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Maternal Nonverbal Behaviours and Infant Gaze During Triadic Play With Toys at 5 and 12 Months

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ABSTRACT

An Investigation of Maternal Nonverbal Behaviours and Infant Gaze During Triadic Play With Toys at 5 and 12 Months

Elka Leiba

Investigations using the face-to-face procedure have demonstrated the importance of maternal nonverbal behaviours in mother-infant interactions, however, fewer studies have explored the contribution of maternal and infant nonverbal behaviours in play. The present study was designed to examine nonverbal communicative behaviours in mother-infant interactions, and investigate how mothers adjust their behaviours to the developmental level of their infants and similarly, how infant behaviours change over time. More specifically, nonverbal strategies that mothers use with toys to structure the attention of their infants within a free play context were examined. Gaze, an important index of attention was used to assess infant attentional behaviours. Given that the motivating force of play is affective in nature, the present study also measured active and passive affection to address the affective component of play between mothers and infants. Twenty-six mother-infant dyads were studied longitudinally at both 5 and 12 months and participated in an 8-minute free play period that included age appropriate toys. The results from the present study indicated that mothers adjusted the duration and frequency with which they used the nonverbal behaviours to attract the attention of their infants and to teach them. These behaviours were also found to relate to infant gaze behaviours. The findings also indicate that mothers' displays of active attention decreased over time while

they maintained their use of passive attention at 5 and 12 months. Together, the results of this study illustrate the important role that maternal nonverbal behaviours have in mother-infant play interactions. Mothers adjust their behaviours to the age of their infants, implying that mothers are attuned to the developmental skills of their infants and also provide structure to further their abilities. The results from this study contribute toward a better understanding of the way in which mothers organize play interactions in ways that scaffold the attention of their infants, and teach them while maintaining emotional communication with their infants.

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There is growing evidence to support that factors in the social environment are related to the developmental outcomes of infants, including their cognitive, social and emotional growth. One such factor is the nature of the caregiver, primarily the mother-infant relationship. While father-infant interactions are important and likely to follow the same developmental trajectory, research has predominantly focused on the mother-infant dyad. Abundant research has focused on distal, demographic variables such as parental education and socioeconomic status as factors that affect parent-infant interactions and has, in some cases, subsequently examined associations with the cognitive and social-emotional growth of children. While studying such variables is important, directly examining caregiver-infant interactions is fundamental because it can reveal processes that underlie development.

The mother-infant dyad is a system of mutual regulation in which both mother and infant are responsive to each other and actively participate in influencing the flow of interaction (Cohn & Tronick, 1988; Tronick, 1980). The mutual regulation that occurs within mother-infant interactions can be investigated by examining two dynamic components of the interchange. The first component deals with the infant's current abilities and developing maturity. The second component involves the mother's calibration of her role in relation to the infant's level of functioning, which is reflected in her interactions with the infant.

Play situations provide a good opportunity for such mutual regulation to grow, because rules, goals and limits are established by the play partners themselves rather than by external demands (McCune, Dipane, Fireoved, & Fleck, 1994). Play is further

characterized as a time in which both partners are joined in a state of active and enjoyable engagement (Fogel, 1991). As a result, it is important to study both components of the dyad and their influence on the process of mutual regulation within a play context. Play provides an opportunity for scaffolding and communication of attention, as well as shared engagement and closeness in the mother-infant interaction by the provision of a valuable context in which both the infant and the mother are active partners (McCune et al., 1994). Although the infant's capacity for self-regulation is more limited in the first year of life, infants use the resources that they have available to communicate with social partners. As infants develop over the first year of life, there is a shift from parental regulation to co-regulation (Maccoby & Martin, 1983) and infants spend more time in coordinated joint play involving a triadic interaction between the infant, an object, and a partner (Bakeman & Adamson, 1984). The emergence of abilities and competencies in the developing infant to attend to and coordinate social and object realms has a clear effect on the style of interaction between mothers and infants, indicating the need for mothers to employ various strategies to match the developmental levels of their infants.

Fogel (1993) has proposed that development and individual differences can be studied by taking a relational perspective. In order to better understand development, Fogel maintains that it is important to study relationships which can only be represented at a level of analysis that goes beyond individual actions. Investigators of parent-infant relationships have recognized that because parents are the more capable partners in the interactions, they provide a supportive framework in which infants can achieve higher levels of performance. Lev Vygotsky was among the first investigators to forward this

notion through his concept of *zone of proximal development* which is defined as the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p.86). The structuring and guidance that adults provide to infants' activities is believed to be the reason why infants' performances differ when they are in interactions with adults compared to when they are alone or with other individuals such as their peers.

Both John Bowlby and Lev Vygotsky conceptualized the early establishment of a collaborative dyadic context (Moss, 1992). Although Bowlby (1969, 1973) discussed the theory of the development of early attachments, and Vygotsky (1978, 1986) forwarded the concept of the social origins of cognitive functions, both models contain conceptual similarities (Moss, 1992). A concept that is fundamental to both these theories is that in infants' and children's development, there is a gradual transfer of social and cognitive abilities from the interpersonal to the intrapersonal domain. They also both emphasized that the patterns of co-regulation established in the context of social relations, especially between mothers and their infants, are critical for how infants engage in later interactions. Fogel (1993) also maintains that co-regulation is an important principle in the development of mother-infant relationships.

As discussed by van der Veer and van Ijzendoorn (1988), in both Bowlby's and Vygotsky's theories, monitoring of the infant's or child's abilities are necessary. Both theories postulate that in order to reach mutual understanding and mutual regulation, adults must adjust to the infant's developmental level by making appropriate demands.

Parents provide a supportive and structuring framework which is open to adaptation in order to achieve co-participation and interaction with infants. In this context, mother-infant relationships can grow through the co-regulation of activity between both partners. The development of the relationship will be influenced by the skills of both participants, their ability to regulate attention, and the adjustments that both make to each other (Fogel, 1993).

Dyadic Interactions

In the first 6 months of life, a large portion of the infant's time is spent in face-to-face encounters with the primary caregiver. These types of interactions provide researchers with an opportunity to study the social, emotional, and cognitive development of infants and the quality of the early mother-infant relationship. The face-to-face procedure is often used to examine infants' socioemotional and communicative development and the mother-infant interaction. This procedure consists of the infant and caregiver, primarily the mother, being seated at eye-level to each other during a series of brief interaction periods (e.g., Rutter & Durkin, 1987; Tronick & Cohn, 1989). Studies employing this method have illustrated the importance of several components of mother-infant interactions, including the roles that both mothers and infants have in influencing social encounters, maternal responding to social signals in early development, the sensitivity of each member of the dyad to the other's behaviour, and the patterns of gazing in infants (e.g., Kaye & Fogel, 1980; Field, 1977; Symons & Moran, 1987). More recently, studies have used the face-to-face procedure to examine the role of nonverbal behaviours, including how mothers use touch and gestures when interacting with their

infants and how infants use nonverbal behaviours such as gaze to communicate with their mothers (Stack & Arnold, 1998; Stack & LePage, 1996).

