
Broadening the Study of Infant Security of Attachment: Maternal Autonomy-support in the Context of Infant Exploration

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Abstract

Although security of attachment is conceptualised as a balance between infants' attachment and exploratory behaviours, parental behaviours pertaining to infant exploration have received relatively little empirical attention. Drawing from self-determination theory, this study seeks to improve the prediction of infant attachment by assessing maternal autonomy-support during infant exploration, in addition to maternal sensitivity. Seventy-one dyads participated in two home visits. Maternal sensitivity was assessed when the infants were 12 months old, whereas maternal autonomy-support and infant attachment were assessed at 15 months. The results revealed that autonomy-support explained an additional portion of the variance in attachment when maternal socioeconomic status and sensitivity were controlled. These results speak to the relevance of a theory-driven approach to examining maternal behaviours in the context of child exploration.

Keywords: Infant security of attachment; infant exploration; maternal autonomy-support; maternal sensitivity

Introduction

One of the greatest challenges currently facing the field of attachment is to improve our understanding of the processes underlying the development of infant security of attachment. Indeed, three distinct meta-analyses have suggested that maternal sensitivity to infants' attachment needs, the putative main precursor of infant attachment, accounts for only a moderate portion of the variance in attachment security (Atkinson et al., 2000a; De Wolff & Van IJzendoorn, 1997; Goldsmith & Alansky, 1987). Several authors have thus highlighted the need to explore other maternal behaviours likely to contribute to the development of infant attachment. Given that secure attachment is defined as an appropriate balance between proximity-seeking and competent exploration, Grossmann, Grossmann, Kindler, and Zimmermann (2008) underscore the importance of attending to parental behaviours in exploratory contexts as well as attachment

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contexts. Working in this direction, some attachment studies focusing on parental exploration-related behaviours have highlighted the importance of these parental behaviours in understanding the development of infant security of attachment (e.g., Matas, Arend, & Sroufe, 1978). However, few studies have included parental behaviours in both contexts of exploration and attachment in order to assess their interplay in explaining infant attachment. Using a theory-driven approach, the present study aims to further operationalise parental behaviours in the context of infant exploration by drawing from a field of research that directly addresses exploration-related parental behaviours, namely self-determination theory (SDT; Deci & Ryan, 2000). Furthermore, this study aims to assess maternal behaviours related to each side of the attachment–exploration balance with the goal of improving the prediction of infant security of attachment.

Infant Attachment Security and Maternal Sensitivity

Infant security of attachment is reflected by the way in which infants organise their behaviours so as to maintain a balance between their needs for protection and comfort and their need to explore the environment (Ainsworth, 1985). Infants described as having a secure attachment pattern are able to seek out their caregivers for comfort and protection when they perceive a threat, and then, upon being comforted, return promptly to their exploratory activities. Infants classified as ambivalent tend to display angry resistant or passive behaviours aimed at ensuring a response from their caregiver which compromises their exploratory activities. Avoidant infants, on the other hand, appear to maintain exploration even when faced with a threatening or stressful situation. In contrast to the different organised responses adopted by infants classified as secure, avoidant, and ambivalent, those with disorganised attachments have no clear strategy for dealing with stressful events. Disorganisation is most obvious upon reunion with the caregiver after a short separation, with disorganised infants displaying behaviours that appear unusual, contradictory, odd, overtly conflicted, or fearful (Main & Solomon, 1986, 1990).

Empirical research has convincingly shown that these patterns of parent–infant attachment play a key role in subsequent psychosocial and behavioural child outcomes (see Thompson, 2008; Weinfield, Sroufe, Egeland, & Carlson, 2008). For instance, at various ages, children with secure attachment histories have been found to display less dependency, more ego-resilience and persistence, as well as more goal-directed and achievement-oriented behaviours. They have also been found to exhibit more social competence and empathy. In contrast, children with resistant attachment patterns have been found to be more prone to anxiety problems, whereas children with avoidant attachment patterns have been shown to be more hostile and aggressive with their parents and peers (Thompson, 2008; Weinfield et al., 2008). Furthermore, longitudinal studies suggest that early attachment continues to be associated with personal adjustment in adolescence and early adulthood (see Grossmann, Grossmann, & Waters, 2005). Given the importance of infant attachment for future adjustment, attachment researchers have long been striving to acquire a fuller understanding of the ways in which attachment patterns are formed.

