mother to assist him in continued exploration of the environment or as a haven of safety to approach. Engagement of mother can involve increases in physical proximity and contact, however, given the child's maturing social cognitive competencies, it is likely to involve affective and information exchanges across a distance. The child treats the mother as a communicative partner and a critical source of substantive and affective information and openly and directly shares his focus of attention and feelings; whether it is fear, uncertainty or interest. The child actively communicates and shares the experience using direct eye gaze, smiles, signals, gestures, vocalizations, or proximity and contact seeking.

A child scoring high on this scale is unwilling and unable to use the mother either for exploration (interest) or as a safe haven (wariness). The responsibility for monitoring the spider and regulating his own emotions rests entirely on the child. The child may attempt to contain his negative affect with self regulatory strategies, such as distractions via toy play, self talk, physically removing the spider from the room, or exiting the room himself. He does not openly convey his fears to his mother or approach for emotional or physical reassurance. He does not expect the mother to offer assistance and may ignore her and even turn away if assistance is offered. He does not look towards the mother or invite her to participate in his exploration. He may seem compliant to his mother requests, but his communication and exchanges are often blunted; child-parent conversations involve short one word responses, rhetorical questions, and impersonal topics. There is a lack of connection between the two, and the child seems to function independent of the mother. In some instances, wariness of the spider is so overwhelming that proximity seeking and contact behaviour may result. However, when in close proximity, the child attempts to regulate his wariness independently, unable to connect with the mother emotionally, resulting in non-reciprocal, disconnected and detached affect between the parties.

A child is assigned a continuous score of 1 to 7 on this scale:

7- Marked and persistent failure to engage mother
- When wary of the spider, the child does not express wariness openly to his mother. He does not involve the mother for assistance in regulating affect, nor does he seek reassurance from her. The child may briefly glance at his mother but pay little or no attention to any overtures from her. The child remains unresponsive and does not engage his mother affectively or physically throughout the episode. If his mother initiates contact, the child remains unresponsive.

5- Failure to engage mother but less persistent
- When wary of the spider, the child does not express his wariness openly to his mother. He may glance at her, vocalize, or partially approach; but he does not follow this with any further engagement of her. If the mother initiates interaction, the child may acknowledge her efforts or approach after a delay but he remains unengaged.

4- Minimal effort to engage mother
- When wary of the spider, the child shares brief glances and vocalizations with his mother. He may approach her after some delay. Initially, the child's affective engagement and attention to his mother is limited, but he becomes more engaged and responsive should the mother initiate interaction or contact.

3- Less active effort to engage mother
- If the child is wary of the spider, he is slow in either communicating or engaging his mother for assistance; but then does so by looking, vocalizing, or approaching her for reassurance.

1- Very active and persistent effort to engage mother
- If the child is wary of the spider, he promptly and directly communicates this to the mother. He utilizes his mother for assistance and reassurance by looking, vocalizing, and approaching for comfort if distal interactions are ineffective.
- If the child is not wary of the spider, he may point, smile, look, or vocalize to the mother to communicate his interest. He responds appropriately to his mother's signals; neither avoiding nor ignoring her overtures.

Appendix F
Mplus Script

```
Title:
   LCA: 2-class solution – 4way Secure, Avoidant, Resistant, and Disorganized
Attachment
  Data:
   File is "C:\Documents and Settings\ Desktop\mplus\4way_attachment.csv";
  Variable:
   names        = mon13 mon27 mon42;
   usevariables = mon13 mon27 mon42;
   categorical  = mon13 mon27 mon42;
   missing = all (-9999);
   classes = c(2);
  Analysis:
   Type= mixture;
   Starts = 50 5;
   LRTBOOTSTRAP = 100;
  Plot:
   type is plot3;
   series = mon13 (1) mon27 (2) mon42 (3.5);
  Savedata:
   file is LCA_2Class_4WayAttachment.txt ;
   save is cprob;
   format is free;
  Output:
   tech1 tech10 tech11 tech14;
```

Appendix G

Mini Preschool MBQS
Pederson, Bailey, Bento, Xue & Moran, 213

Detailed explanations for the following item statements are available in the Maternal Behaviour Q-Sort (MBQS) Manual by Pederson, Moran, and Bento