Infants' nonverbal communicative behaviours are thought to provide a window onto important aspects of social, affective, and cognitive development in infancy (e.g., Adamson & Bakeman, 1981; Bates, 1979; Bruner, 1981; Stern, 1985). In early infancy, prior to infants' abilities to produce language, infants' affective displays, vocalizations, and gaze behaviours have been identified as potent signals with which infants communicate with their social partners. Among the earliest forms of communication is infant gaze which represents a critical component of early mother-infant interactive sequences (Stern, 1974). At around 6 months of age, cognitive processing is closely linked to an infant's attentional capacity, including both sustained gaze and shifts in gaze to different aspects of their surroundings (Jeffrey, 1968). Gaze serves as a way to maintain contact between mother and infant and to allow processing of visually represented signals (Barratt, Roach & Leavitt, 1992). Furthermore, the direction of gaze is an important social signal that indicates an infant's willingness to engage or terminate social activities (Kaye & Fogel, 1980; Stern, 1974).

By four months of age, infants appear to be able to control the extent of the stimulation they receive from their social partners, as evidenced in part by their tendency to attend selectively to their mothers when their mothers are looking at them as opposed to when they are looking away (Barrat et al., 1992). Additional findings from face-to-face studies employing manipulations of maternal behaviour have demonstrated that changes in either the amount or variety of maternal activity appear to alter the patterns of infant

gaze (Stack & Arnold, 1998). For example, altering the tempo of mother-infant play has been shown to influence both parental expressivity and the amount of infant gaze toward the parent (Arco & McCluskey, 1981).

Perturbations and manipulations of naturalistic face-to-face interactions have also been useful in examining mother-infant interactions. Such investigations demonstrate the effects of maternal behaviour on infant responses, sensitivity of infants to their mothers behaviour, and the importance of maternal responsiveness in the early development of infants and to the mother-infant relationship (Stack & LePage, 1996; Stack & Poulin-Dubois, 1998). The "still-face" paradigm is a modified face-to-face procedure, in which the interaction between mother and infant is typically divided into three brief periods and behavioural responses of the infant are often measured by the direction and duration of infant gaze and levels of affect (Tronick, Als, Adamson, Wise & Brazelton, 1978; Tronick, 1989). In period 1, the mother interacts normally, using facial expression, voice and touch. In period 2, the mother assumes a neutral, non-responsive still face and displays no vocal or tactile stimulation. During period 3, the mother resumes normal interaction with her infant. The still-face procedure is one way with which to demonstrate young infants' sensitivity to maternal social signals and allows inferences to be made about how infants understand social expectancies and how they use their coping strategies when there are violations in the expected progression of social interchange. By manipulating maternal behaviour in the still-face procedure, it has consistently been shown that infants develop expectancies about their mothers' behaviour during social interactions, that the procedure taps meaningful individual differences in the quality of

the developing mother-infant relationship, and that it reflects the history of the interaction, not merely infant characteristics (e.g., Cohn & Tronick, 1989).

Findings from studies using the still-face procedure have shown that infants decrease their gazing at their mothers during the periods in which there was a withdrawal of maternal attention as compared to the periods in which mothers interacted normally with their infants (Mayes & Carter, 1990; Stack & Muir, 1992). Changes in infant gaze patterns, from looking toward to shifting their gaze away from their social partners, are ways in which infants use their abilities to communicate with their social partner, indicating that infants are active participants who are responsive to changes in their partners' behaviour.

While research has focused on maternal vocal behaviour, fewer studies have investigated the nonverbal components of maternal behaviour. Nonverbal communication, however, is an important part of the repertoire of parental behaviours which has been shown to encourage early competencies in infants and help in their adaptation to the social world (Koester, Papousek & Papousek, 1989). Touch is one component of nonverbal communicative behaviour which is considered significant in helping infants organize environmental input (Koniak-Griffin & Ludington-Hoe, 1988). Studies have shown that the nonverbal behaviours which mothers use when interacting with their infants include different types of touch and hand gesturing (Stack & Arnold, 1998; Stack & Lepage, 1996; Stack & Muir, 1990).

Stack and Muir (1990) examined how maternal touch influenced infants' gaze and affect during early mother-infant interactions. To assess the contribution of touch, tactile

stimulation was isolated from the visual and vocal components of maternal behaviour. The results of this study revealed that infants smiled more and grimaced less during a still-face period in which touch was permitted. This suggests that maternal touch can be effective at reducing the negative affect and gaze aversion which is characteristic during still-face interactions. Furthermore, subsequent studies demonstrated that it was the tactile rather than visual stimulation from the hands that accounted for the effects (Stack & Muir, 1992). These findings indicate that touch is effective in reducing negative and increasing positive infant affect, and in directing and sustaining attention during touch-only interactions.

A study by Stack and LePage (1996) investigated infants' sensitivity to manipulations of maternal touch during face-to-face interactions. They found that infants were sensitive to subtle modifications in mothers' touch behaviour and that mothers changed their touching during different instructional conditions. Among some of their results, Stack and LePage (1996) found that when mothers were in a still-face condition and instructed to obtain their infants' smiling, they were able to obtain the same amount of smiling from their infants by only using touch as compared to mothers in the control group who were using their faces, voices, and touch. This study also found that infants' gaze shifted from their mothers' faces in the period where mothers were instructed to interact with their infants normally and to their hands in the period where they were instructed to maintain a still face but were permitted to touch their infants. A further study by Stack and Arnold (1998) investigated infants' responses to changes in maternal touch and gesture. Their findings indicated that infants were sensitive to changes in maternal

tactile and gestural behaviour, as evidenced by changes in their gaze and smiling. Furthermore, maternal touch and hand gestures were able to attract the attention of infants to their mothers' faces, even when the face was still and expressionless. The results of these investigations culminate to illustrate that mothers appear to be able to reliably elicit responses from their infants through the use of nonverbal behaviour, supporting the importance of maternal nonverbal behaviours in interactions with their infants.

Together, these results indicate the effectiveness of touch and gesture in influencing infant responsiveness while interacting with their mothers. These results demonstrate that mothers' touching and hand gestures can elicit affect and direct attention, underscoring the influence of maternal nonverbal behaviours on infants' responses. These findings also suggest that infants are sophisticated enough to detect subtle changes in their mothers' nonverbal behaviour and seem to be able to respond to these changes with shifts in their own behaviour. This adds a new dimension to infants' cognitive competence during social interactions and points to important avenues to investigate in order to advance our understanding of the role that nonverbal communicative behaviours play in interchanges between mothers and their infants.

Current research has increasingly addressed the role of nonverbal behaviours in face-to-face interactions, however, less is known about nonverbal behaviours in triadic interactions which involve infants, mothers and objects. In the second half of the first year, mothers use of objects in play with their infants becomes more frequent and infants' exploration of objects becomes more socially oriented as they begin to bring objects into communication with their social partner (McCune et al., 1994). The shift in the nature of

mother-infant interactions from more dyadic to triadic in nature points to the need to study mothers and infants within a context that involves the dyad and objects. Findings from the study of dyadic interactions support the importance of investigating the nonverbal components of interaction and illustrate a further need to study the role of nonverbal behaviours in mother-infant interactions which include objects. More specifically, research is warranted that examines the types of nonverbal strategies that mothers use when interacting with their infants and with objects and the nonverbal behaviours of infants during play taking place in a triadic context.

