THE AMBIANCE-BRIEF:

AN INVESTIGATION OF A NOVEL TOOL DESIGNED TO ASSESS DISRUPTED

MATERNAL BEHAVIOUR

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Abstract

Maternal sensitivity has long been associated with optimal child development, yet outcomes of studies investigating its predictive validity have been far from consistent. One explanation for this inconsistency is that sensitivity measures tend to focus on the normative range of caregiving behaviours and may not capture the extreme behaviours most likely to produce suboptimal outcomes in children (i.e. disrupted maternal behaviours). The current study examined the AMBIANCE-Brief, a tool designed to assess disrupted behaviours, in comparison to more common measures of maternal sensitivity. It was found that ratings on the AMBIANCE-Brief were only moderately correlated with sensitivity ratings, suggesting that disrupted behaviour may be a distinct construct, rather than an extreme form of insensitivity. Moreover, AMBIANCE-Brief ratings significantly predicted preschool aged children's self-perceived cognitive competence, while the sensitivity measures did not. These results provide support for the consideration of disrupted maternal behaviour in combination with sensitivity by researchers and clinicians.

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Introduction

Maternal sensitivity, or a mother's ability to attend and respond promptly and

appropriately to her child's signals (Ainsworth et al., 2015), is understood to play a significant

role in children's healthy development, influencing domains such as social, cognitive, and

emotional functioning (Bernier et al., 2010; Hirsh-Pasek & Burchinal, 2006; Lemelin et al.,

2006; Pederson et al., 1990; Stams et al., 2002). The research investigating the nature and

magnitude of this role however has been inconsistent, with some studies failing to support the

above associations. This inconsistency has prompted researchers to query the nature of measures

that have been used to assess caregiver sensitivity (Bohr et al., 2018). Indeed, inconsistent

longitudinal associations should call into question whether the behaviours commonly assessed by

typical measures of maternal sensitivity can in fact validly and reliably be linked to important

suboptimal developmental outcomes. In response to Bohr et al.'s call for the identification of

measures of sensitivity that are in fact predictive of healthy child development, and for a critical

discussion of "what exactly is measured when "sensitivity" is assessed from different vantages"

(Bohr et al., 2018, p. 743), the current study investigated the use of a novel measure that assesses

disrupted maternal behaviour (the AMBIANCE-Brief; Madigan et al., 2018) and how it

compares to more traditional measures of maternal-child interaction quality when it comes to

predicting child outcomes.

Caregiver Sensitivity

Introduced and popularized by Mary Ainsworth, the concept of maternal sensitivity is

recognized as a crucial component of healthy child development. Ainsworth proposed that

maternal sensitivity encompasses several components: a mother's ability to notice an infant's signals, to interpret them accurately, and to subsequently respond promptly and appropriately (Ainsworth et al., 2015). Such sensitive behaviours promote child development by facilitating the child's understanding of their actions as purposeful and meaningful (Ainsworth et al., 2015; Meins, 1997). Sensitive caregiving has been linked in the literature to several domains of development, including social adjustment (Stams et al., 2002), attachment classifications (Pederson et al., 1990), executive functioning (Bernier et al., 2010), and cognitive and language outcomes (Hirsh-Pasek & Burchinal, 2006; Lemelin et al., 2006). However, the evidence supporting these links has been remarkably inconsistent. For example, contrary to findings supporting the association between maternal sensitivity and cognitive development, Page et al. (2010) found that sensitivity did not predict cognitive ability in their investigation of 6377 mother-infant dyads.

Most surprisingly, the association between maternal sensitivity and attachment classifications has not been consistently supported. In designing the Strange Situation Procedure, Ainsworth was able to observe distinct patterns in how children responded to distress and developed three attachment classifications: secure, resistant/ambivalent, and avoidant (Ainsworth et al., 2015; Weinfield et al., 2008). Ainsworth hypothesized that past experiences with caregivers shaped how children behaved during this procedure. When caregivers were consistently available and responsive (i.e. sensitive), children were confident in their caregiver's ability to help them cope with distress and sought them out for comfort. Such behaviour is believed to be indicative of a secure attachment bond (Ainsworth et al., 2015; Weinfield et al., 2008). On the other hand, when caregivers were unavailable or inconsistent (i.e. insensitive), children often developed anxiety about their responsiveness and adapted alternative strategies to

cope with the distress they experienced during the Strange Situation Procedure (Weinfield et al., 2008). Infants classified as resistant/ambivalent appeared to escalate their distress signals in order to elicit an appropriate response from their caregivers, yet even when tended to, they were much harder to soothe (Ainsworth et al., 2015). Those classified as avoidant appeared to suppress their distress signals altogether and generally avoided their caregivers in fear of experiencing rejection (Ainsworth et al., 2015). Both these strategies are considered to be indicative of an insecure attachment bond with caregivers (Ainsworth et al., 2015; Weinfield et al., 2008).

Despite this strong theoretical (as well as intuitive) link between sensitivity and attachment, empirical findings have failed to support the importance of maternal sensitivity in the development of attachment security. A meta-analysis by De Wolff and van IJzendoorn (1997) examined 30 studies investigating the relationship between maternal sensitivity and infant attachment security and revealed a combined effect size of $r = 0.22$ ($N = 1,666$) with other parental variables, such as mutuality and synchrony, emerging as just important as maternal sensitivity ($r\ (166) = .32$ and $r\ (256) = .26$, respectively; De Wolff & van Ijzendoorn, 1997). Similarly, another meta-analysis by Atkinson et al., (2000) examined 41 studies and found a combined effect size of $r = 0.27$ linking sensitivity to security, leaving a significant amount of the variance in attachment classifications still unexplained by sensitivity. Such antitheoretical findings call into question, among other things, the nature of the measures that have traditionally been used to assess maternal sensitivity.

Measuring Caregiver Sensitivity

Upon conceptualizing maternal sensitivity, Ainsworth developed what have since been termed the Ainsworth Maternal Sensitivity Scales (AMSS; Ainsworth, 1969). This system for

evaluating maternal sensitivity has for decades provided the foundation of research in the field (Ainsworth et al., 2015; Bohr et al., 2018). However, since the development of the AMSS, several other measurement tools have been devised to assess maternal sensitivity and related constructs. While many of these measures have been inspired by the AMSS itself, the use of disparate measures of sensitivity in the literature has led to a great deal of disagreement among scholars regarding what exactly constitutes sensitivity and how it should be measured. A review by Shin et al. (2008) reveals that there is an overwhelming lack of consensus in the literature on an operational definition for maternal sensitivity.

A previous examination of the sample to be used in this study sought to examine the concordance of four commonly used approaches to assessing maternal sensitivity to evaluate whether they are reliably tapping into the same core construct (Bohr et al., 2018). The measures considered included the AMSS (Ainsworth, 1969), the Emotional Availability Scales (EAS; Biringen et al., 1998), the mini Maternal Behaviour Q-sort VR (MBQS; Pederson et al., 1990; Tarabulsy et al., 2009), and the Parent Child Interaction – Nursing Child Assessment Satellite Training Feeding Scale (NCAFS; Barnard, 1978; Oxford & Findlay, 2015). While each of the measures were conceptually related to the AMSS, a significant amount of unshared variance between measures was noted (Bohr et al., 2018). These findings offer a potential explanation for the inconsistencies in the literature surrounding maternal sensitivity, especially when it comes to meta-analyses that tend to combine findings based on a variety of different measures, as different measures appear to be capturing different aspects of maternal behaviour (Bohr et al., 2018). Extant research thus suggests that further investigation into which maternal behaviours specifically are related to suboptimal developmental outcomes may be required to improve the predictive validity of measures of maternal interaction quality (Bohr et al., 2018). One potential

avenue of investigation is examining how disrupted maternal behaviours may impact children's development, and whether identifying disrupted maternal behaviours explicitly would enhance the analysis of quality of parenting beyond the examination of sensitivity.