1. Provides C with little opportunity to contribute to the interaction
2. Awkward and ill at ease during interaction with C
3. Unaware or indifferent to C's distress or frustration
4. Ignores bids, requests for assistance or attention
5. Conveys information which C understands
6. Accepts C's initiatives
7. Responds to signals of distress or frustration
8. Content and pace of interaction are set by parent rather than C's responses
9. Responds with flat affect when interacting with C
10. Non-synchronous interactions
11. Acknowledges C's positive emotions: joy ,excitement, and contentment
12. Skillful in dividing attention between C and competing demands
13. Realistic expectations regarding C's self-control of affect
14. Praises C, parent takes advantage of opportunity for positive evaluation
15. Is comfortable in close contact or physical proximity
16. Mislabels C's affect
17. Delights in C
18. Annoyed, irritated, or impatient with C
19. Emphasizes parent's needs and wishes
20. Offers acceptable alternatives to divert attention form inappropriate activity
21. Inflexible when interacting with C
22. Builds on focus of C's attention
23. Structures activities to provide opportunities for C to be successful or satisfied
24. Makes verbal commands of C
25. Well resolved interactions; interaction revolves around C's tempo and current state and ends when C is satisfied

Appendix H
Domains of Maternal Interactive Behaviour Descriptions
See Maternal Behaviour Q-Sort (MBQS) Manual by Pederson, Moran, and Bento

Controlling/Interfering
This domain assesses the quality of the mother's guidance of the baby's behaviour. It looks at the extent to which the mother interferes with the baby's autonomy in their interactions, interrupts the flow of their interaction, and is misattuned to her child's behaviours. A mother high on this domain shows little respect for the child; she acts in accordance with her own agenda despite knowing that the child's wishes are not in accordance with hers. The mother will often consciously ignore the child's protests against her interventions and continue at her own pace. A mother low on this domain seems to support, rather than control, the interactions and interferes as little as possible, or only when absolutely necessary. The opposite of a controlling or interfering mother is one who guides the interaction in a supportive manner.

- Mother provides child with little opportunity to contribute to the interaction; Mother does not follow child's lead; little or no turn taking; mother is directive without regards to child's intentions
- Content and pace of interaction are set by mother rather than according to child's responses
- Interaction revolves around Child's tempo and current state; interaction ends when Child is satisfied; well resolved interactions (R)
- Mother builds on the focus of the baby's attention (R); low – mother introduces new activity according to her agenda rather than attends to child's interests and uses this as an opportunity to scaffold and further their interaction
- The mother's interaction with the child is non-synchronous; example: M interferes with activity child is enjoying or initiate interactions when b is attending other activities
- α = .93 (10 months), .93 (21 months), and .86 (42 months)

Positive Affectivity
This domain assesses how the mother's affect influences her interactions with the child. Mother's interest and delight in her interaction with her child and her communication of her interest and positive affect are evaluated in this domain. Positive affect is evidenced through warmth, delight and enjoyment of the child and of their interactions. A mother high on this domain is outwardly expressive of her positive feelings towards her child. In contrast, a mother low on this domain is characterized by a lack of animation and positive expression in their interactions, or may be characterized by communicating predominant negative affectity towards her child.

- Mother praises child; takes advantage of opportunities for positive evaluation
- Mother responds with flat affect when interacting with child (low – mother is animated when interacting with child) (R)
    - The original wording at 10 and 21 months is "mother is animated when interacting with child; low – mother responds with flat affect when interacting with child; example, uses varied expressions and enthusiastic with B"
- Mother is annoyed, irritated, or impatient with child (R)

    - The original wording at 10 and 21 months is "mother scolds or criticizes baby"
- Mother notices/acknowledges when child's positive emotions (i.e., joy, excitement, contentment)
    - The original wording at 10 and 21 month is "mother notices when B smiles; gives an observable sign that she is aware of child's positive signals"
- Mother delights in child; enjoyment is obvious and continual (42-month item only)
- Mother is distressed by child's demands (10 and 21-month item only) (R)
- α =.74 (10 month), .81 (21 month), and .76 (42 months)

Awareness/Accessibility

This domain reflects the mother's awareness of her child's signals and needs. She is clearly aware that the child is signalling to her. Her responses to the baby are used to denote her awareness. Signs of awareness include acknowledgement of the child's signals, even when she is involved in other activities, and by efforts to position herself in order to facilitate accessibility to child's cues. A mother high on this domain is constantly alert to the child's cues, regardless of competing tasks or demands, and clearly demonstrates her acknowledgement of the child's signals. A mother low on this domain demonstrates lapses in awareness of her child's signals and seems oblivious to the child's signals.