Thus far, most of the research conducted has focused on maternal sensitivity to infants' attachment needs, that is, a mother's ability to respond to her infant's needs promptly and appropriately. However, in recent years, it has become clear that maternal sensitivity may not suffice in fully explaining the development of infant attachment

patterns. A classic meta-analytic study showed that maternal sensitivity accounts for only 23 percent of the inter-generational transmission of attachment patterns, and thus cannot fully explain the correspondence between parents' and their infants' attachment patterns (Van IJzendoorn, 1995). The author argued that the unexplained common variance may be due to the fact that the existing measures of maternal interactive behaviour do not capture all of the relevant aspects of parent-child interactions likely to favour security of attachment (Van IJzendoorn, 1995).

In a subsequent meta-analysis, De Wolff and Van IJzendoorn (1997) explored the relevance of different parental behaviours in shaping infant attachment. The authors found that several maternal behaviours that are conceptually distinct from maternal sensitivity yielded comparable effect sizes in the prediction of infant security of attachment. They therefore stressed the need to adopt a broader multidimensional approach to the study of infant attachment, where several maternal behaviours are considered. Two other meta-analyses yielded similar conclusions, finding that the link between maternal sensitivity and infant attachment is robust but smaller in magnitude than what was originally thought (Atkinson et al., 2000a; Goldsmith & Alansky, 1987). Furthermore, this finding holds true even when using extensive home-based assessments of sensitivity (e.g., Pederson, Gleason, Moran, & Bento, 1998; Raval et al., 2001; Tarabulsky et al., 2005). It thus appears potentially useful to follow De Wolff and van IJzendoorn's suggestion, and study a broader diversity of parental behaviours in addition to maternal sensitivity. However, in order to yield meaningful results, it seems critical that the search for other precursors of attachment be theoretically driven. Furthermore, Grossmann et al. (2008) propose that in addition to addressing a wider variety of maternal behaviours, we should also broaden the contexts within which we observe these behaviours. Specifically, they suggest that infant attachment be studied in the breadth with which the concept was originally defined by attachment theory.

Attachment theory posits that infants are equipped with two distinct yet inseparably linked behavioural systems: the attachment system and the exploratory system (Bowlby, 1982). Ainsworth (1985) stated that infant security of attachment is reflected by the way in which infants organise their behaviours so as to maintain a balance between these two systems. In assessing infant attachment, it is therefore key to focus on this balance rather than focusing solely on the infant's comfort-seeking behaviours (Weinfield et al., 2008). Thus, it is proposed that in addition to maternal sensitivity to infants' emotional needs for comfort and protection, maternal behaviours aimed at providing appropriate support and challenge to the child with respect to his or her exploratory activities are also important in shaping the development of infant security of attachment (Grossmann et al., 2002).

It is generally postulated that a mother's sensitivity to her child's distress also fosters competent exploration by providing the child with a sense of trust in the fact that the attachment figure will be available should a threat arise during exploration. Although this undoubtedly influences child exploration, it seems reasonable to propose that parental behaviours aimed specifically at enhancing the child's confidence in the context of exploration may also contribute to the exploration side of attachment security. Matas et al. (1978) assessed maternal behaviours towards their two-year-old children during a problem-solving task. Maternal behaviours were rated on two scales, reflecting the extent to which mothers were involved and attentive to their children while helping them feel comfortable with the task, and the quality of assistance they provided, that is, the extent to which they gave their children enough assistance to stay

focused on the task without solving it for them. These maternal behaviours were found to differentiate children previously identified as presenting secure vs. insecure attachment patterns during the strange situation assessment conducted six months prior. In a study conducted by Moss, Gosselin, Parent, Rousseau, and Dumont (1997) exploring maternal strategies during a joint problem-solving task with their preschoolers, mothers of secure children were found to centre their interventions well within the zone of proximal development of their child, whereas insecure children and their mothers were found to be far apart in their cognitive activities. Furthermore, mothers and their secure children were found to share metacognitive responsibility for the task, whereas mothers of insecure children tended to assume full responsibility.

Despite these noteworthy findings and the more recent call for increased attention to be paid to a broader range of maternal behaviours, very few attachment studies have independently assessed both maternal behaviours within contexts where the infant's attachment and exploration systems are activated. Thus, to our knowledge, no studies have disentangled the relative contributions of maternal behaviours pertaining to each side of the attachment–exploration balance in predicting infant security of attachment. With the goal of building on the work of Matas et al. (1978) and Moss et al. (1997), and in keeping with Bowlby's eclectic tradition, the current study draws from SDT (Deci & Ryan, 2000), which is particularly well-suited to inform the exploration side of the attachment–exploration balance. SDT provides a theory-driven framework within which parental behaviours related to child exploration are clearly defined and operationalised and have already been linked to a variety of important child outcomes, including the quality of infant exploration.