Triadic Interactions

Although in the first year of life much of an infant's time is spent in face-to-face interactions with the primary caregiver, a number of investigators have identified a change in social interaction that occurs at about 5 to 6 months (Kaye, 1982; Schaffer, 1984; Trevarthan, 1982). At around this time, infants appear to shift their interest from the focus of person-based activity to physical objects and events. This change may be attributed to developments in the physical domain such as increasing manipulative and postural control (Fogel, 1993), better vision or to neurological changes (Messer, 1997).

As infants become increasingly interested in and attentive to objects and events, the interactions between infant and caregiver begin to involve topics other than the adult-child pair themselves. Infants, as a result, must learn how to coordinate their attention and actions in a triadic situation that involves them, an object and another individual. The emergence of the ability to coordinate attention toward a social partner and an object of mutual interest is regarded as an important developmental milestone and is often referred

to as joint attention (Adamson & Bakeman, 1991). Joint attention is further characterized by a situation in which two people are aware that they are attending to a common event or object. Prior to its advent, infants engage primarily in dyadic interactions. When they are engaged with a person, their attention seems confined to the process of interaction itself. By the middle of the first year of life, face-to-face interactions with infants shift to interactions that are increasingly object focused and involve object exploration. Gradually, infant social interactions become triadic as object-focused attention becomes embedded in social contexts. It is around 6 months of age that babies begin to switch their gaze back and forth between caregiver and object (Newson & Newson, 1975).

When the joint attention skill emerges in the latter part of the first year of life, infants have learned to differentiate between a person and an object (Coorkum & Moore, 1998). More specifically, infants must have recognized that the other participant is not an object, but a person, who perceives the same aspect of the environment as they perceive. The developmental significance and functions of joint attention are evident in its involvement across dimensions such as cognition and affect, aspects which are fundamental to an infant's growth and maturation (Adamson & Bakeman, 1991). Moreover, the importance of joint attention interactions is evidenced by studies that show an association between joint attention skill and cognitive competence (Landry & Loveland, 1988; Mundy et al., 1990; Rocissano & Yatchmink, 1983).

The ability of infants to coordinate their attention to objects with a caregiver in these early interactions is thought to relate not only to the infants' developing cognitive abilities but also to parenting variables (Landry & Chapieski, 1988). The quality of early

joint attention interactions is dependent in part on the caregiver's ability to adapt attention-directing techniques to the infant's cognitive and attentional capabilities (Wood, Bruner & Ross, 1976). Mothers' use of attention-directing techniques that are sensitive to infants' attentional focus and interests have been associated with higher developmental functioning in children (Landry, Chapieski & Schmidt, 1986; Rocissano & Yatchmink, 1983; Ruddy & Bornstein, 1982). Studies investigating mothers' impact on development in relation to their behaviours in joint attention interactions (gestures such as giving or showing toys) report relationships across time with children's competencies (Belsky, Goode & Most, 1980; Ruddy & Bornstein, 1982; Sigman, Cohen & Forsythe, 1981).

While some studies have addressed the impact of maternal variables on joint attention interactions between mothers and their infants and their subsequent effects on child functioning, the weight of the available research has largely emphasized verbal aspects of interaction. Few investigations have addressed nonverbal interactions and communication between mothers and their infants. Furthermore, much of the available research has studied joint attention interactions between mothers and their infants in older infants, typically around 12 months of age. Notably, by this age, research has shown that joint attention skills have fully emerged in most infants (e.g., Adamson & Bakeman, 1991). However, it is important to study infants at younger ages to help identify potential precursors to joint attention in infants, and to assess the capacity of maternal behaviours to influence the development and emergence of joint attention skills in infants. For example, research has found that onlooking, when an infant watches an adult engage with an object, and simultaneous looking, when both infant and adult look at the same thing at

the same time, predominate the skills of infants before they are 9-months-old, and these may be potential precursors to joint attention (Corkum & Moore, 1998).

Landry and colleagues (Landry, 1986; Landry & Chapieski, 1988, 1989, 1990; Landry, Chapieski & Schmidt, 1986) have studied joint attention interactions and the effects of maternal attention-directing strategies during interactions with their infants. However, the main focus of these studies has been on at-risk populations, such as premature infants and infants with Down Syndrome. For example, Landry et al. (1986) studied the relationship of maternal attention-directing strategies and the responses of a group of 12-month-old preterm (low-risk and high-risk) and full-term infants in play interactions. Among some of their hypotheses, the investigators hypothesized that maternal verbal and nonverbal techniques that provided more structure such as attention-directing verbs and toy demonstrations, respectively, were expected to lead to higher levels of infants' responses. They also hypothesized that the relationship between the strategies that mothers used and the responses of infants would vary across the groups studied. The authors found that mothers of preterm infants used different attention-directing strategies as compared to mothers of the full-term infants. For example, mothers of the full-term infants used questions more often to direct attention than the mothers' of the low-risk preterm group and mothers of both preterm groups tended to use attention-directing verbs more often that the full-term group. Furthermore, across all groups, questions, imperatives, demonstrations of toys, and gives were most highly related to manipulative toy responses by the infants.

Landry and Chapieski (1989) studied the effects of Down Syndrome and

prematurity on joint attention and infant toy exploration in 12-month-old infants. More specifically, this study examined the verbal and nonverbal techniques that mothers use when interacting with their infants and subsequent infant responses (i.e., manipulating a toy and/or looking at it). The results of this study revealed that infants with Down Syndrome and their mothers displayed different joint attention behaviours compared to high-risk preterm infants and their mothers. Mothers of infants with Down Syndrome physically oriented their infants more but handed toys to their infants less than the mothers of the preterm infants. However, the mothers were similar in their use of a number of attention-directing techniques, including demonstration of toys and use of attention directing gestures such as pointing and tapping a toy. They were also similar in their use of their verbal techniques. Furthermore, infants showed differences in their attention behaviours. Overall, the children with Down Syndrome were more passive than the high-risk preterm infants during the interactions with their mothers. They manipulated toys less often and passively looked and held toys more often in response to their mothers' attention directing behaviours.

These studies have focused primarily on joint attention and maternal interactions with premature infants and infants with Down Syndrome, while other studies have also examined joint attention in infants with autism (e.g., Landry & Chapieski, 1990). Less attention, however, has been given to examining joint attention interactions in full-term, normally developing infants. In addition, most of these studies have examined infants at one point in time and as a result have not provided a longitudinal context within which the development of joint attention interactions could be studied. As a result, there is a

need to investigate the joint attention behaviours of mothers and their normally developing infants. Furthermore, research is needed to address the development of joint attention interactions by longitudinally studying mothers and their infants and examining how these interactions change over time. It is also important to note that there is a paucity of research addressing the role of nonverbal behaviours (e.g., Messer, 1997) in joint attention interactions between normally developing infants and their mothers. Studies have emphasized the verbal strategies that mothers use when interacting with their infants (e.g., Messer, 1997) while less attention has been given to the specific nonverbal behaviours which are used in these interactions to scaffold infants attention and to teach them.

During mother-infant interactions, mothers teach their infants through the use of various communicative modalities. During the first 6 months, evidence suggests that infants depend on their parents' ability to structure and frame interactive moments and on the parents' capacities to respond to their bids (Cohn & Tronick, 1987; Kaye & Fogel, 1980). As infants mature, there is a gradual shift in their ability to initiate interactions. As a result, it is important to examine the nonverbal strategies that mothers employ in order to teach their children and to structure their attention. Although it is recognized that the quality of mother-infant interactions and sensitive mothering in such early interactions are related to more optimal infant outcome (Ainsworth, Blehar, Waters & Wall, 1978), less is known about specific maternal factors that directly affect children's learning.