- Unaware of child's distress and frustration (R)
    - Original 10 and 21 month items: Mother appears to tune out and not notice child's bids for attention
- Mother responds to signals of distress and frustration; example: she is aware and responds to his signals of distress
    - Original 10 and 21 month item: Mother responds to baby's distress and non-distress signals (original 10 and 21 month item)
- Mother is skillful in dividing attention between child and competing demands
    - Original 10 and 21 month-item "during interactions with the visitor, mother does not notice child; low – mother is skillful in dividing attention between child and competing demands"
- Mother ignores child's signals, including bids, requests for assistance or attention; Low – mother responds to child's signals
    - Original 10 and 21 month item: mother responds to child's signals; not only is mother aware of child's signals, she also responds to these signals.
- Realistic expectation regarding child's self-control of affect; example: M monitor and intervenes when child reaches the limit in the ability to self soothe or regulate emotions
- α =.91 (10-month), .92 (21-month), and .86 (42-month);

Appendix I

Infant Negative Affect[2]

This scale is a measure of the frequency and intensity of the infant's expression of negative affect (NA) (i.e., anger, sadness, fear, undifferentiated NA). Negative affect includes facial expressions of anger, sadness, and fear, vocalizations of NA, and bodily expressions of NA (i.e., distancing behaviour). Some examples of NA include crying, whining, pouting/grimacing, turning away from Mom or attempting to escape the infant seat, arching one's back, pulling body part away from Mom, or pushing Mom away. This scale captures all forms of negative affect expressed during the session. A high score on this scale may be obtained even if the child expresses positive affect in the session. **Score negative affect regardless of instances of positive affect.**

1. **Very low**: Infant shows very little or no negative affect throughout entire session.

2. **Low**: Infant exhibits only a few instances of negative affect (i.e. slight pouting); however, the intensity of the negative affect is low.

3. **Moderately low**: Infant shows more negative affect than indicated in #2, but it is brief and only of moderate intensity (i.e. some brief instances of pouting or slight angry gestures).

4. **Moderate**: Infant shows some clear negative affect, but these are only minor elements of the session and are not expressed frequently or consistently throughout.

5. **Moderately high**: On a number of occasions, the infant expresses negative affect. The infant displays several (2 or 3) clear high level instances of negative affect (i.e. angry outburst, crying, throwing toys).

Alternatively, the infant frequently displays low levels of negative affect (i.e. whining) but does not do so consistently throughout the session.

6. **High**: Infant expresses negative affect. This can be demonstrated by a number of high level instances of NA or consistent displays of lower level NA or a mixture of both. These instances should be more frequent and/or more intense than in #5 and occur at various points throughout the session. There should be no ambivalence in the infant's expression of negative feelings. However, NA may not completely dominate the session as in #7.

7. **Very high**: Infant demonstrates high levels of negative affect. The infant's negative affect permeates the session as a whole and is displayed to some degree during the whole session.

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[2] **Note:** This coding system is a modified version of the Child Negative Affect scale created by Dr. E Hayden's Child Personality Development Lab. The scale is derived from the Teaching Tasks coding manual and Qualitative Ratings for Parent-Child Interactions (Weinfield, Egeland, & Ogawa, 1998; Cox & Crnic, 2003).

Appendix J
Preschool-Mini-AQS

P-AQS item #	weight	description
2	4	Child orients toward/approaches M upon her return (e.g. greets her, invites her to play)
10	3	Child easily becomes angry with toys
13	2	C rarely asks M for help
16	1	Child is physically aggressive towards mother
17	1	Child's communication with mother typically takes the form of whining, crying, insulting, or complaining
20	4	Child shows pleasure in interactions with mother
24	2	Child avoids mother (does not initiate interaction)
29	1	Interactions with mother are conflictual
32	5	When child is bored, he goes to mother looking for something to do
34	5	Child communicates with mother about activities that happened while she was gone
36	2	Child appears cool or aloof during interactions
40	4	C readily shares with M and lets her hold things
41	5	When child finds something new to play with, he/she introduces it to M
42	4	Child follows M's suggestions readily, even when they area clearly suggestions rather than orders
43	3	When M tells C to bring or give her something, he/she obeys
46	4	Child smiles and laughs easily with M
50	3	When mother says No or punishes him, child stops misbehaving (at least at that time).
52	2	C frequently makes demands
55	1	Child acts like he/she expects mother to interfere with his/her activities when she is simply trying to help him with something
58	5	If M reassures C by saying "it's ok" or "it won't hurt", child will approach or play with things that initially made him cautious
59	3	Child is light-hearted and playful most of the time
60	3	Child follows M's directives
61	2	Child is easily upset when M makes him change from one activity to another
65	2	When M doesn't do what C wants right away, C behaves as if she were not going to do it at all
66	1	C easily becomes angry at M
67	1	C cries as a way of getting M to do what he/she wants
70	3	C wants to be the centre of M's attention. If M is busy or talking to someone, he interrupts
72	5	Child asks or seeks mother for reassurance
74	4	Child seeks and is comfortable in proximity with mother
80	5	Child uses M's facial expressions as a good source of information

Curriculum Vitae

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Education:

Western University, London Ontario,
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Conference Oral Presentations:

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Xue, Y., O'Connor, K., Bailey, H., Pederson, D., & Moran, G. (July 2012). The association between attachment security, maternal sensitivity, and externalizing behaviour. Poster presented for: *International Society for the Study of Behavioural Development (ISSBD),* Edmonton, AB.

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