SDT

SDT posits that children naturally explore their environments, striving to acquire new skills, seek challenges, and extend themselves (Ryan & Deci, 2000). This ongoing process is referred to as *intrinsic motivation*, which is defined as the 'innate propensity to explore and master one's internal and external worlds' (Ryan, Connell, & Grolnick, 1992, p. 170). Infant exploration is probably one of the purest expressions of intrinsic motivation. However, although infants are thought to be innately inclined to explore and seek challenge, SDT theorists caution that this natural tendency does not take place automatically regardless of context (Deci & Ryan, 2002). Instead, SDT proposes that individuals will be most intrinsically motivated when the environment supports their need for autonomy rather than controlling their behaviour. Autonomy, as defined by SDT, is not synonymous with independence. In certain fields of study, the term autonomy-support (or encouragement of autonomy; e.g., Meins, Fernyhough, Fradley, & Tuckey, 2001) is used to describe parental behaviours aimed at encouraging children to do things by themselves without parental assistance. In contrast, SDT uses the term autonomy-support to refer to parental behaviours aimed at supporting children's goals, interests, choices, and sense of volition rather than controlling their behaviours (Grolnick & Ryan, 1989, p. 144). When adults are working with infants or children on problem-solving tasks, examples of autonomy-supportive behaviours may include providing informative feedback and positive encouragement, waiting for the child to require assistance before intervening, giving hints or suggestions upon child request and/or according to the child's needs, and providing appropriate assistance given the child's abilities (Grolnick, Gurland, DeCoursey, & Jacob, 2002).

A substantial array of empirical work has established a clear link between autonomy-support and intrinsic motivation (for reviews see Deci, Koestner, & Ryan, 1999; Grolnick, 2003; Mageau & Vallerand, 2003). For example, Grolnick, Frodi, and Bridges (1984) investigated the way in which mothers' autonomy-supportive vs. controlling behaviours towards their 12-month-old infants affected the latter's motivation to explore the environment. They found that mothers who displayed overt autonomy-supportive behaviours had infants who were more persistent during play (i.e., spent more time engaging in appropriate task-related behaviours). Frodi, Bridges, and Grolnick (1985) followed up this sample of mother–infant dyads 8 months later when the infants were 20 months old. Maternal autonomy-support and infant mastery motivation (exploration) were reassessed at this time and were once again found to be inter-related. Maternal autonomy-support scores remained stable between the 12-month and the 20-month assessments.

In addition to the link between autonomy-support and intrinsic motivation, an important body of empirical work has also established links between parental autonomy-support and a number of child outcomes throughout various stages of child development. For instance, parental autonomy-support has been found to relate to children's academic achievement (Grolnick & Ryan, 1989; Joussemet, Koestner, Lekes, & Landry, 2005), social adjustment (Joussemet et al., 2005), popularity with peers (Avery & Ryan, 1988), acting out problems (Grolnick & Ryan, 1989; Joussemet et al., 2008), perceived self-worth and self-competence (Avery & Ryan), as well as child well-being and life satisfaction (Chirkov & Ryan, 2001). However, very few studies have directly explored the link between parental autonomy-support and infant attachment. Frodi et al. (1985) examined this association at both 12 and 20 months. Maternal autonomy-supportive behaviours were not found to relate to infant attachment at any age. However, the authors noted that the analyses were conducted with small cell sizes, which could have significantly limited their statistical power. Furthermore, they noted that their sample did not show the expected stability in attachment classifications between the 12- and 20-month assessments. The authors thus cautioned that their study should be considered as exploratory in nature, and they suggested that future research be conducted in this area. More research is thus needed to further investigate the link between autonomy-support and security of attachment.

The Present Study

The present study aims at assessing maternal behaviours in both attachment and exploratory contexts. Both maternal sensitivity and maternal autonomy-support were assessed in order to explore their unique and combined associations with infant attachment. As postulated by attachment theory, it was hypothesised that maternal sensitivity would be significantly linked to infant security of attachment. It was further predicted that maternal autonomy-support would explain an additional and distinct portion of the variance in security of attachment. We assessed sensitivity with the maternal behavior Q-sort (MBQS; Pederson & Moran, 1995), which meta-analytic data have shown to hold high predictive power with respect to attachment (Atkinson et al., 2000b; Van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). Using an assessment of sensitivity with strong predictive validity constitutes an especially stringent test of the hypothesis that autonomy-support *adds* to the prediction of attachment above and beyond the contribution of sensitivity.