Pêcheux, Findji and Ruel (1992) studied maternal scaffolding of attention of infants at 5 and 8 months of age. The aim of the study was to investigate infants' abilities

to focus their attention on objects and to demonstrate the association of infants' exploration and maternal mobilization of attention (e.g., showing infant a toy, talking about a toy) at both time points. To address the goals of this study, mother-infant dyads were observed in their homes for at least a 45-minute period and global evaluations were made of both infant attention abilities and mother mobilizing behaviours. Pêcheux et al. (1992), found that at 8 months of age, infants focused their attention on objects longer than at 5 months of age. Correlations between infant and mother behaviours according to age revealed that at 5 months of age, infant attention was related to the percentage of time that mothers spent mobilizing their infants' attention and the total number of occurrences of mobilizing attention, while at 8 months of age, these correlations were no longer significant. The older infants spent more time attending to objects than younger ones. In addition, mothers' encouragement to attend decreased with age and their interventions tended to be shorter. The findings support the notion that mothers scaffold their child's attention and change their behaviours depending on their infants' age. At 5 months of age, infant and maternal orientation toward objects were correlated and when mothers did not mobilize their attention, infants did not maintain their attention on objects for a long time. At 8 months of age, however, maternal support was less or even no longer needed. This study demonstrates the importance of maternal scaffolding of attention and the adaptation of maternal behaviour according to the age of their infants. Although Pêcheux et al. (1992) examined changes that occur in maternal scaffolding with infants by including a longitudinal component, this study did not address the specific strategies which mothers use to structure the attention of their infants and how these strategies

change over time. Furthermore, little research has addressed the responses of infants to the attentional behaviours of their mothers and the association of maternal nonverbal behaviours to the gaze responses of their infants.

Findji (1993) studied the relationship between the attentional abilities of children at 5 and 8 months of age and maternal scaffolding of their infants' attentional behaviours. Thirty mother-infant dyads were studied in their homes, without any specific instructions or objects provided. Findji (1993) found that mothers did have an early impact on their infants' attention. At 5 months, infants showed increased sustained attention (measured by mean duration) when their mothers were present compared to when they were alone or when they were being physically cared for. At 8 months, however, infants seemed to have acquired their own control of attention, and were as capable of sustaining their attention when alone as when they were with their mothers. Notably, there seems to be a relationship between maternal stimulation of attention at 5 months and infants' sustained attention at 8 months, suggesting that maternal behaviour at an earlier point in time influences the later behaviour of their infants. These findings support the hypothesis that mothers scaffold their infants' attention and that they adjust their scaffolding behaviours according to the age of their child. Furthermore, these results indicate that studying infants' attentional behaviours in such an interactive framework points to attention being an important socio-cognitive ability in infants.

In the studies previously discussed, the examination of maternal behaviours included verbal as well as nonverbal behaviours, but did not assess the individual components of mothers' behaviours. Many studies have addressed the relationship of

verbal behaviour of mothers to the development of joint attention in infants. Fewer studies, however, have investigated the nonverbal components of behaviour which mothers employ to structure the attention of their infants. There is a need to more specifically examine the nonverbal strategies that mothers use when scaffolding the attention of their infants, how these individual behaviours change over time, and how they relate to infant gaze which is a critical nonverbal measure of infant attention. Such an examination would help elucidate the role of nonverbal maternal behaviour within a triadic context and reveal which maternal behaviours compared to others are more successful at structuring the attention of infants.

While minimal, there has been some research which has examined the relationship between maternal behaviours and attention in infancy. For example, Lawson, Parrinello and Ruff (1992) investigated the role that mothers have in their 12-month-old infants' attention to objects during a period of joint play. Infants were observed when they played independently with objects (4 minutes) and when they played with the same objects in an interaction period with their mother (2 to 3 minutes). The investigators found that during the interaction period with their mothers and toys, infants showed a marked increase in the duration of their focused attention and a decreased amount of inattention (dropping and throwing).

The results suggest that infants' attention to objects during the interaction period with their mothers was related to the behaviour of their mothers, as well as the infant's tendency to be attentive. When the infants were divided into groups of low, average, and high attending, they found that the degree of focused attention and decreased inattention

varied across the three groups. Mothers' behaviours, including holding, demonstrating, physically manipulating, and switching objects were related to the attention of infants who showed average and relatively low levels of spontaneous focused attention. The focused attention of high attenders, however, remained relatively stable across the play periods. These findings suggest that there is an important interplay between the individual attentional differences in infants and the behaviours that mothers use to structure the attention of their infants during joint play.

Although this study investigated maternal behaviour and the relationship to attention in infants, its focus was on 12-month-old infants and did not longitudinally study infants across different ages. Available studies investigating the relationship of maternal behaviours and infant attention have revealed that mothers modify their behaviours according to the age of their infants (McCune et al., 1994). However, few studies have addressed nonverbal maternal strategies alone and how they change over time. Furthermore, object manipulation was used as a measure of infant response, while other measures such as infant gaze, which is an important measure of infant attention was not used. Gaze and object manipulation are important nonverbal behaviours which are used to coordinate adult and infant attention. However, gaze is a critical measure of infant attention because it can reveal how infants respond to the attentional strategies used by their mothers and can reveal instances in which infants may be manipulating objects but are attending to other objects or events. In play interactions, where mothers are likely to incorporate an array of toys, gaze would be a critical indication of an infant's attentional focus. In turn, it is important to investigate the behaviours which mothers use to

encourage the attentional focus of their infants while in play interactions.

Play

The special qualities of play settings provide a unique way in which to study mother-infant interaction and to more closely examine the specific nonverbal communicative behaviours which occur within this context. Garvey (1977) characterizes play as pleasurable and enjoyable, having no extrinsic goals, and including active engagement on the part of the player. Furthermore, play has been linked to the development of a number of cognitive and social phenomena. As described in an earlier section, during the latter half of the first year, infants become increasingly attentive to objects, and they sustain exploration and attention to the external environment. As a result, caregivers have an important role in facilitating object exploration by introducing objects and helping their infants attend to these objects during play interactions.

Dyadic and triadic interactions between mothers and their infants may also be conceptualized as periods of time in which both partners are participating in play interactions. Children's play has been a continual focus of interest for educators and psychologists, and there have been many explanations of its meaning and importance. One popular interpretation is that play provides opportunities to affect and control the environment in ways that the infant is unable to do in other contexts (Moss, 1992). Bruner (1973) argued that for infants, exploration/play provides a forum for the development and practice of behavioural routines that are subsequently integrated into more complex behavioural sequences. Piaget (1952) argued that such activity is more as a means of promoting the integration of strategies for current use. He also showed that the

manner in which infants explore their world through play can serve as a window on cognitive development. Parent-infant play is regarded not only as an important component of infants' cognitive growth but also as critical for their socioemotional development and self-regulation skills (Beeghly, 1993).