Disrupted Maternal Behaviour

The study of disrupted maternal behaviour emerged from Ainsworth's work on children's attachment classifications. Although the nature of behaviours displayed by secure, avoidant and resistant/ambivalent children is quite varied, they all share in common the use of a coherent, organized strategy to regulate distress experienced during the Strange Situation Procedure. In the years following the development of these categories, however, it became clear to researchers that there was a portion of children who did not fit into any of the three attachment categories (Main & Solomon, 1986). In attempting to formulate new attachment classifications that would explain the patterns of behaviour displayed by these children, it was found that no distinct pattern could be discerned (Main & Solomon, 1986). Rather, it became evident that what set these children apart from the others was their lack of a coherent attachment strategy altogether (Main & Solomon, 1986). The children often displayed contradictory behaviour patterns (e.g. approaching caregiver while turning face away, crying while moving away from the parent), or appeared to inhibit attachment behaviours as they were performed (e.g. freezing, slowing, incomplete/interrupted movements; Main & Hesse, 1990). Given the incoherent nature of these behaviours, Main and Solomon (1986) coined the term "disorganized" to explain the attachment relationship these children had with their caregivers.

Since its discovery, the disorganized attachment classification has been associated with a variety of suboptimal developmental outcomes, including poor relationship quality with mothers, behaviour and conduct problems, and serious forms of psychopathology, including dissociation

(Carlson, 1998; Liotti, 1992; Lyons-Ruth, Alpern, et al., 1993; Moss et al., 2004; O'Connor et al., 2011; Solomon et al., 1995). These concerning findings sparked further research into understanding the mechanism through which children became disorganized. As researchers observed the behaviours that disorganized children exhibited towards their parents during distressing situations (i.e. the contradictory or inhibited behaviours), they speculated that these behaviours may be indicative of a fear response the child was having regarding the caregivers themselves (Main & Hesse, 1990). As Bowlby originally posited, during distressing situations, the experience of fear activates children's attachment behaviour system and encourages them to seek proximity with their caregiver for protection (Bowlby, 1982). However, when caregivers have been a source of fear in the past, children may experience confusion, leading them to second guess themselves and engage in contradictory behaviours or to inhibit attachment behaviours after initiating them (Lyons-Ruth, Bronfman, 1999; Main & Hesse, 1990). Frightening behaviours on the part of caregivers might include unusual vocal patterns (e.g. sudden drops in intonation), unusual movements (e.g. sudden movements, unpredictable invasions of space), and unusual speech (e.g. stammering, apprehensive voice; Main & Hesse, 1990). These and other frightening behaviours formed the basis for a construct that was later termed "maternal disrupted communication" (Lyons-Ruth, Bronfman et al., 1999).

The AMBIANCE-Brief

While Main & Hesse were developing a list of frightening maternal behaviours, Bronfman et al. (1999) were simultaneously developing a measure to assess and classify these types of behaviours. The resulting measure was named The Atypical Maternal Behavior Instrument for Assessment and Classification (AMBIANCE). This system assesses five dimensions of atypical maternal behaviour: affective communication errors, role/boundary

confusion, fearful/disoriented behaviour, intrusiveness/negativity, and withdrawal (Bronfman, Madigan et al., 2008). Since the development of the AMBIANCE, research has empirically supported its association with disorganized attachment in childhood (Forbes et al., 2007, Goldberg et al., 2003, Madigan et al., 2006). Specific dimensions of the AMBIANCE have also been linked to several suboptimal mental health outcomes including dissociation (Dutra et al., 2009), substance use (Pechtel et al., 2012), and personality disorders (Lyons-Ruth, Bureau, Easterbrooks, et al., 2013; Shi et al., 2012). However, coding with the AMBIANCE involves evaluating approximately 150 behavioural codes and requires extensive training and access to video-recorded interactions, rendering the measure impractical for use in clinical settings, and expensive for use by researchers (Cooke et al., 2020; Haltigan et al., 2019). To address these challenges, Haltigan and colleagues (2019) set out to develop a briefer, more user-friendly version of the measure. They used latent-trait item response theory to identify which maternal behaviours were most germane to the construct of disrupted behaviour, and successfully identified 45 behavioural codes which now form the basis for the AMBIANCE-Brief (Madigan et al., 2018). In a study investigating the reliability and validity of this new measure, the AMBIANCE-Brief demonstrated convergent validity with the original AMBIANCE in play sessions with toys ($r = .65$, $p < .001$) and without toys ($r = .61$, $p < .001$; Cooke et al., 2020). It also demonstrated concurrent validity with infant attachment disorganization in play sessions with toys ($r = .36$, $p < .05$) and without toys ($r = .32$, $p < .01$; Cooke et al., 2020). These results suggest that the AMBIANCE-Brief is a valid and practical tool that can be used to evaluate disrupted maternal behaviour in varied settings (Cooke et al., 2020).

The Current Study

In essence, maternal sensitivity and disrupted maternal behaviour are both measures of the quality of maternal-infant interaction. However, meta-analytic work has revealed that while maternal insensitivity is a robust predictor of insecure-organized attachment classifications, it does not reliably predict disorganized attachment (Bakermans-Kranenburg et al., 2003; van Ijzendoorn et al., 1999). There are two main explanations in the literature for why this may be the case. The dominant view has been that maternal sensitivity and disrupted maternal behaviour are distinct, orthogonal constructs that uniquely predict security and disorganization, respectively (Main & Hesse, 1990). However, there is some evidence to suggest that this is not always the case. Several studies have demonstrated that in higher-risk samples, the association between maternal sensitivity and disorganization is stronger than has been suggested by meta-analytic work (Bailey et al., 2007; Bernier & Meins, 2008; Carlson et al., 1998; Grienenberger et al., 2005; Moran et al., 2008). Such contradictory findings have led to an alternate explanation: that maternal sensitivity and disrupted maternal behaviour exist on opposite ends of the same continuum (Moran et al., 2008). In other words, disrupted maternal behaviours may simply be highly insensitive behaviours that are too extreme to be detected by most measures of sensitivity, which tend to focus on the normative range of caregiving behaviours (Lyons-Ruth & Jacobvitz, 1999; Lyons-Ruth, Bureau, Easterbrooks et al., 2013). It has been suggested that the inconsistent findings pertaining to the relationship between maternal sensitivity and various child outcomes may be partially due to the omission of fear-inducing maternal behaviours from the most commonly used measures of sensitivity (True et al., 2001). If this hypothesis is correct, it may be that measures designed to assess these frightening, disrupted maternal behaviour are better suited than measures of sensitivity to predict a range of other suboptimal developmental outcomes

(perhaps those that are most deleterious), as they include within their scope parental behaviours that are more extremely disruptive to a child. However, to our knowledge, this hypothesis had not yet been empirically tested.

The current study had three main objectives. The first objective was to investigate how ratings on the AMBIANCE-Brief, a tool that exclusively measures disrupted maternal behaviours, compare to ratings on Ainsworth's original scales of maternal sensitivity, as well as ratings derived using the mini MBQS-VR, a commonly used tool that is conceptually based on the AMSS. Based on the theory that disrupted maternal behaviour may simply be an extreme form of maternal insensitivity, it was hypothesized that there would be a strong negative association between ratings on the AMBIANCE-Brief and ratings on both the AMSS and the mini MBQS-VR. The second objective was to examine the predictive validity of the AMBIANCE-Brief, coded when infants were 5 months old, in relation to children's developmental outcomes at 4 and 10 years of age. Given the established relationship between the quality of early dyadic interaction and children's social emotional development (Denhan, 1993; Denham et al., 1994), the focus was on social emotional outcomes. At 4 years, maternal reports of children's problematic behaviours and children's self-reports of their perceived competence and acceptance were considered. At 10 years, four measures completed by the child were examined including a measure of self-reported attachment security, self-reports of depression and anxiety, and a self-perception profile. It was expected that lower levels of disrupted maternal behaviour at 5 months would be associated with more optimal social emotional outcomes at subsequent time points. The third and final objective of this study was to compare the predictive validity of the AMBIANCE-Brief to that of measures of maternal sensitivity. It was expected that lower levels of disrupted maternal behaviour at 5 months would emerge as a stronger

predictor of optimal social emotional outcomes than higher levels of sensitivity, as assessed by the AMSS and the mini MBQS-VR. Given that the AMBIANCE-Brief tool captures maternal behaviours that are more extremely disruptive to the development of healthy parent-infant relationships, it was expected that the absence or infrequency of such behaviours would be associated with more optimal developmental outcomes.