Method

Participants

This project is part of a larger longitudinal study on early parent–child relationships and children’s developmental pathways. Participating families living in a large Canadian metropolitan area were recruited randomly through birth lists provided by the Ministry of Health and Social Services. Criteria for participation were full-term pregnancy and the absence of a severe developmental delay. Seventy-one upper middle-class mother–infant dyads (37 girls and 34 boys) participated in the current study. Mothers were predominantly White (80 percent of the sample) and French speaking (82 percent of sample). They had a mean age of 30.8 years ($SD = 4.5$). On average, they had 15 years of formal education ($SD = 2.4$), and their family income ranged from under \$20 000 to above \$100 000. All but seven mothers were married to, or living with, the child’s father at the time of data collection.

Measures

Maternal Socioeconomic Status (SES). Information pertaining to mothers’ SES was obtained using a self-report questionnaire where mothers were asked to provide socio-demographic information such as their level of education and their family income. Given the high correlation ($r = .65$) between maternal education and family income, these two variables were centred and averaged, yielding a global index of maternal SES.

Maternal Sensitivity. Maternal sensitivity was assessed when infants were 12 months of age, using the MBQS (Pederson & Moran, 1995). The MBQS is a 90-item measure designed to assess the quality of maternal behaviours during in-home mother–infant interactions. Items describing potential maternal behaviours are sorted by an observer into nine piles (10 items in each pile) depending on the degree to which the items resemble the mother under observation. Items in the first pile are those that are least representative of the mother under study, and they are given a score of 1. Items in the ninth pile are those that are most representative of the mother, and they receive a score of 9. Items in the second pile receive a score of 2, and so on. The observer’s sort is then correlated with a criterion sort representing the prototypically sensitive mother, which is provided by the authors of the instrument. The sensitivity scores thus vary from $-1 = \textit{least sensitive}$ to $1 = \textit{prototypically sensitive}$. In the present study, the MBQS scores are based on observations made throughout a 90-minute home visit when the infants were 12 months old. Inter-rater reliability was conducted for 20 percent ($N = 14$) of the dyads and was found to be .85 (intra-class coefficient).

The development of the MBQS is anchored in attachment theory, more specifically in the descriptions of sensitivity and responsiveness provided by Ainsworth, Bell, and Stayton (1974) and Ainsworth, Blehar, Waters, and Wall (1978). Pederson, Moran and their colleagues (Pederson & Moran, 1995; Pederson et al., 1990, 1998) have provided detailed validity and reliability information. The MBQS is significantly correlated with other assessments of maternal behaviour, such as the home observation for measurement of the environment inventory (HOME; Caldwell & Bradley, 1978) and the Ainsworth scales of sensitivity (see Pederson & Moran, 1995). Its predictive validity is well demonstrated by meta-analytic data, which reveal that it is currently the sensitivity measure that is most predictive of infant attachment security (Van IJzendoorn et al.,

2004). In fact, the MBQS presents twice the predictive validity with respect to attachment as that offered by brief free-play sequences (Atkinson et al., 2000b).

Maternal Autonomy-support. Mother–infant dyads were asked to complete a challenging problem-solving task (puzzle) together at T2. Based on the videotapes of these interactions, maternal behaviours were coded on four scales ranging from 1 = *not autonomy-supportive* to 5 = *extremely autonomy-supportive*. The four scales were developed based on Grolnick et al.'s (1984) rating system. In their system, Grolnick et al. (1984) coded maternal behaviours along two scales: verbal and non-verbal behaviours. In the current study, we further categorised these scales into four distinct categories that specifically reflect the behaviours implied by the definition of autonomy-support (Grolnick & Ryan, 1989, p. 144), as well as those explicitly proposed in previous SDT studies (e.g., Grolnick et al., 2002). The four scales included the extent to which the mother (1) intervenes according to the infant's needs and adapts the task to create an optimal challenge for the child; (2) encourages her child in the pursuit of the task, gives useful hints and suggestions, and uses a tone of voice that communicates to the child that she is there to help; (3) takes her child's perspective and demonstrates flexibility in her attempts to keep her child on task; (4) follows her child's pace, provides the child with the opportunity to make choices, and ensures that the child plays an active role in the completion of the task. Given the inter-correlations between the four scales (ranging from .51 to .82), they were averaged to obtain a total autonomy-support score ($\alpha = .89$). All videotapes were coded by the first author of this report, and 38 of the 71 interactions were also coded by a second independent observer. Intra-class correlation between coders for the total autonomy-support score showed very satisfying inter-rater agreement ($ICC = .86$).