The first playful interchanges between a mother and infant are often dyadic in nature and promote an infant's beginning sense of self and other within an intimate and affectively tuned relationship. Furthermore, play in the mother-infant relationship can be seen as a context which provides scaffolding for the evolving representations of both self and other (Bergman & Sckler-Lefcourt, 1994). Over the second 6 months of life, the nature of play shifts as infants show interest in and attention to their environment by increased gaze and physical examination of objects (Ruff, 1986). Infants acquire information about the world through their active involvement with toys (Uzgiris, 1967). However, this free play behaviour is sensitive not only to ontogenic change but the quality of such activity can be influenced by the child's early environment (Belsky et al., 1980). More specifically, Belsky et al. (1980) showed that infant exploratory competence can be enhanced by increasing maternal attention-focusing behaviour during everyday interactions between the mother and the infant in the home.

In a longitudinal study designed to investigate how infants coordinate attention to people and objects, Bakeman and Adamson (1984) observed infants between 6 and 18 months of age in their homes playing with their mothers and with peers. An issue addressed in their study was how partners may affect the way infants deploy their attention. Some investigators of early communication development emphasize the

essential nature of partner support when infants first begin to maintain engagement with an object to which the partner is also attending. For example, Bruner (1982) suggests that caregivers provide a necessary scaffold or supportive structure for infants as they begin to employ referential communicative actions during shared activities such as picture-book reading and object hide and seek.

During play with mothers and their peers, Bakeman and Adamson (1984) examined various sequences of states of engagement, including passive joint engagement, coordinated joint engagement, person engagement, object engagement, onlooking and unengaged. Passive joint engagement states were defined as children playing with objects while mothers complemented their engagement, while coordinated joint engagement states were defined as when children played with objects but also glanced briefly at the partner. It was hypothesized that if mothers were more competent than peers in assisting shared activities and more motivated to complement their infants attention, that both passive and joint engagement states would occur more frequently when infants were interacting with their mothers.

The authors found that as infants grew older, they spent more time in coordinated joint attention play and less time engaged with the other person (i.e., the mother in the mother condition and the peer in the peer condition). When their mother was the play partner, infants spent more time in both coordinated joint and passive joint activity and less time in unengaged. Engagement states which offered some potential for referential communication were more frequent when infants interacted with their mothers, while no partner effects were found for states that did not (i.e., person play, onlooking and object

play). The mothers' most striking contribution was evident when mother/peer differences for passive joint engagement were examined. This state occurred during every mother-infant interaction, and characterized infant's engagement for about 20% of the period, regardless of the infant's age. Mothers were able to use their capacity to capture their infant's attention to an interesting spectacle as a prelude to a period of mutual exploration of an object. The passive joint engagement state thus seems to be closely tied to mothers' actions. And it seems that it is this form of joint engagement that adults are most likely to foster as they scaffold their infants' activities during the period of development when new communication skills are just forming. These findings further indicate the importance of studying how mothers and infants coordinate their attention and the behaviours that mothers employ to capture the attention of their infants.

In a study of infant exploration and play, Belsky and Most (1981) found that between the last quarter of the first year and through the second year, infant play becomes increasingly sophisticated, changing from simple undifferentiated manipulation to the exploration of unique properties of objects to pretense play involving ever more complex and cognitively demanding behavioural routines. These documented developmental changes, when coupled with the results of other studies, suggest that free play behaviour may serve as a valid and reliable measure of cognitive-motivational development during the late infancy period. This study also demonstrates the developmental changes that occur in infants' play behaviour, indicating that with time, infant behaviour becomes more sophisticated. It is important to note that developmental change within mother-infant interactions is also evident in the way that mothers respond and adjust to the

infant's developmental level. As the mother observes an increasingly complex and capable child, her role in the interaction changes. Children proceed through developmental milestones in cognitive, language, motor and social-emotional abilities. As a result, it is important to investigate how mothers adapt their behaviours to the growing sophistication and complexity of their infant in ways that facilitate the infant's growth.

Affection and Physical Contact

It is also important to note that although emerging attentional abilities can be observed in play interactions, the motivating force behind play is affective in nature (Bergman & Sackler-Lefcourt, 1994). However, little available research has addressed the affective component of play between mothers and their infants and how affective interchanges develop over time. Accordingly, a free play situation also provides an opportunity to examine shared states of engagement, physical contact and proximity as well as affective exchanges that occur between mothers and infants. Shared engagement states and affective displays are important because they represent periods of time when both parties are mutually involved in an activity and/or jointly involved in communicating a usually positive affective state.

The quality of mother-infant affection has been found to influence later social, affective and cognitive development (Franco et al., 1996). For example, hugs and affectionate touches have been shown to contribute to attachment and development in early childhood (Endsley & Bradbard, 1981; Hans & Clifford, 1980; Hyson et al., 1988, Prescott et al., 1972; Scarr, 1984), and studies examining child rearing have shown that warmth and nurturance has been associated with children developing positive self

concepts (Coopersmith, 1967) and prosocial behaviours (Zahn-Waxler et al., 1979).

Lindahl and Heimann (1997) studied degree of social proximity between mothers and their 9-month-old infants. Their measure of social proximity included 9 subscales, and one of them consisted of physical contact which was rated on a scale of 1, where there was no instances of gentle, warm or sensitive touching observed to 5, where positive contact was characteristic of the play interactions. They found gender differences in the degree of social proximity between mothers with daughters compared to mothers with sons. For example, while in interactions, mothers with daughters scored higher on physical contact compared to interactions of mothers and their sons. Lindahl and Heimann's (1997) note, however, that further research is needed to elucidate whether gender differences exist in the social proximity of mothers and their infants. The authors point to the need for longitudinal investigations to examine these interactions and starting the observations at a younger age.

Franco et al. (1996) examined cultural differences in physical contact between Hispanic and Anglo mother-infant dyads living in the United States. They found that there were no overall differences in physical contact between the two cultures. However, Hispanic mothers displayed more close touch and more close affectionate touch compared to Anglo mothers who showed more distal touch. Their findings revealed that mothers showed a high percentage of physical contact with their infants, indicating that physical contact, affection and touch are recognized by mothers as essential ingredients of early communication with their infants. Together, these studies indicate the importance of affective displays and physical contact in mother-infant interactions. However, further

research is needed to elucidate the development of affection in mother-infant interactions and the role of affective communication within a free play context.

Summary

Recent investigations using the face-to-face procedure have demonstrated the important effect of maternal nonverbal behaviours, including touch and gesturing on infant gaze and affect. Such findings have illustrated that infants are able to detect subtle changes in maternal nonverbal behaviour, adding a new dimension to infants' competencies in the cognitive domain. These studies have pointed to the need for research to further address the role of nonverbal communicative behaviours in interchanges between mothers and their infants. Investigations addressing nonverbal behaviours are especially warranted within settings which include toys and allow for both dyadic and triadic interactions to take place between mothers and their infants. As the nature of mother-infant interactions shift from more dyadic to triadic, it is important to address the changes that take place in these interactions over time. As toys become included in play interactions, mothers begin to implement strategies to structure the attention of their infants, having them attend to both the toys and themselves within the play context. Few studies have addressed the nonverbal strategies that mothers implement to scaffold the attention of their infants within a free play context and the effects that such strategies have on the gaze of infants which is a critical measure of infant attention.