Methods

Participants

The current study was part of a larger initiative by the National Institute of Health in which data were collected from families at nine time points. This study employed data collected when infants were 5 months of age, when they were 4 years of age, and when they reached 10 years of age. The full sample at 5 months consisted of hundreds of mother-infant dyads, but for the purposes of this coding initiative, a subsample of 50 dyads (50% female) with diverse sociodemographic backgrounds was selected. Selected infants' ages at the 5-month wave ranged from 140.00 - 180.00 days ($M = 163.78$ days, $SD = 7.02$ days). 98.0% of the infants were term (M birth weight $= 3467.45$ g, $SD = 444.66$ g). At 4 years of age, complete data are available for 26 participants from this subsample and partial data are available for 29 participants. Children's ages at the 48-month wave range from 46.72 – 52.11 months ($M = 49.10$, $SD = 1.11$). At 10 years of age, complete data are available for 19 participants from this subsample and partial data are available for 26 participants. Specific information about children's ages at the 10-year wave is not available.

Mothers' ages when their infants were 5 months range from 15.25 - 41.25 years ($M = 27.48$, $SD = 6.92$). Of all participating mothers, 18% had not completed high school, 16% had completed high school, 20% had completed college partially, 26% had completed college or

university, and 20% had completed university graduate programs. Family socioeconomic status for the entire sample (SES; Hollingshead, 1975) ranged from 19-66 ($M = 48.39$, $SD = 13.93$), which affirms that the sample is socioeconomically diverse. Additional demographic details are available in Table 1. It is important to note that the sample in this study was ethnically homogenous, consisting of European-American mothers only. The sample was limited to European Americans to enable the examination of quality of maternal behaviour without culture as a confounding variable.

Procedure

Mothers were recruited via mailing lists of recent births in the Washington metropolitan area, with a letter describing the study and an invitation to contact the researchers if mothers were interested in learning more about the study and/or participating. After recruitment, mothers completed a demographic questionnaire about the infant and the family. At 5-months, dyads were visited in their homes by a female research assistant. The research assistant reviewed and obtained informed consent with the mothers. She then asked mothers to engage in their typical daily activities with their infant (e.g. feeding, changing, playing). After allowing for acclimation to the recording equipment and observer, a one-hour video of naturalistic mother-infant behaviour was obtained. The research assistant refrained from any interaction with the dyad during filming. Coding for maternal sensitivity and disrupted maternal behaviour was based on the first 20 minutes of this video recording and is further outlined in the measures section. At 4 years of age, families were mailed a letter describing the 4-year follow-up protocol and inviting them to participate. If they agreed, a package of questionnaires was sent to be completed by the mother and a lab visit was scheduled to complete additional activities. When children reached 10 years of age, families were once again contacted to see if they were interested in participating in

the follow-up session. If they agreed, another package of questionnaires was sent to be completed by both the child and the mother. A lab visit and home visit were also scheduled to complete additional tasks.

Measures

Measures 5 months.

Maternal sensitivity.

Ainsworth Maternal Sensitivity Scales (AMSS; Ainsworth, 1969). The AMSS consists of four scales: 1) acceptance vs. rejection, 2) cooperation vs. interference, 3) availability vs. ignoring and neglecting, and 4) sensitivity vs. insensitivity. The AMSS is coded by observing a maternal-child interaction (i.e. play interaction, feeding) and assigning a code from 1 to 9 for each scale. The "acceptance vs. rejection" scale assesses the mother's balance of positive and negative feelings about the infant, with ratings ranging from 1 (highly rejecting) to 9 (highly accepting). The "cooperation vs. interference" scale assesses the mother's degree of physical and verbal interference of the infant's activity and the frequency of these interruptions, with ratings ranging from 1 (highly interfering) to 9 (conspicuously cooperative). The "availability vs. ignoring and neglecting" scale assesses the mother's accessibility in terms of responsiveness to the infant, with ratings ranging from 1 (highly inaccessible, ignoring or neglecting) to 9 (highly accessible). The "sensitivity vs. insensitivity" scale assesses the mother's capacity to be aware of the infant's signals, to interpret, and to respond appropriately and promptly, with ratings ranging from 1 (highly insensitive) to 9 (highly sensitive). The first 20 min of the interactions were coded with the AMSS. The ICCs, computed on 20% of the coded mother-infant interactions, were 0.93 for acceptance, 0.92 for cooperation, 0.94 for availability, and 0.93 for sensitivity. The four Ainsworth's subscales were highly correlated and were therefore averaged to create a total scale,

$\alpha = 0.95$, which was used in the current study. Coding of the videos using this measure had already been completed as part of another research study.

Mini-Maternal Behaviour Q-Sort-VR (Mini-MBQS-VR; Pederson et al., 1990; Tarabulsy et al., 2009). The mini-MBQS-VR is a shortened version of the original 90-item MBQS card set (Pederson et al., 1990), adapted to be time efficient and better suited for coding filmed interactions (Tarabulsy et al., 2009). The mini-MBQS-VR is reliable ($r = .94$, $p < .0001$) and is significantly associated with the Original MBQS-90 ($r = .35$, $p < .05$; Tarabulsy et al., 2009). Coding with the mini-MBQS-VR entails watching an interaction twice, creating a running narrative of the interaction, reflecting on Ainsworth's maternal sensitivity scales, and finally using a Q-sorter application to sort 25 descriptive items into 5 piles ranging from behavior most like the mother to behavior least like the mother. Examples of items include "Speaks to baby directly" and "Interactions revolve around baby's tempo and current state". Sensitivity ratings are then derived by computing a correlation between the observers' sort and a sort describing the prototypically sensitive mother, with higher ratings reflecting greater sensitivity. Ratings vary from -1.0 (least sensitive) to 1.0 (prototypically sensitive). The first 20 minutes of each interaction were coded. The ICC, computed on 22% of the coded mother-infant interactions, was 0.98. Coding of the videos using this measure had already been completed as part of another research study

Disrupted maternal behaviour.

The Atypical Maternal Behavior Instrument for Assessment and Classification Brief (AMBIANCE-Brief; Madigan, et al., 2018). The AMBIANCE-Brief assesses atypical maternal behaviour along five dimensions: affective communication errors (contradictory signaling to infant, failure to initiate responsive behaviour to infant cue, inappropriate responding to infant

signals or needs), role/boundary confusion (difficulty prioritizing infant's needs over own needs, treating infant as sexual/spousal partner), fearful/disoriented behavior (vigilant, dissociative or disorganized behaviour), intrusiveness/negative behavior (physical intrusion, verbal intrusion or negativity, inappropriately attributing negative feelings or motivations to infant) and withdrawal (creating physical distance from infant, use of verbal communication to maintain distance; Madigan et al., 2018). The first 20 minutes of each interaction were coded by the author of this study, to align with the segments previously coded for the AMSS and mini MBQS-VR. Coding entails first watching the video-recorded interaction and tallying the occurrence of 45 specific behaviours across each of the five dimensions. A score for overall level of disrupted communication is then assigned based on the behavioural codes tallied and an overall clinical impression of the interaction. Ratings range from 1 ("High Normal") to 7 ("Disrupted Communication with few or no ameliorating behaviours"). Ratings ranging from 1 to 4 are not considered disrupted while ratings from 5 to 7 are considered disrupted. Two profiles of disrupted behaviour are possible: an intrusive/self-referential profile and a helpless/fearful profile. For the purposes of this study, both ratings from 1 to 7 and categorizations as disrupted or not disrupted were considered in analyses. A portion of interactions were also coded by a second trained coder in order to ensure inter-rater reliability. For discrepant ratings, coders met to discuss their coding procedures and came to a final consensus on ratings. The final ICC for the AMBIANCE-Brief ratings, computed on 20% of interactions, was .90.