Infant Security of Attachment. Infant security of attachment was measured when infants were 15 months old, using the attachment behavior Q-set (AQS; Waters, 1995). The AQS comprises 90 items describing potential infant behaviours. As with the MBQS, following a home visit, an observer sorts 90 items describing potential infant behaviours into nine piles based on the degree to which each item reflects the infant under observation. Each cluster of items receives a score from 1 = *least representative of infant* to 9 = *most representative of infant*. The observer's sort is then correlated with a criterion sort provided by the developers of the instrument. Like sensitivity scores, attachment scores thus vary from $-1 = \textit{most insecure}$ to $1 = \textit{prototypically secure}$. In the present study, AQS scores were based on observations performed throughout a 90-minute home visit. Inter-rater reliability was conducted for 21 percent ($N = 15$) of the dyads and was found to be .88 (intra-class coefficient). Meta-analytic data (Van IJzendoorn et al., 2004) suggest that the observer-AQS shows excellent construct validity, with attachment scores converging with maternal sensitivity, attachment security assessed with Ainsworth's strange situation procedure, and child socio-emotional adaptation.

Procedure

Two in-home visits lasting about 90 minutes each were conducted when the infants were 12 months old (T1) and 15 months old (T2). Prior to the first visit, mothers had completed a questionnaire aimed at collecting socio-demographic information.¹ Both T1 and T2 home visits were modelled after the work of Pederson and Moran (1995) and aimed at challenging the mother's capacity to divide her attention between several

competing demands, thus reproducing the natural conditions of daily life when caring for an infant. The home-visit protocol was thus purposely designed to create a situation where maternal attention was being solicited by both the research tasks and the infant's demands, which placed the dyad in a challenging situation, likely to activate both the infant's attachment system and the mother's caregiving system.

In order to maximise the reliability of the observations performed during the home visits, we followed Pederson and Moran's (1995) recommendations for training our home visitors. Research assistants first attended a two-day training workshop consisting of seminars related to (1) early mother–infant interactions; (2) behavioural observation; and (3) techniques of home visiting. They reviewed several videotapes of mother–infant interactions in order to practise coding the MBQS and the AQS. After the workshop, the assistants performed their first few home visits with a more experienced colleague, and they completed the MBQS or the AQS together. When the junior home visitors were ready to lead a home visit without the assistance of a colleague, the visits were followed by a debriefing session either with the principal investigator or with an experienced graduate student in order to review the salient elements of the visit before scoring the MBQS or the AQS.

During the first visit, mothers were asked to complete a series of tasks (questionnaires, interview, etc.) aimed at creating a situation where they would have to divide their attention between the research tasks and their infant's needs or bids for attention. Maternal sensitivity was assessed with the MBQS based on observations made during this visit. During the second visit, mothers were asked to help their children complete a problem-solving task (puzzle task) that was designed to be slightly too difficult for the infants, such that they would require some adult assistance to complete it. This interaction was videotaped and later coded for maternal autonomy-supportive behaviours. During this visit, mothers were also asked to engage in various research tasks aimed at keeping them occupied throughout the visit so that the research assistant could observe the infant's attachment behaviours in the context of limited maternal availability. Infant attachment was assessed with the AQS based on observations made during this second visit. Observers in charge of infant attachment assessments did not participate in the coding of autonomy-support and in fact, most of them were not familiar with the concept and its measurement. Autonomy-support coders were blind to attachment scores and to any aspect of the home visit that was not part of the videotaped sequence. The MBQS and the AQS were completed by different observers.

Results

Preliminary Analyses

Maternal autonomy-support scores ranged from 1.0 to 5.0, with a mean of 3.5 ($SD = 1.1$). Maternal sensitivity scores ranged from $-.60$ to $.86$, with a mean of $.59$ ($SD = .34$). Finally, scores for infant security of attachment ranged from $-.29$ to $.82$, with a mean of $.46$ ($SD = .27$). All three main variables thus presented satisfying variability. No gender differences were found for maternal sensitivity, infant attachment, or maternal autonomy-support. Zero-order correlations were conducted to examine whether any of the main variables were related to maternal SES. Maternal sensitivity ($r = .32$, $p < .01$), maternal autonomy-support ($r = .25$, $p < .05$), and infant security of attachment ($r = .31$, $p < .01$) were all significantly related to maternal SES. Given these results, maternal SES was entered as a covariate in the main regression analysis.