Parent-infant play behaviour with age-appropriate toys has been regarded as a powerful index of infants' cognitive competence (Piaget, 1962; Vygotsky, 1978). The establishment and coordination of joint attention is a major developmental milestone for

infants, as it marks the emergence of intentional communication. At this point, infants use their communicative abilities, including vocalizations, affect and gaze to signal a desire for shared attention and game playing. There is a paucity of research, however, investigating general developmental changes that occur within dyadic and triadic interactions in a free play setting that involves toys.

Studies in the play literature have shown a relationship between: overall competence of infants and mother's behaviours (Clarke-Stewart, 1973), joint attention in the mother-infant interaction and child linguistic skill (Rocissano & Yatchmink, 1983) and the direct stimulation of infant cognitive growth through play-associated behaviours such as demonstrating toys and cognitive development in infants (Pettit & Bates, 1984). Such studies are among those that illustrate the importance of play in the social, emotional, and cognitive development of infants and in the mother-infant relationship. However, there is a need for research to examine developmental changes that occur with the infant, mother and the mother-infant relationship within a free play context. Studying mothers and infants in such a setting would provide an important opportunity to examine the mother-infant relationship and how mothers use the situation to structure infant attention and teach them to attend to toys within a play setting. Some research has addressed the affective components of play between mothers and infants (Lindahl & Heimann, 1997; France et al., 1996). However, further elucidating these affective elements is warranted. Play interactions present the opportunity to study the affective overtones of mother-infant play and the emotional communication which takes place between the dyad while in a triadic context.

The Present Study

The examination of mother-infant interactions over time is fundamental because it can reveal processes that underlie development and demonstrate changes that occur in maternal and infant behaviours. Play is an important context in which the development of the mother-infant relationship and infants' cognitive, and socio-emotional growth takes place.

Early caregiver-infant interactions often take place in the form of dyadic play which involves the infant and caregiver, and triadic play which includes the addition of an object(s) or toy(s). These interactions help infants learn about and participate in communication with their caregivers. They also allow infants to learn how to attend to another person or object in the environment and how to coordinate their attention between an object and a person. Accordingly, early caregiver-infant play interactions are affected by the caregivers' abilities to adapt their behaviours and strategies to their infants' changing cognitive and attentional abilities.

The current study was designed to longitudinally examine maternal nonverbal attention strategies, affectionate behaviours, and infant gaze within a free play context. Furthermore, the associations between nonverbal maternal attention strategies and infant gaze and how they change over time were investigated. Affection and affective displays are important because they represent periods when both parties are mutually involved in an activity and/or jointly involved in communicating a usually positive, affective state. The behaviours measured included active displays of physical affection (e.g., kissing, hugging), and passive demonstrations of affection (physical proximity). The present study

also examined maternal nonverbal behaviours to structure infant attention and teach them such as demonstrating a toy's function. Such behaviours are critical because they stimulate emerging infant skills, while providing structured guidance and support. Finally, cognitive processing is closely linked to an infant's attentional capacity, which is demonstrated through direction of infants' gaze. Furthermore, the direction of gaze is an important social signal that infants possess to indicate a willingness to engage or terminate social activities (Kaye & Fogel, 1980; Stern, 1974). Hence, in the current study, gaze was used as a measure of infant attention.

The specific behaviours that were examined during mother-infant interactions reflect some of the strategies that parents use with their children. Investigating such behaviours can provide important information about the types of strategies and behaviours that parents use during play interactions with their infants and how these are related to their cognitive development.

In the current study, mother-infant dyads were studied at 5 ½ (time 1) and 12 months of age (time 2). The main objectives of the study were to describe and evaluate: 1) the nonverbal maternal strategies which mothers use at times 1 and 2, and examine how they change over time 2) the relation between mothers' behaviours and infant gaze and how these associations change over time and 3) the affective displays at times 1 and 2 and examine how they change over time.

Some specific hypotheses relating to each objective of the current research were formulated. For the first objective, it was hypothesized that mothers would use more active physical/gestural strategies when their infants were 5 months compared to when

they were 12 months. In addition, it was hypothesized that mothers would use the strategy of demonstrating the toy's use or function more frequently when their infants were 12 months compared to when they were 5 months of age because this is a strategy which can present more cognitively sophisticated information, making mothers more likely to use it with their infants at 12 compared to at 5 months. It was also hypothesized that mothers' use of more structured strategies such as physically orient, physically assisting and give or offering of a toy would decrease over time because as infants grow they gain greater control over their posture, and become more mobile, requiring less physical adjustment of their bodies by their mothers to orient their attention towards toys. Relating to the second research objective, it was hypothesized that infant gaze would be more highly associated with active strategies used by mothers, such as pointing and shaking toys, compared to the less active attentional strategies such as touching. It was also hypothesized that infant gaze would be more highly associated with instances when both mother and infant were touching a toy because this represents a time that infant and mother are more likely to be sharing attention to the same object. With regard to the third research objective, it was hypothesized that both mothers' use of more active and passive forms of affection would decrease over time. This was hypothesized because it was thought that over time, mothers would be more likely to emphasize the cognitive and teaching aspects of the play context, to foster more independent play in their infants thus decreasing their more active affective displays and physical proximity to their infants.

Method

Participants

Subjects were recruited from a community teaching hospital in Montreal (Quebec, Canada) and mothers were contacted and recruited by telephone. The original sample consisted of 28 mother-infant dyads, however, 2 dyads were not included in the study because they participated only at 5 months. The final sample consisted of twenty-six full-term, healthy infants and their mothers who participated in the study when infants were 5 ½ -months-old (time 1) and 12-months-old (time 2). The sample consisted of 11 males and 15 females, and the mean age of infants was 5 months and 12 days at time 1 (SD = 0.25) and 12 months and 10 days (SD = 0.37) at time 2. The mean age of mothers was 30 years (SD = 5.04) at time 1. The majority of subjects were white (96%) and middle class (92%). The ages 5 and 12 months were chosen because by 5 months infants possess the attentional capacities required for sustained social interactions and they are also able to initiate and maintain interactions with adults. Furthermore, at 5 months, joint attention has not yet emerged in infants while by 12 months, infants have typically developed the joint attentional skill. Therefore, these ages allow for the study of potential precursors of joint attention in mother-infant interactions.

Materials

The experimenter and mother located a quiet place in the home where the materials for the study could be set up. The set-up for each experimental session included a plastic mat (1M x 1M) which was placed on the floor. Mothers were asked to place a blanket on the mat to make it more comfortable. At each time point, the set-up and

presentation of toys was standardized for all participants. The toys included in the study were selected so to be age appropriate and to provide a diverse array of toys which had social and functional uses. At 5 months, a plush bear, rattle, Fisher Price rack-a-stack and plastic book were placed on the mat from right to left. At 12 months, a plastic phone, tea set, doll, plastic comb and brush, Lego blocks and two books were placed on the mat from right to left.

All mother-infant interaction sessions were recorded on Sony 8 mm video cassettes by a Sony Video Cassette camera which was mounted on a tripod facing the experimental set-up and recording a frontal view of mothers and infants on the mat. A time line was recorded on each video record to permit precise calculation of the duration of each dependent measure in minutes, seconds and milliseconds, using a Video Timer (FOR.J VTG-22). Second-by-second and frame-by-frame coding of the video records was facilitated by a Sony VTR/TV variable speed wireless remote with shuttle function.

The free play session was timed using a stop clock, and the termination of the play session was communicated to the mother by way of a knock on a wall.