Measures 4 years.

Child reported self-concept.

  The Pictorial Scale of Perceived Self-Competence and Social Acceptance for Young Children (Harter & Pike, 1984). The Pictorial Scale of Perceived Self-Competence and Social

Acceptance for Young Children was completed with children during the 4-year lab visit. The scale is specifically designed to assess self-concept in young children who are not yet able to read. The measure consists of 24 pictorial items assessing two general constructs: perceived competence and perceived social acceptance. The perceived competence construct is broken into two subscales: cognitive competence (e.g. knows names of colours, is good at counting) and physical competence (e.g. can tie shoes, is good at running). Likewise, the perceived social acceptance construct is broken into peer acceptance (e.g. has lots of friends, gets asked to play with others) and maternal acceptance (e.g. mom plays with you, mom cooks your favourite foods). Each item is scored on a scale of 1 to 4, based on how strongly children endorse them. Items are read to children and presented with corresponding pictures (i.e. the item "This child is good at doing puzzles" and "This child isn't very good at puzzles" is accompanied by a picture of child who has completed a puzzle and picture of a child who has not completed a puzzle). Children are first asked to indicate which child is most like him or her by pointing at the corresponding picture and then indicate whether that child is "a lot like them" by pointing at a bigger circle (resulting in a score of 1 or 4), or "just a little like them" by pointing at a smaller circle (resulting in a score of 2 or 3). The administrator records the child's response on a scoring sheet. Numerical scores for each subscale are calculated by summing the scores for the six items that make up each subscale. Numerical scores for each subscale can thus range from 6 (low competence) to 24 (high competence). Mean scores are then calculated by dividing each numerical score by six. Each subscale was considered separately in analyses. This scale has good internal consistency and good validity (Harter & Pike, 1984).

Child behaviour as rated by parent.

Preschool Behaviour Questionnaire (PBQ; Behar & Stringfield, 1974). The PBQ was among the questionnaires sent to families for the mother to complete at the 4-year time point. The PBQ was designed to detect early internalizing and externalizing problems in preschool aged children. The measure consists of 30 items assessing behaviours across three subscales: hostile-aggressive behaviour (e.g. destroys own or other's belongings, tells lies), anxious-fearful behaviour (e.g. worries about many things, cries easily), and hyperactive-distractible behaviour (e.g. doesn't keep still, has poor concentration). A total problem behaviours scale can be computed as the sum of all 30 items. For the purposes of this study, only the total problem behaviours score was considered. The PBQ has good criterion validity, inter-rater reliability, and test-retest reliability (Behar & Stringfield, 1974).

Measures 10 years.

Child-reported depression.

Children's Depression Inventory (CDI; Kovacs, 1992). The CDI was among the questionnaires sent to families for children to complete at 10 years. It is a 27-item self-report measure designed to assess depression in children and adolescents. The scale requires children to select between three sentences that describe various levels of a symptom of depression experienced over the last two weeks. For example, one item requires children to select between "I am tired once in a while", "I am tired many days" and "I am tired all the time". Responses are assigned a score from 0 to 2, with higher scores being indicative of greater depression symptomology. The CDI has five factor scales: negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. For the purposes of this study, the total

score, incapsulating all factor scales was used. The CDI has good internal consistency and validity (Carey et al., 1987; Kovacs, 1992; Saylor et al., 1984).

Child-reported anxiety.

Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978). The RCMAS was among the questionnaires sent to families for children to complete at 10 years. It is a 37-item self-report measure designed to assess trait anxiety in school-aged children. Examples of items on this scale include "I get nervous when things do not go the right way for me" and "Often I feel sick in my stomach". Each item requires children to respond either "yes", indicating that the item is descriptive of their feelings or actions, or "no", indicating that the item is not descriptive of their feelings or actions. Higher scores are indicative of higher trait anxiety. A Total Anxiety score is computed based on 28 items, which are divided into three anxiety subscales: physiological anxiety, worry/oversensitivity, social concerns/concentration. The remaining nine items on the RCMAS constitute the Lie subscale. For the purposes of this study, only the Total Anxiety score was used. This scale has good internal consistency and validity (Reynolds & Richmond, 1978; Turgeon & Chartrand, 2003; Varela & Biggs, 2006).

Child reported attachment security.

Kerns Security Scale (KSS; Kerns et al., 1996). The KSS was among the questionnaires sent to families for children to complete at 10 years. It was designed to assess children's perceptions of security in parent-child relationships in middle childhood and early adolescence. Children completed this measure for both their mother and their father, but for the purposes of this study, only responses for mothers were considered. The measure is composed of 15 items that are rated on a 4-point scale using Harter's (1982) "Some kids … Other kids…" format. The KSS taps into the child's perceptions of an attachment figure as responsive and available, their

tendency to rely on an attachment figure during times of stress and their reported ease and

interest in communicating with an attachment figure. For example, one item reads "Some kids

find it easy to trust their mom… Other kids are not sure if they can trust their mom." Scores

across items are averaged so that children receive a score on a continuous dimension of security.

According to a meta-analysis by Brumariu et al., (2018), the Security Scale is moderately stable

over time (r = .51). It is also significantly associated with other measures of attachment (r =

.29), to maternal sensitivity (r = .45), as well as emotional competence (r = .17), self-esteem (r

= *.31),* internalizing behaviours (r = -.23) and externalizing behaviours (r = -.19), providing

evidence for concurrent and construct validity.

Child reported self-concept.

Self-Perception Profile for Children (SPPC; Harter, 1985). The SPPC was among the

questionnaires sent to families for children to complete at 10 years. It is a 36-item self-report

measure that assesses children's perceptions of their competence across five specific domains

(scholastic competence, social acceptance, athletic competence, physical appearance, and

behavioural conduct) as well as their sense of global self-worth. For the purposes of this study,

only the six items constituting the global self-worth score were considered. This scale taps into

the extent to which the child likes themselves as a person and constitutes a global judgment of

one's worth as a person, rather than domain-specific competence or adequacy. The measure

employs a modified version of Harter's (1982) "Some kids … Other kids…" response format.

For example, one item reads "Some kids are often unhappy with themselves… Other kids are

pretty pleased with themselves". Children are first asked to identify which kind of kid is most

like them and then identify whether this is only "sort of true" or "really true" for them. The

global self-worth scale of the SPPC is considered to be a reliable (ICC = .86) and valid measure

of self-esteem (Harter, 1985; Muris et al., 2003).

<div align="center">

Results

</div>

Preliminary Analyses

Before analyzing the data, all data were screened for outliers by converting all variables

to *z*-scores to detect extreme values falling more than three standard deviations above or below

the mean. Using this method, three outliers were identified: one for child-reported attachment

security, one for child-reported depression, and one for child-reported self-concept (all measured

at 10 years of age). These values were Winsorized to match the next highest value in the

distribution of scores (Field, 2012). Based on previous estimates of the influence of maternal-

child interaction quality on subsequent child outcomes, an effect size estimate of *r* = 0.30 was

made in order to conduct a power analysis. In order to achieve 80% power with an effect of this

size, a sample size of 20 dyads is required. This requirement was met for all outcome variables

except child self-reported depression at 10 years of age (*N* = 19). Imputation of missing data was

not recommended given the small quantity of data points that were available. In order to

determine if the sociodemographic composition of the subsample at later time points (*N* = 29 at

48 months; *N* = 26 at 10 years) differed significantly from the original sample (*N* = 50 at 5

months), *t*-tests were performed to compare each sample in terms of maternal age, maternal

education, and SES (as assessed by the Hollingshead Index; Hollingshead, 1975). All *t*-tests

were non-significant, indicating that there are no significant sociodemographic differences

between the participants who dropped out of the study and those who did not.