Main Analyses

Bivariate correlations were conducted between the three main variables under study: maternal sensitivity, maternal autonomy-support, and infant security of attachment. As expected, maternal sensitivity was significantly linked to infant security of attachment ($r = .33, p < .01$). In line with our hypotheses, maternal autonomy-support was also significantly linked to infant security of attachment ($r = .32, p < .01$). Maternal autonomy-support and sensitivity were not significantly related ($r = .17$), thus suggesting that they refer to two distinct maternal behaviours.

Infant security of attachment was submitted to a hierarchical regression analysis wherein maternal SES was entered in the first block, followed by maternal sensitivity in the second block, and maternal autonomy-support in the third block (see Table 1). The overall model was significant, $F(3, 69) = 5.67, p < .01$, explaining 21 percent of the variance in security of attachment. Maternal SES accounted for 10 percent of the variance of infant attachment. Maternal sensitivity accounted for 6 percent of variance when maternal SES was controlled, and maternal autonomy-support explained an additional and unique 5 percent of the variance above and beyond maternal SES and maternal sensitivity. Results show that infants who have sensitive mothers ($\beta = .23, p < .05$) and autonomy-supportive mothers ($\beta = .23, p < .05$) tend to display higher security of attachment. Both maternal behaviours thus significantly contribute to explaining variation in infant security of attachment.

The regression analysis presented above represents an empirically stringent test of our hypothesis that maternal autonomy-support adds to the prediction of security above and beyond the contribution of sensitivity, given that it also partials out the common variance between SES and the three main constructs. However, for the purpose of theoretical clarity, we also ran a hierarchical regression analysis without including maternal SES, which examined the unique contribution of autonomy-support in the prediction of attachment, after accounting for sensitivity only. Although less empirically rigorous, this model complements the previous one because it is closer to the central theoretical question and closer to the manner in which links between sensitivity and attachment are usually reported in attachment studies. The analysis reveals that if

Table 1. Summary of Regression Analysis Predicting Infant Security of Attachment

Block	R^2	ΔR^2	F change	β
1. SES	.10		7.34**	.31**
2. SES				.23
Sensitivity	.16	.06	4.78*	.26*
3. SES				.18
Sensitivity				.23*
Autonomy-support	.21	.05	3.93*	.23*

Note: Seventy of the 71 participants were included in this analysis. One participant was dropped from analyses due to missing data related to her SES.

* $p < .05$; ** $p < .01$.

SES = socioeconomic status.

SES is not partialled out, sensitivity accounts for 10.8 percent ($p < .01$) of the variance in infant attachment, whereas autonomy-support explains an additional and unique 7.2 percent ($p < .05$) of the variance above and beyond maternal sensitivity.

Discussion

Infants' experiences with their caregivers provide answers to two questions, both equally central: 'What do others do when I am upset?' and 'What happens when I venture to explore?' (Thompson, 1999, p. 282). It has been suggested that in order to fully capture the mechanisms through which attachment patterns are formed, one should focus on the maternal behaviours related to both sides of the attachment–exploration balance that defines infant security of attachment (Grossmann et al., 2008). In contrast to the quality and quantity of work that has been devoted to refining the operationalisation and measurement of maternal sensitivity to infants' attachment needs, the field of attachment has not yet developed a clear theoretical framework from which to assess maternal behaviours related to infant exploration. The purpose of this report was to introduce a theory-driven approach to addressing maternal behaviours in the context of infant exploration, and assess whether these behaviours are related to infant security of attachment. Furthermore, given that few attachment studies have included maternal behaviours related to *both* sides of the attachment–exploration balance, this study aimed at assessing both maternal sensitivity and maternal autonomy-support in their respective contexts in order to compare their relative contributions to the prediction of infant attachment. Results showed that maternal sensitivity predicted infant security of attachment, and maternal autonomy-support made a significant independent contribution to the prediction of infant attachment above and beyond maternal sensitivity. Specifically, maternal sensitivity was significantly linked to infant attachment, explaining 6 percent of the variance when maternal SES was controlled and 11 percent of the variance when maternal SES was not controlled. These results are not surprising given that the association between maternal sensitivity and infant attachment has already been clearly established across numerous attachment studies. The association found in this study ($r = .33$) is comparable with what has been documented in classic meta-analytic reviews ($r = .24$ in De Wolff & Van IJzendoorn, 1997; $r = .32$ in Goldsmith & Alansky, 1987).