Procedure

This study was part of an ongoing longitudinal study which involved the investigation of other aspects of mother-infant interactions over time. Observations took place in the homes of the participants and the experimental interactions were videotaped. Prior to commencing the study, the mother was provided a consent form to read and sign (see Appendix A). The experimenter and mother located a quiet place in the home where the materials for the experiment could be set up. Mothers were asked to sit on the mat,

across from the toys and facing the camera. Mothers were asked not to hold their infants up in the air, so not to bring the infant out of the camera's view.

At 5 months, before the start of the 8 minute free play session, mothers were given the following instructions: "During this period, you will simply play with (*CHILD*) as you usually do, for approximately 8 minutes. You can use the toys we placed on the carpet if you wish, but there is no obligation to use them. Do you have any questions?" At 12 months, before the start of the free play session, mothers were given the same instructions. A stopwatch was used to time the free play, and the onset and offset of the interaction was communicated to the mothers by an experimenter, who tapped lightly on the wall. Mothers were also told that if at anytime they wanted to stop the study that they were free to do so. If infants fretted for a sustained period of 20 seconds (n=2), or if the mother desired to terminate the session (n=0), the experimental session was interrupted. Mothers were given the time needed to soothe, feed, change or have their infants rest. The session was restarted once the mother felt comfortable to begin again.

At the end of the experimental session, mothers completed a demographic questionnaire. This questionnaire consisted of standardized questions on general demographic information and the infant's medical history. Once the questionnaire was completed, the experimenter thanked the mother and infant for their participation in the study and mothers were given an "Infant Scientist Award" in recognition of the infant's participation. Mothers were also notified that upon completion of the study a report detailing the general findings would be mailed to their home.

Data Reduction and Coding

A coding scheme was developed to describe and evaluate the attentional strategies which mothers use with their 5- and 12- month-old infants in a free play situation which includes toys. The goal of the coding scheme was to capture the specific nonverbal or physical/gestural strategies which mothers employ to scaffold their infants' attention while playing with them. To obtain a detailed account of the strategies which mothers used with their infants, each play interaction (5 and 12 months) was coded by one-second intervals. In addition, segmenting the play into discrete units allowed for comparisons to be made within each age group and also allowed for comparisons to be made across developmental time.

The coding system consisted of seven main categories of strategies which mothers used to scaffold the attention of their infants to toys while in a play context. These categories included: 1) attention directing gestures which included the subcategories of showing, shaking/waving, tapping or pointing to a toy; 2) touching a toy(s); 3) touching a toy with the infant; 4) physically assisting the infant with a toy; 5) physically orienting the infant toward the toy; 6) giving or offering a toy to the infant; and 7) demonstrating the appropriate use or function of a toy. The attention-directing gestures, demonstrate and give or offering a toy were considered more active techniques which mothers used with toys to structure the attention of their infants, while show, touch, touch-with, physical orientation, and physical assistance were considered less active maternal strategies. Appendix B provides operational definitions of each strategy.

The coding system also consisted of two main categories of affection measures

that recorded when mothers and infants were engaged in shared positive affective interactions. These categories included: 1) active physical affection which included the subcategories of kiss, hug, caress/rub, pat, squeeze, tickle, shake, or rock the infant; and 2) passive affection which included when the mother touched her infant (excluding active physical affectionate touches) and/or maintained close physical proximity with her infant. Appendix C includes operational definitions of each of these measures.

The direction of infants' gaze was also coded by one second intervals. Infant gaze was coded when infants were looking at the toys on the mat, when their mothers hand(s) were in contact with a toy(s), and when infants were looking at their mothers' faces. A no code category was added to record the times when the coder was unable to see the infant's gaze and an ambiguous category was added to record the time when the direction of infant gaze could not be determined. Gaze categories similar to these have been reliably coded in the past (Stack & Arnold, 1998; Stack & LePage, 1996). Appendix D includes operational definitions for each gaze category.

Each play session was coded with a time line that consisted of minutes (**01**:20:12), seconds (01:**20**:12) and frames (01:20:**12**), with a total of thirty frames per second. An adjustable speed remote control was used to score the duration of each response. To reduce the potential bias arising from extraneous contextual cues during coding, all interactions were coded with no sound. Segments requiring re-coding with sound were used only to confirm two forms of physical affection (tickle and kiss) when necessary. Appendix E provides a more detailed description of the coding criteria. Once all free play interactions were coded, the data were reduced into percent duration and frequency for

each measure.

Two observers were trained on videotape examples prior to scoring the present data set until such time as they achieved a high level of reliability ($\underline{r} > 0.85$) with experienced raters. Upon completion of coding, an independent rater, blind to the hypotheses of the study, coded 20% of the records to assess inter-rater reliability. To assess the reliability of onset and offset times for each measure, Kappa coefficients (Cohen, 1968) were calculated and ranged from $\underline{r} = 0.88$ to $\underline{r}$ 0.94 (maternal nonverbal strategies, $\underline{r} = 0.88$; affective displays, $\underline{r} = .0.94$; infant gaze $\underline{r} = 0.92$).

Results

The design of the study was a 1-way repeated measures design, with Age (5 and 12 months) as the repeated factor. The dependent variables were maternal nonverbal behaviours, shared engagement states and infant gaze. Data screening at the univariate and multivariate levels was first conducted. Descriptive statistics, designed to assess the normality of the distribution, were calculated on each dependent variable to determine whether significant skewness or outliers were presented necessitating transformation of any variables. Skewness was evaluated against the numerical criterion provided by Tabachnick and Fidell (1989) and square root transformations were conducted when the descriptive statistic exceeded the proposed numerical value for all measures. Transformations were also performed if significant univariate outliers existed in the data. All dependent variables were also examined for any outliers at the multivariate level. No multivariate outliers were present in the data.

A critical alpha level of .05 was selected as the criterion for statistical

significance. To facilitate presentation of the results, only significant findings will be reported in the text, while non-significant results can be found in the tables summarizing the results of each measure located in Appendix F. Furthermore, in cases where transformations were necessary, raw means are included in the text and in Appendix G. Transformed means are located in Appendix H. However, when transformations were conducted, the F-scores and p-values cited in the text are taken from the analyses on the transformed data, as these are the findings on which the interpretations were based.

The general statistical approach consisted of four main steps. First, to assess for main effects of Sex or interaction effects for the factors of Sex and Age, separate multivariate analyses of variance (MANOVA) with Sex as a between subjects factor were conducted on the 5 and 12 month data. MANOVAs were conducted on the percent durations and frequencies of all the dependent measures for each age group. Second, to address the question of whether maternal nonverbal strategies, affectionate displays changed over time, multivariate repeated measures analyses of variance (MANOVA) were conducted on the percent durations and frequencies of all the dependent measures. MANOVAs were used as the statistical strategy because such analyses take into account the intercorrelations between the dependent variables and take into account Family-Wise Type I error. The third step consisted of following up multivariate significant effects with univariate analyses to examine differences in the dependent variables across time. Finally, correlations were conducted to address the associations between maternal nonverbal strategies and infant gaze.

MANOVAs using Sex as a between subjects factor revealed no main effects of

Sex or interactions between Sex and Age (all ps > .058). Consequently, Sex was removed from analyses and one-way repeated measures MANOVAs were conducted.