Descriptive Statistics

The means, standard deviations, score ranges, and sample sizes for each measure are reported in Table 2. The mean for AMBIANCE-Brief ratings was 4.18 (SD = 1.81, range = 1-7). Of the 50 dyads coded, 20 dyads received ratings within the "disrupted" range (rating > 5). The mean for AMSS ratings was 4.25 (SD = 2.28, range 1-9) while the mean for MBQS ratings was -.21 (SD = .58, range = -1 - +1). Each of these scales showed nearly the full range of scores, suggesting that there was adequate variance of disrupted behaviour/sensitivity in this sample of mother-infant dyads. The outcome variables showed less dispersion across the range of scores, particularly those with wider ranges (i.e. preschool behaviour problems, children's self-reported depression/anxiety), and scores clustered on the lower end of the distribution.

Objective 1

In order to investigate how the AMBIANCE-Brief compares to the AMSS and the MBQS, correlations analyses were performed between the full range of ratings of disrupted maternal behaviour and each of the two maternal sensitivity ratings. The assumption of normality was not met for any of the three measures of maternal interaction quality and transformations were not successful in normalizing the distributions. As such, Spearman rank order correlations were performed in lieu of Pearson correlations. The correlation between ratings on the AMSS and ratings on the AMBIANCE-Brief was ρ = -0.5971 (p = 0.00). The correlation between ratings on the MBQS-VR and ratings on the AMBIANCE-Brief was ρ = -0.5488 (p = 0.00). Follow-up analyses were then run to determine if ratings within the "not disrupted" range on the AMBIANCE-Brief were more closely related to sensitivity ratings than the full range of ratings. Spearman rank order correlations were performed on the sample of 30 AMBIANCE-Brief ratings that fell within the not-disrupted range (1-4) and their corresponding

sensitivity ratings. The correlation between ratings on the AMSS and not-disrupted ratings on the AMBIANCE-Brief was ρ = -0.5858 (p = 0.00). The correlation between ratings on the MBQS-VR and not-disrupted ratings on the AMBIANCE-Brief was ρ = -0.5480 (p < 0.01).

Objective 2

In order to investigate the predictive validity of the AMBIANCE-Brief, regressions were performed on each of the developmental outcomes outlined above, using both the continuous AMBIANCE-Brief ratings and the disrupted/not disrupted categorization as a dummy variable. Prior to performing regressions, bivariate correlations were tested between the following demographic characteristics and each outcome variable in order to test for covariance: infant's age, infant's gender, mother's age, mother's level of education, and family socioeconomic status (as assessed by the Hollingshead Index; Hollingshead, 1975). There were no significant correlations between any of the identified variables and the outcome measures. However, given the established impact of SES on the relative importance of maternal behaviours in the literature, all regressions were performed with Hollingshead Index Scores as a second predictor, to control for variance that might be accounted for by SES.

All the assumptions required for regression analyses were tested. For the models using continuous ratings, it was revealed that the relationship between ratings on the AMBIANCE-Brief and children's self-reported depression and sense of global self-worth at 10 years were non-linear in nature. Log transformations were unable to correct for this. Homoscedasticity was violated for the models predicting peer acceptance at 48 months, problem behaviours at 48 months, and both self-reported depression and anxiety at 10 years. Applying log transformations significantly improved heteroscedasticity for the model predicting total problem behaviours at 48 months and self-reported anxiety at 10 years. Transformations were unable to improve

heteroscedasticity for the model predicting peer acceptance at 48 months and self-reported

depression at 10-years. All transformations applied at this stage were also applied in all

subsequent analyses, in order to allow for comparison across models. For the models using

dummy variables, the relationship between a disrupted/not disrupted classification on the

AMBIANCE-Brief and self-reported depression at 10 years was again non-linear, even with the

log transformation applied. The models predicting peer acceptance at 48 months and global self-

worth at 10 years also emerged as heteroscedastic and could not be remedied by a log

transformation. The results of models with persistent non-linearity and heteroscedasticity should

all interpreted with caution. The assumptions of normally distributed errors and independence of

errors were also tested and were satisfied for all models. Multicollinearity was also tested by

computing the Variance Inflation Factor for each model. No models exhibited problematic

multicollinearity.

Table 3 reports the results of each regression model performed with continuous

AMBIANCE-Brief scores. Of the 9 outcome variables analyzed, only the model predicting self-

perceived cognitive competence at 4 years of age was significant ($B = -.10$, $t = -2.21$, $p = 0.04$).

The model predicting self-perceive physical competence at 4 years was approaching significance

but did not reach the alpha cut off at .05 ($B = -.09$, $t = -1.81$, $p = 0.08$). Table 4 reports the results

of the regression models performed with the disrupted/not disrupted categorization. None of the

models were statistically significant at an alpha level of .05.

Objective 3

In order to compare the predictive validity of AMBIANCE-Brief ratings to that of

sensitivity ratings, the proportion of variance in developmental outcomes explained by each

measure were compared. Regressions were run again with each sensitivity measure separately

entered as a predictor of each developmental outcome, along with Hollingshead Index Scores to control for SES. All necessary regression assumptions were again checked prior to running these regressions using the same approaches as outlined above. In order to allow comparisons between regressions performed with the AMBIANCE-Brief ratings, all outcome variables that were log transformed in Objective 2 were also log transformed for the regressions with sensitivity measures. Similar to the AMBIANCE-Brief model, the models for both sensitivity measures predicting log-transformed self-reported depression scores at 10 years were non-linear, likely due to the very small sample size. The models predicting self-perceived cognitive and physical competence at 4 years were also slightly heteroscedastic for both sensitivity measures. Finally, the model predicting self-reported anxiety at 10 years from MBQS ratings was heteroscedastic, despite the log transformation applied. The results of all models with assumption violations should again be interpreted with caution. The regression coefficients, standard errors, t-values, and p-values for the regressions performed with the AMSS and the MBQS can be found in Tables 5 and 6. None of the models predicting any of the outcome variables were significant for either of the sensitivity measures. Table 7 reports the proportion of variance (sr^2) for each developmental outcome that can be accounted for by each measure of maternal-child interaction quality. All proportions were small ($sr^2 < .09$), except for the proportion of self-perceived cognitive competence at 4 years explained by the AMBIANCE-Brief ($sr^2 = .16$), the proportion of self-perceived physical competence at 4 years explained by the AMBIANCE-Brief ($sr^2 = .11$), and the proportion of self-reported global self-worth at 10 years explained by the AMBIANCE-Brief ($sr^2 = .09$).

Discussion

This purpose of this study was to investigate a novel measure designed to assess disrupted maternal behaviour and to compare it to more traditional measures of maternal-child interaction quality. Based on the theory that disrupted maternal behaviour may be an extreme form of maternal insensitivity, it was hypothesized that there would be a strong negative association between ratings of disrupted maternal behaviour, as assessed by the AMBIANCE-Brief, and ratings of sensitivity, as assessed by the Ainsworth Maternal Sensitivity Scales and the Maternal Behaviour Q-sort VR. It was also hypothesized that ratings on the AMBIANCE-Brief would emerge as a stronger predictor of social-emotional outcomes in children, as it is intended to specifically assess behaviours that are known to disrupt the development of healthy parent-infant relationships.

The Relationship between Disrupted Maternal Behaviour and Maternal Sensitivity

In line with the advanced hypothesis, the results of the study indicate that there is a negative relationship between ratings on the AMBIANCE-Brief and ratings on each of the two sensitivity measures, but this relationship was moderate rather than strong for both measures. This indicates that mothers who engage in more insensitive behaviours are also more likely to engage in disrupted behaviours and vice versa, however, there is still a proportion of variance that is not shared between the measures. As discussed above, this unshared variance can be accounted for by either of the dominant perspectives in the literature. The results could lend support to the perspective that disrupted maternal behaviours are merely an extreme form of maternal insensitivity. The sensitivity measures used in this study may have only been suited to capture a certain range of maternal behaviour and reached their ceiling once behaviour became disrupted (Lyons-Ruth & Jacobvitz, 1999; Lyons-Ruth, Bureau, Easterbrooks et al., 2013).

However, if this were the case, the AMBIANCE-Brief ratings within the "not-disrupted" range (1-4) should have been more closely related to the sensitivity ratings. The follow-up analyses conducted between the ratings within the not-disrupted range and the sensitivity ratings do not lend support to this theory as the correlation coefficients were nearly identical to those for the full range of ratings.