Maternal autonomy-support was also found to be significantly related to infant security of attachment, explaining 7 percent of the variance above and beyond maternal sensitivity and 5 percent of the variance when both maternal SES and maternal sensitivity were controlled. The results thus suggest that maternal autonomy-support explains a portion of the variance of infant attachment that is independent from and comparable in magnitude to what can be explained by maternal behaviours related to infants' attachment needs. Results also revealed that maternal sensitivity and autonomy-support were not related, which lends further support for the premise that they are two separate concepts that may influence infant behaviour in different ways. Taken together, these findings lend some support to the idea put forth by Grossmann et al. (2008), who suggested that studying maternal behaviours related to infant exploration may add to our current understanding of the processes through which attachment patterns are formed.

Some attachment studies have addressed the exploration side of the attachment–exploration balance in various ways. For instance, certain early attachment studies addressed the link between infant security of attachment and the quality of infant

exploration (e.g., Belsky, Garduque, & Hrcncir, 1984). Other studies, like the present study, have specifically focused on parental behaviours in the context of exploration and have found them to be linked to infant security of attachment or the quality of child exploration (for a review see Grossmann et al., 2008). However, in many of these studies, the investigators were interested in parental *sensitivity*, but in the context of exploration. During exploration, children are often faced with stimuli or challenges that may elicit fear, wariness, or distress, thus activating the attachment system; previous studies were interested in parental sensitivity in response to their child's distress in these types of situations (e.g., Grossmann & Grossmann, 1991, 1993). In the present study, we were interested in maternal behaviours specifically aimed at supporting the infant's exploration system, thus building on the work of Matas et al. (1978), Moss et al. (1997), as well as Grolnick et al. (1984). The current findings converge with those reported by Matas et al. (1978) and Moss et al. (1997) in highlighting the relevance of maternal behaviours in the context of infant exploration with respect to the understanding of attachment security.

Furthermore, although many attachment studies have explored the links between various types of maternal behaviours and infant attachment (for a review see De Wolff & Van IJzendoorn, 1997), very few have explored whether these behaviours make an independent contribution to the prediction of infant attachment when maternal sensitivity, as defined in the Ainsworth tradition, is controlled. Given that maternal sensitivity reliably explains a portion of the variance of infant security of attachment, coupled with the great care that went into assessing sensitivity in the present study, this report presents a particularly stringent test of the links between maternal autonomy-support and infant attachment. Although the effect sizes were not substantial, maternal autonomy-support was found to make a unique contribution to attachment security, thus presenting a step towards a more thorough understanding of the different parenting dimensions implicated in the development of infant attachment security.

While this study presents an initial effort towards a wider view of infant attachment, future studies are needed to replicate the findings and address certain shortcomings. For instance, infant security of attachment was assessed at the same age as maternal autonomy-support, whereas maternal sensitivity was measured three months earlier during a previous home visit. This methodological consideration may have favoured the additional contribution of autonomy-support to the prediction of infant attachment. However, the fact that attachment and autonomy-support were assessed by independent observers contributes to weakening the concern that shared method variance would account for their inter-relation. Furthermore, the weak and non-significant link between sensitivity and autonomy-support suggests that the latter is not simply another form of sensitivity that owes its unique link to attachment to the fact that it was assessed at the same age. The non-significant correlation between sensitivity and autonomy-support rather suggests that they are conceptually distinct behaviours that relate to different portions of the variance in attachment security. We are aware of very few studies that have examined the short-term stability of maternal sensitivity. However, in one recent, carefully conducted study using the same sensitivity measure as that used in the current study, Tarabulsy et al. (2005) found moderate and highly significant stability of maternal sensitivity over a longer (four months) period of time ($r = .42, p < .01$), and with a high-risk sample (adolescent mothers and their infants). Given the low-risk nature of our sample, which makes for greater stability, this suggests that the non-significant correlation between autonomy-support and sensitivity probably reflects a conceptual distinction rather than sheer temporal variation.

However, there is no doubt that future studies are needed where sensitivity and autonomy-support are assessed in methodologically equivalent contexts in order to clarify the exact magnitude of their respective contributions to infant attachment when methodology can clearly be ruled out as an alternate hypothesis.

Therefore, given the design used here, the clearest contributions of this study are (1) the theory-driven operationalisation of maternal behaviours in the context of infant exploration; and (2) the demonstration that such behaviours relate to infant attachment, assessed concurrently but independently, even after partialling out the portion of infant attachment that was already predicted by maternal sensitivity and SES. However, the unambiguous demonstration that autonomy-support adds, in a causal way, to the prediction of infant attachment beyond the contribution of maternal sensitivity awaits further research assessing sensitivity and autonomy-support concurrently and infant attachment subsequently.