As such, these findings altogether do not lend support to the theory that disrupted maternal behaviour is merely an extreme form of insensitive maternal behaviour. Rather, the results suggest that disrupted maternal behaviour and maternal sensitivity may in fact be two conceptually different constructs that share a large proportion of variance. This explanation makes sense given the intended purpose of each of these measures. The AMSS was developed by Ainsworth to identify key features of maternal behaviour that facilitated the development of an organized, secure attachment bond between children and their mothers (Ainsworth, 1969). Conversely, the original AMBIANCE was specifically designed to assess maternal behaviours that were thought to result in disorganized attachment. These behaviours are not necessarily the opposite of sensitive behaviours but are rather a distinct set of behaviours that are believed to inhibit the formation of a coherent strategy for coping with distress (Main & Solomon, 1986). However, as noted above, there is evidence to suggest that insensitive behaviours may be more closely related to infant disorganization in high-risk samples (Bailey et al., 2007; Bernier & Meins, 2008 Carlson et al., 1998; Grienenberger et al., 2005; Moran et al., 2008). This suggests that the conceptual distinction between disrupted and insensitive maternal behaviours may be less clear among mothers in these higher-risk samples. The sample in this study was not a high-risk sample, and while it was composed of socio-demographically diverse dyads, the sample size did not permit for separate analysis of the lower-SES dyads, and so SES was controlled for in all

subsequent analyses. Examining the association between disrupted behaviour and sensitive behaviour among an exclusively high-risk sample may reveal different findings about the strength of the relationship.

The Predictive Validity of the AMBIANCE-Brief

The predictive validity of the AMBIANCE-Brief was tested with six different socioemotional outcome measures, two assessed at 4 years of age and four assessed at 10 years of age. The AMBIANCE-Brief ratings were entered as predictors both as continuous ratings from 1-7 and as a classification of not disrupted (a rating from 1-4) or disrupted (a rating from 5-7). It was hypothesized that higher ratings and/or a disrupted classification would be predictive of greater suboptimal outcomes at 4 and 10 years. None of the regressions using the categorical ratings were significant, indicating that within this sample, the disrupted/not-disrupted classification was not able to predict a significant amount of variance in the outcomes studied. Of the nine regressions conducted using the continuous AMBIANCE-Brief ratings, only one emerged as significant: the model predicting self-perceived cognitive competence at 4 years of age from AMBIANCE-Brief scores. This indicates that within this sample, children of mothers who engaged in more atypical behaviours at 5 months of age had lower self-perceived cognitive competence at 4 years of age. The model predicting self-perceive physical competence at 4 years of age showed a similar trend and was approaching significance but did not meet the alpha cut-off. In addition, while the proportion of variance explained by the AMBIANCE-Brief for most developmental outcomes was small, it was moderate for the models predicting self-perceived cognitive/physical competence at 4 years and self-perceived global self-worth at 10 years. Identical regressions were also run for the Ainsworth Maternal Sensitivity Scales and the mini MBQS-VR. None of the regressions for either measure of sensitivity was significant, and the

proportion of variance explained by these measures was small for all outcome variables, including self-perceived cognitive/physical competence and self-perceived global self-worth. These findings are in line with our hypothesis, suggesting that disrupted maternal behaviour may be a stronger predictor of certain developmental outcomes than maternal sensitivity.

It is important to note that the *Pictorial Scale of Perceived Self-Competence and Social Acceptance for Young Children* (PSPCA; Harter & Pike, 1984) does not assess children's actual competence in either of these domains. Young children are typically not reliably capable of reporting on their actual abilities and so their perceived sense of competence may not be very accurate (Harter & Pike, 1984). The scale is rather intended to capture children's thoughts and beliefs about their abilities. Children under the age of eight have not yet established a firm understanding of the notion of the "self" and so evaluating concepts such as self-concept and self-esteem during the preschool years is difficult (Harter & Pike, 1984). Assessing their perceived sense of competence/acceptance thus permits an early glimpse into their blossoming understanding of the self. The role of the maternal-child relationship in the development of children's self-concept has been well documented in the literature (Houck & Lecuyer-Maus, 2002; Lothman et al., 1990; Paulus et al., 2018; Rudy & Grusec, 2006). This association make sense from an attachment perspective. Consistent and responsive caregiving is believed to help children form positive working models of themselves, which is a precursor to a positive self-concept (Miller & Mangelsdorf, 2005). The finding that atypical maternal behaviour predicts lower self-perceived cognitive competence at 4 years of age thus makes theoretical sense, as children of mothers who engage in these behaviours may have struggled to form a positive working model of the self which is reflected in their low sense of perceived cognitive competence.

It is somewhat surprising that self-perceived cognitive competence at 4 years of age emerged as the only significant outcome variable. Based on the theory outlined above, it would be expected that the other domains of children's self-understanding (i.e. peer acceptance, maternal acceptance) would also be significantly related to atypical maternal behaviours. One possible explanation for this finding is that self-perceived competence may be more closely related to children's internal working model of the self, as it pertains solely to their understanding of themselves as individuals, not within relationships. The subscales within the domain of social acceptance assess children's perceptions of the quality of their relationships with others. In doing so, these subscales not only capture children's internal working model of the self, but they also tap into their working models of others. Indeed, Harter and Pike (1984) have noted that ratings on these scales may be confounded by issues that do not pertain to the self necessarily. For instance, children's responses to items probing maternal acceptance (e.g. mom cooks my favourite foods, mom plays with me, mom talks to me) may be indicative of their understanding of the self as lovable but may also be indicative of their understanding of the mother as unloving (Harter & Pike, 1984). As such, the perceived social acceptance scales of the PSPCA may not be as capable of capturing the effects of disrupted maternal behaviour on children's perceptions of the self as the scales examining perceived self-competence.

As noted above, children's perceptions of their own abilities are often not entirely accurate. However, the PSPCA does have acceptable convergent and discriminant validity (Harter & Pike, 1984), indicating that, even at a young age, children demonstrate some limited insight into their own abilities. The cognitive competence subscale of Harter's pictorial scales assesses a child's perceived sense of competence in basic cognitive tasks appropriate for their level of development. Items include being good at puzzles, knowing the alphabet, and getting

stars on papers (Harter & Pike, 1984). Children's responses to these questions may not be

entirely accurate but may demonstrate some insight into what they are "good" at (Harter & Pike,

1984). Thus, children of mothers who engage in more disrupted behaviours may report feeling

less competent at these tasks because they are actually less skilled in these areas. Literature

supports the relationship between maternal behaviour and children's cognitive development,

specifically in the area of language development (Bornstein et al., 2020; Bornstein & Tamis-

LeMonda, 1989; Leigh et al., 2011; Lemelin et al., 2006). Given that many of the cognitive

abilities assessed by the cognitive competence subscale of the measure are language-based (e.g.

knowing the alphabet, knowing how to count, knowing different colours), this pattern is notable

in interpreting the present findings. However, in the current study, maternal sensitivity did not

emerge as a significant predictor of self-perceived cognitive competence. This finding

contradicts the findings in the literature but may be due to the nature of the behaviours examined

by the measures employed. Researchers have linked specific maternal behaviours to delayed

language development in children, including non-responsiveness (Bornstein & Tamis-LeMonda,

1989), intrusiveness (Keown et al., 2001), restrictiveness, and control (Garcia Coll et al., 1986).

These maternal behaviours correspond to specific behaviours captured by the withdrawal

dimension (e.g. interacts silently with infant; no interaction with infant) and the

intrusiveness/negativity dimension (e.g. disapproves, criticizes or threatens; mocks or teases

infant) of the AMBIANCE-Brief. On the other hand, the AMSS does not take specific

behaviours into consideration but rather relies on the coder's general impression of the

interaction. The mini-MBQS-VR does include language-specific items (e.g. "speaks to baby

directly", "repeats words carefully and slowly to baby as if teaching meaning", "labelling an

activity or object"), but these do not correspond directly with the behaviours that have been

linked to delayed language development. The maternal hostility and withdrawal captured by the AMBIANCE-Brief may hinder children's language development more than consistent sensitive parenting promotes it. Therefore, the specific behaviours assessed by the AMBIANCE-Brief may be better suited than sensitivity measures to predict delays in language development among preschool aged children.

There are several possible reasons why the AMBIANCE-Brief did not emerge as a significant predictor for the other socioemotional outcomes examined in this study. As noted above, the full AMBIANCE measure has been linked to a variety of suboptimal developmental outcomes including disorganized attachment (Forbes et al., 2007; Goldberg et al., 2003; Madigan et al., 2006), controlling behaviours (Bureau et al., 2009), dissociation (Dutra et al., 2009), substance use (Pechtel et al., 2012), borderline personality disorder and associated symptoms (i.e. suicidality; Lyons-Ruth, Bureau, Holmes et al., 2013), and antisocial personality disorder (Shi et al., 2012). The dataset employed in this study did not allow for the examination of any of these variables directly. Most of these outcomes are assessed in adolescence, whereas the outcomes chosen to examine children's socioemotional wellbeing in this study were assessed at preschool age (problem behaviours and self-cognitions) and in middle childhood (attachment security, self-reported depression/anxiety, and global self-worth). These variables may provide a general picture of children's socioemotional well-being, but they do not encompass the specific outcomes that have previously been linked to atypical maternal behaviour. In addition, prior research using the original AMBIANCE measure has examined individual dimensions of maternal behaviour in isolation. Coding with the original AMBIANCE allowed researchers to examine each dimension separately, based on the number of tallies that were coded for the behaviours included in each category. Most notable are the withdrawal dimension and the

intrusiveness/negativity dimension, which have been most consistently linked to negative outcomes (Lyons-Ruth, Bureau, Holmes et al., 2013). While the AMBIANCE-Brief has retained the dimensions used in the original measure, the new coding system is not intended to allow for the examination of each dimension individually (Madigan et al., 2018). Coding involves tallying the number of behaviours that occur, but these tallies are intended to inform the generation of a single more global rating of behaviour (Madigan et al., 2018). The loss of specificity related to the individual dimensions may have contributed to the lower than expected predicted validity of the AMBIANCE-Brief.

Another important consideration is the long period of time that elapsed between the waves of data collection in this study. The video-recordings that were coded were taken when children were 5-months of age, while the outcomes assessed were measured several years later. While this study design allowed for longitudinal analysis of the data, it is possible that the period of time in between data points was too lengthy to clearly discern any existing relationships. There is also evidence to suggest that the impact of disrupted maternal behaviour may be moderated by events that occur later in a child's life (Lyons-Ruth et al., 2014). The nature of the current study did not allow for the consideration and control of many significant life events, whether positive (e.g. maternal educational milestone, occupational promotion) or negative (e.g. loss in the family, traumatic event), that could have affected the relationship being examined. Therefore, the true relationship between disrupted maternal behaviour in infancy and the social-emotional outcomes assessed later in childhood could have been moderated by a number of significant life events or other variables.

Implications

The unshared variance between the measures of maternal sensitivity and that of disrupted maternal behaviour suggests that it may be beneficial for both researchers and clinicians to use the two measures in combination. Evidence in the literature supports this theory. Moran et al. (2008) found that consideration of atypical maternal behaviour in conjunction with maternal sensitivity significantly improved prediction of both attachment security and disorganization among a sample of adolescent mothers and their infants. Likewise, True et al. (2001) concluded that considering atypical behaviours in combination with sensitivity tripled the amount of variance in attachment security explained by sensitivity alone. These findings suggest that maternal sensitivity and disrupted maternal behaviour each predict distinct portions of variance in attachment security. Employing them in combination allows for the explanation of the greatest amount of variance and the best prediction of attachment security. Researchers seeking to create prediction models for attachment security and related developmental outcomes may benefit from including a measure of disrupted maternal behaviour as well as a measure of sensitivity in their model, in order to account for the greatest amount of variance. Moreover, clinicians working with mothers and infants would benefit from exposure to both coding schemes as it would allow them to familiarize themselves with a greater range of behaviours that may impact the mother-child relationship and, ultimately, the child's development.

The finding that disrupted maternal behaviours significantly predicts children's self-perceived cognitive competence at 4 years also has important clinical implications. Children in high-risk samples (e.g. children in low SES families; children of adolescent mothers) have consistently been found to have delays in cognitive development, specifically in the area of language (Pan et al., 2004; Raviv et al. 2004). Mothers of these children are also more likely to

engage in the disrupted maternal behaviours captured by the AMBIANCE-Brief (Lyons-Ruth, Bronfman et al., 1999). Thus, understanding these specific behaviours offers clinicians a targeted approach to helping struggling mothers promote their children's cognitive and language development. Clinicians can work to support mothers in reducing their intrusive, restrictive, and controlling behaviours, while increasing responsiveness to their children during interactions.

Limitations and Future Directions

Despite the novel nature of the current investigation, there are some limitations that should be considered when designing future studies in this area of research. Firstly, the questions investigated in this study should be examined further using larger, more diverse samples. While the sample in this study met the requirements of the power analysis conducted, the small sample size resulted in the violation of several important statistical assumptions. As such, the true nature of the relationship between study variables may have been obscured by statistical violations. In addition, as noted above, the present sample did not allow for the separate analysis of low- and high-risk dyads. Given the evidence that the relationship between attachment classifications and maternal sensitivity and disrupted behaviour may look different among low- and high-risk samples, it will be important for additional research to be done examining how these constructs are related within each of these sociodemographic groups. Moreover, while the sample employed in this study was sociodemographically diverse and encompassed mothers who varied in age with a wide range of educational achievement and socioeconomic status, the sample was ethnically homogenous. While limiting the ethnic composition of the sample to European-Americans eliminates the potential confounding effects of culture, it also severely limits the generalizability of the findings. It is well known that what is considered "ideal" or "sensitive" parenting can vary across cultures, and so the relationship between maternal behaviours and

developmental outcomes may look different in diverse populations (Bornstein et al., 2013; Mesman et al., 2016). Additional research needs to be done investigating the constructs of disrupted maternal behaviour and maternal sensitivity across cultures, including work to understand the level of overlap that may exist between these constructs and their respective predictive validities.

As noted above, there are also many factors that were not accounted for in this study that may have influenced the relationship between study variables. In the time that elapsed from when maternal behaviours were assessed to when the socioemotional outcomes were measured, many significant changes may have occurred in the dyad's life. Mothers may have grown more sensitive over time, and their behaviour less disrupted, or the reverse may have occurred. Similarly, significant life events, such as the loss of an attachment figure or another traumatic event, may have taken place that had a more significant impact on children's development than disrupted behaviour at 5 months. Future research in this area should seek to ameliorate this problem by shortening the span of time between assessment of maternal behaviour and assessment of developmental outcomes and attempting to control for potential confounding life events.

A final limitation of this study pertains to the nature of the measures employed. The inability to individually examine the five dimensions of the AMBIANCE-Brief limited the predictive validity of the measure. Future research should seek to investigate the study's relationships using the original AMBIANCE measure, in order to retain the use of the individual dimensions and to investigate their unique predictive validity. Moreover, aside from the maternal behaviour coding schemes, all measures in this study were questionnaire-type assessments completed by either the mother (the PBQ) or the child themselves (all other measures). The

purpose of the PBQ was to assess children's problematic behaviours at preschool age. However, maternal reports of children's behaviour are not always perfectly accurate. For example, mothers with depression often have distorted views of their children's behaviour (Fergusson et al., 1993; Richters, 1992), and make more causal attributions for children's problem behaviours (White & Barrowclough, 1998). Depression and other mental health variables were not controlled for in this study and so maternal mental health could have influenced the accuracy of data pertaining to children's problem behaviours. Moreover, while the measures completed by the child were all tapping into internal phenomenon best assessed by self-report measures, children may not always be able to accurately report on their thoughts and feelings (Beitchman & Corradini, 1988). Factors such as social desirability and embarrassment may also result in biased responses from children on self-report measures. In order to reduce these biases, future research should seek to gather data from multiple informants (e.g. self-report, mother, father, teacher) and triangulate such data to gain a more accurate and thorough picture of children's socioemotional wellbeing (Beitchman & Corradini, 1988).