It should be noted that the AQS does not assign attachment classifications as does the strange situation procedure, and thus does not allow for a distinction between the different types of insecure attachment, which are characterised by different exploration-proximity seeking imbalances. Given that children presenting ambivalent attachment patterns are characterised by hyperactivation of attachment behaviours and underactivation of exploratory behaviours, it is possible that maternal autonomy-support would be particularly useful in distinguishing secure and ambivalent infants. Future research using the strange situation procedure to measure attachment is thus needed to explore these questions.

Although the results suggest that maternal autonomy-support does contribute to individual differences in attachment security, the results also indicate that a significant portion of variance remains unexplained. Future research is thus needed to address other relevant aspects of parent-child interactions. For instance, another aspect of maternal behaviour that may contribute to additional variance in infant security of attachment is maternal *mind-mindedness*, or mothers' tendency to comment appropriately on their infants' putative internal states during infant-mother interactions (Meins et al., 2001). Mind-mindedness has been found to predict security of attachment (Laranjo, Bernier, & Meins, 2008; Lundy, 2003), even after accounting for the contribution of maternal sensitivity (Meins et al., 2001). In light of empirical evidence suggesting that infants' attachment patterns to each of their parents are inter-related (Steele, Steele, & Fonagy, 1996), it may also be useful to widen the scope of attachment figures considered as influential in the development of child attachment security. Evidence suggests that through father-child play, fathers play a particularly important role in supporting the development of their child's exploration system (for a review see Grossmann et al., 2008). Given the proposed salient role of fathers in child exploration, one may wonder if assessing autonomy-support within the context of father-child interactions, in addition to mother-child interactions, might further contribute to explaining a portion of variance in child attachment security. Future research could also be conducted exploring parental exploration-related behaviours in different types of contexts. For example, autonomy-support as assessed within a more emotionally laden context such as a clean-up task, where children may experience frustration, could perhaps reveal meaningful individual differences especially relevant to the development of attachment security.

Finally, although the current study was conducted with infants, Sroufe and Rutter (1984) highlight the cascading effects of the successful or unsuccessful resolution of stage-salient issues from one developmental stage to the next. The authors note that

developing a secure attachment relationship in infancy makes the development of competent autonomy in the toddler period more likely. Working from this perspective, one may propose that maternal sensitivity and autonomy-support could reach their maximum developmental relevance sequentially rather than concurrently, in synchrony with the developmental salience of emotional security in infancy followed by autonomy in the toddler period. Speculating further, one may wonder if these two parental behaviours, through their respective influences on attachment security, contribute to distinct outcomes of attachment later on, with perhaps maternal sensitivity in infancy preparing the way for emotional self-regulation in the preschool period and maternal autonomy-support leading to better problem-solving skills (e.g., confidence, persistence) in preschoolers. Future longitudinal research is needed to explore these questions.

In sum, given the importance of infant attachment for future child adjustment, it is critical to move towards a greater understanding of the ways in which attachment patterns are formed. Maternal sensitivity has already been established as an important and reliable predictor, but it is increasingly clear that it is not the only key variable involved. Grossmann et al. (2008) have suggested that addressing the exploration side of the attachment–exploration balance may inform some of the current gaps in our understanding of the development of infant attachment. The present study introduces work from another field of research, one that has extensively studied maternal exploration-related behaviours and thus presents a theory-driven framework from which to address mother–infant interactions within an exploratory context. Furthermore, given that both maternal sensitivity and maternal autonomy-support were assessed within their respective contexts, the present study presents an appropriate initial test of the ideas put forth by Grossmann et al. (2008). Although maternal sensitivity most likely contributes to the quality of infant exploration by providing the infant with a secure base from which to explore, the current findings suggest that maternal behaviours directly aimed at supporting the child while he or she explores provide an additional contribution.

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Acknowledgements

The research described in this article was supported by grants from the Social Sciences and Humanities Research Council of Canada and the Fonds Québécois de Recherche sur la Société et la Culture to the second author. We gratefully acknowledge Marie-Pier Nadeau-Noël, Émilie Rochette, Natasha Ballen, Isabelle Demers, Jessica Laranjo, Célia Matte-Gagné, Stéphanie Bordeleau and several other students for help with data collection, as well as George M. Tarabulsky and Chantal Mongeau for substantial intellectual contributions. Special thanks go to the participating families of the *Grandir Ensemble* project who generously opened their homes to us.

Note

1. The initial visit, not included in the current study, involved a research assistant going to the family's home to explain the project in detail, getting parents' informed consent, performing an interview with the mother, and asking her to complete a socio-demographic questionnaire, from which the socioeconomic information used in the present study was gathered.