Conclusion

This study was the first to examine disrupted maternal behaviour as assessed by the AMBIANCE-Brief in comparison to common measures of maternal sensitivity. It was found that disrupted maternal behaviour and maternal sensitivity share a great deal of variance but are not opposite ends of the same spectrum. Disrupted maternal behaviour emerged as a significant predictor of children's self-perceived cognitive competence at 4 years and had greater predictive validity than maternal sensitivity in predicting both self-perceived cognitive and physical competence at 4 years, as well as global self-worth at 10 years. These findings affirm the need for researchers and clinicians to broaden the scope of behaviours they consider when

investigating maternal-child interaction quality. Considering disrupted maternal behaviours in addition to sensitive maternal behaviours may improve researchers' ability to predict important developmental outcomes in children as well as clinicians' ability to create focused interventions that support mothers and children. Further research should strive to investigate both these constructs in combination to enhance researchers' understanding of their unique roles in children's development.

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Appendix A

Table 1: *Sample demographic characteristics*

Variable	5-month sample (*n* = 50)	48-month sample (*n* = 29)	10-year sample (*n* = 26)
Child Gender			
Female	50%	45%	46%
Male	50%	55%	54%
Child Age	*M* = 163.78 days (*SD* = 7.02)	*M* = 49.10 months (*SD* = 1.11)	**Not available**
Maternal Age	*M* = 27.48 (*SD* = 6.92)	*M* = 32.73 (*SD* = 5.79)	*M* = 40.58 (*SD* = 4.77)
Maternal Education Level (highest level completed at 5-month visit)			
Elementary School Graduate	18%	6.9%	3.8%
High School Graduate (or GED)	16%	13.8%	7.7%
Partial College	20%	24.1%	30.8%
College Graduate	26%	31%	34.6%
Graduate or Professional Training	20%	24.1%	23.1%
Socioeconomic Status (Hollingshead Index assessed at 5-month visit)	*M* = 48.58 (*SD* = 13.93)	*M* = 52.10 (*SD* = 11.45)	*M* = 53.37 (*SD* = 10.68)

Table 2: *Descriptive statistics for study variables*

Variable	n	M	SD	Range
1. AMBIANCE-Brief	50	4.18	1.81	1-7
Not disrupted	30	2.93	1.05	1-4
Disrupted	20	6.05	0.83	5-7
2. AMSS	50	4.25	2.28	1-9
3. MBQS	50	-.21	.58	-1 - +1
4. The Pictorial Scale of Perceived Self-Competence and Social Acceptance for Young Children				
Cognitive Competence	28	3.35	.48	1-4
Physical Competence	28	2.92	.59	1-4
Peer Acceptance	28	3.08	.52	1-4
Maternal Acceptance	27	3.13	.59	1-4
5. Preschool Behaviour Questionnaire	27	15.29	6.74	0-60
6. Children's Depression Index	19	6.16	5.45	0-54
7. Revised Children's Manifest Anxiety Scale	26	9.38	7.3	0-37
8. Kerns Security Scale	26	3.26	.53	1-4
9. Self-Perception Profile for Children - Global Self Worth	26	3.32	.57	1-4

Table 3: *Summary of regressions on developmental outcomes using continuous AMBIANCE-Brief scores*

Outcome		B	SE B	t	p
Child-reported self-concept at 4 years	Cognitive Competence	-.10	.04	-2.21	.04*
	Physical Competence	-.09	.05	-1.81	.08
	Peer Acceptance	-.04	.06	-.69	.50
	Maternal Acceptance	-.03	.06	-.44	.67
Child behaviour as reported by parent at 4 years	Total Problem Behaviours (log transformed)	.01	.05	-.13	.90
Child-reported outcomes at 10 years	Self-reported depression (log transformed)	-.07	.15	-.47	.65
	Self-reported anxiety (log transformed)	.05	.10	.49	.63
	Self-reported attachment security	.02	.06	.33	.74
	Global self-worth	-.10	.06	-1.60	.12

*$p < .05$

Table 4: *Summary of regressions on developmental outcomes using categorical AMBIANCE-*

Brief scores

Outcome		*B*	*SE B*	*t*	*p*
Child-reported self-concept at 4 years	Cognitive Competence	-.30	.19	-1.63	.12
	Physical Competence	-.17	.21	-.80	.43
	Peer Acceptance	.08	.24	.34	.74
	Maternal Acceptance	.07	.23	.30	.76
Child behaviour as reported by parent at 4 years	Total Problem Behaviours (log transformed)	.00	.21	.04	.97
Child-reported outcomes at 10 years	Self-reported depression (log transformed)	.35	.50	.70	.50
	Self-reported anxiety (log transformed)	.36	.37	.96	.35
	Self-reported attachment security	.10	.24	.40	.84
	Global self-worth	-.33	.24	-1.41	.17

*p < .05

Table 5: *Summary of regressions on developmental outcomes using AMSS scores*

Outcome		*B*	*SE B*	*t*	*p*
Child-reported self-concept at 4 years	Cognitive Competence	.06	.04	1.31	.20
	Physical Competence	.02	.05	.32	.75
	Peer Acceptance	-.07	.05	-1.24	.23
	Maternal Acceptance	-.03	.05	-.60	.56
Child behaviour as reported by parent at 4 years	Total Problem Behaviours (log transformed)	.00	.05	0.03	.97
Child-reported outcomes at 10 years	Self-reported depression (log transformed)	.03	.12	.28	.78
	Self-reported anxiety (log transformed)	.03	.08	.42	.68
	Self-reported attachment security	.00	.05	.17	.87
	Global self-worth	-.00	.05	-.08	.94

*p < .05

Table 6: *Summary of regressions on developmental outcomes using MBQS scores*

Outcome		*B*	*SE B*	*t*	*p*
Child-reported self-concept at 4 years	Cognitive Competence	.12	.16	.75	.46
	Physical Competence	.09	.17	.54	.60
	Peer Acceptance	-.17	.19	-.88	.39
	Maternal Acceptance	-.19	.18	-1.01	.32
Child behaviour as reported by parent at 4 years	Total Problem Behaviours (log transformed)	.02	.17	.14	.89
Child-reported outcomes at 10 years	Self-reported depression (log transformed)	-.01	.43	-.02	.99
	Self-reported anxiety (log transformed)	.25	.28	.90	.38
	Self-reported attachment security	.10	.18	.55	.59
	Global self-worth	.09	.18	.47	.65

*p < .05

Table 7: *Proportion of variance in developmental outcomes explained by each measure of maternal-infant interaction quality*

Outcome		AMBIANCE-Brief	AMSS	MBQS
Child-reported self-concept at 4 years	Cognitive Competence	$sr^2 = .16*$	$sr^2 = .06$	$sr^2 = .02$
	Physical Competence	$sr^2 = .11$	$sr^2 = .00$	$sr^2 = .01$
	Peer Acceptance	$sr^2 = .02$	$sr^2 = .06$	$sr^2 = .03$
	Maternal Acceptance	$sr^2 = .01$	$sr^2 = .01$	$sr^2 = .04$
Child behaviour as reported by parent at 4 years	Total Behaviour Problems (log transformed)	$sr^2 = .00$	$sr^2 = .00$	$sr^2 = .00$
Child-reported outcomes at 10 years	Self-reported Depression (log transformed)	$sr^2 = .01$	$sr^2 = .01$	$sr^2 = .00$
	Self-reported Anxiety (log transformed)	$sr^2 = .01$	$sr^2 = .01$	$sr^2 = .03$
	Self-reported Attachment Security	$sr^2 = .00$	$sr^2 = .00$	$sr^2 = .01$
	Global Self-Worth	$sr^2 = .09$	$sr^2 = .00$	$sr^2 = .00$

*$p < .05$