Results from the MANOVAs for the maternal nonverbal strategies are discussed first, followed by results from infant gaze, and correlations between maternal strategies and infant gaze. Finally, the results from the active and passive affection data are presented.

Maternal Nonverbal Strategies

The results from the repeated measures MANOVAs were conducted to evaluate (1a) maternal nonverbal active strategies which included shake/wave, tap, point, give and demonstrate and (1b) less active maternal nonverbal strategies which included touch, touch-with, show, physically assist, and physically orient.

A MANOVA on the percent duration of the more active maternal strategies revealed an overall multivariate significant effect of Pillais Exact F (1, 25) = 41.99, p < .001. Univariate follow-up analyses revealed significant results for: shake, F (1, 25) = 75.28, p < .001, tap, F (1, 25) = 7.57, p < .01; give F (1, 25) = 7.52, p < .001; point F (1, 25) = 17.16 , p < .001; and demonstrate F (1, 25) = 69.45, p < .001. These analyses indicated that the percentage of time mothers' spent shaking toys decreased from 5 (M = 6.40%) to 12 months (M = 0.87%). The percentage of time mothers' spent giving or offering a toy also decreased from 5 (M = 2.12%) to 12 months (M = 1.68%). The percentage of time mothers' pointed at toys, however, increased from 5 (M = 0.86%) to 12 months (M = 3.87%) as did her tapping of toys from 5 (M = 0.61%) to 12 months (M = 1.40%). Furthermore, mothers' spent more time demonstrating toys' uses or functions

from 5 (M = 22.30%) to 12 months (M = 29.56%). Figure 1 represents the means of the percent duration of the less active maternal nonverbal strategies at 5 and 12 months.

A MANOVA on the percent duration of the less active maternal nonverbal strategies yielded a multivariate significant effect of Pillais Exact F (1, 25) 10.71 = , p < .001. Univariate follow-up analyses revealed significant results for: touch, F (1, 25) = 8.91, p < .01; touch-with, F (1, 25) = 7.65, p < .01, physically assist F (1, 25) = 4.51, p < .01, and physically orient F (1, 25) = 19.45, p < .001. These analyses showed that mothers use of touch increased from 5 (M = 2.87%) to 12 months (M = 5.26%) but that their use of touch-with decreased from 5 (M = 13.91%) to 12 months (M = 8.39%). Mothers' use of the physically assist strategy decreased from 5 (M = 1.96%) to 12 months (M = 0.59%), as did their use of physically orienting their infant from 5 (M = 7.50%) to 12 months (M = 0.94%). Figure 2 represents the means of the percent duration of the less active maternal nonverbal strategies at 5 and 12 months.

MANOVA on frequency of active maternal nonverbal strategies yielded a multivariate significant effect of Pillais Exact F (1,25) = 28.28, p < .001. Univariate follow-up analyses revealed significant results for: shake, F (1, 25) = 75.28, p < .001, tap, F (1, 25) = 5.15, p < .03; point F (1, 25) = 5.28, p < .03. These analyses indicate that mothers tapped less frequently at 5 (M = 1.12) compared to 12 months (M = 2.96) and they pointed less often at 5 (M = 1.77) than at 12 months (M = 6.08). Mothers, however, shook toys more frequently when their infants were 5 (M = 10.50) than when they were 12-months-old (M = 2.15).

MANOVA on the frequency of the less active maternal attention strategies

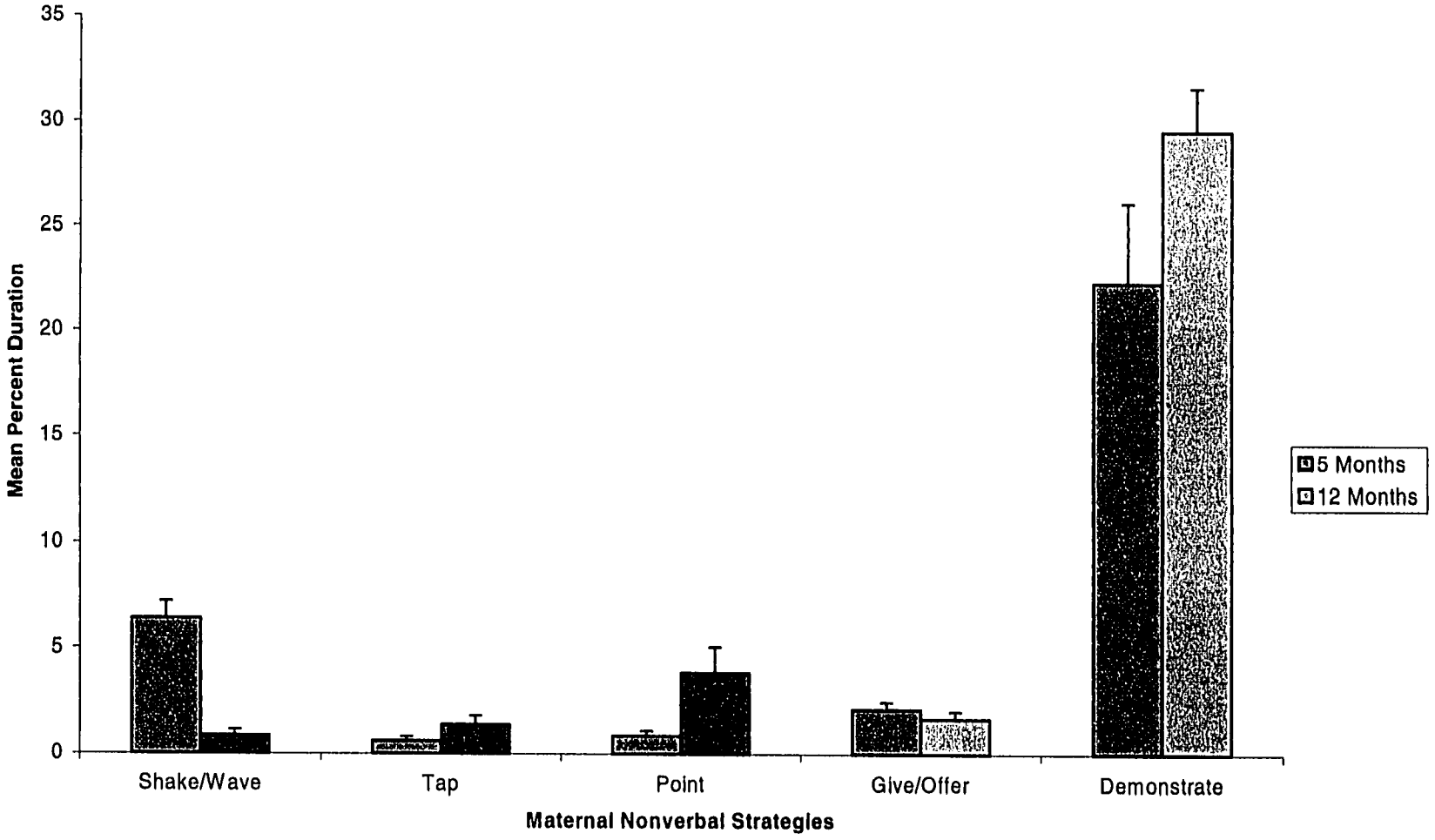

Figure 1. Mean Percent Duration of Active Maternal Nonverbal Strategies as a Function of Age (5 and 12 months)

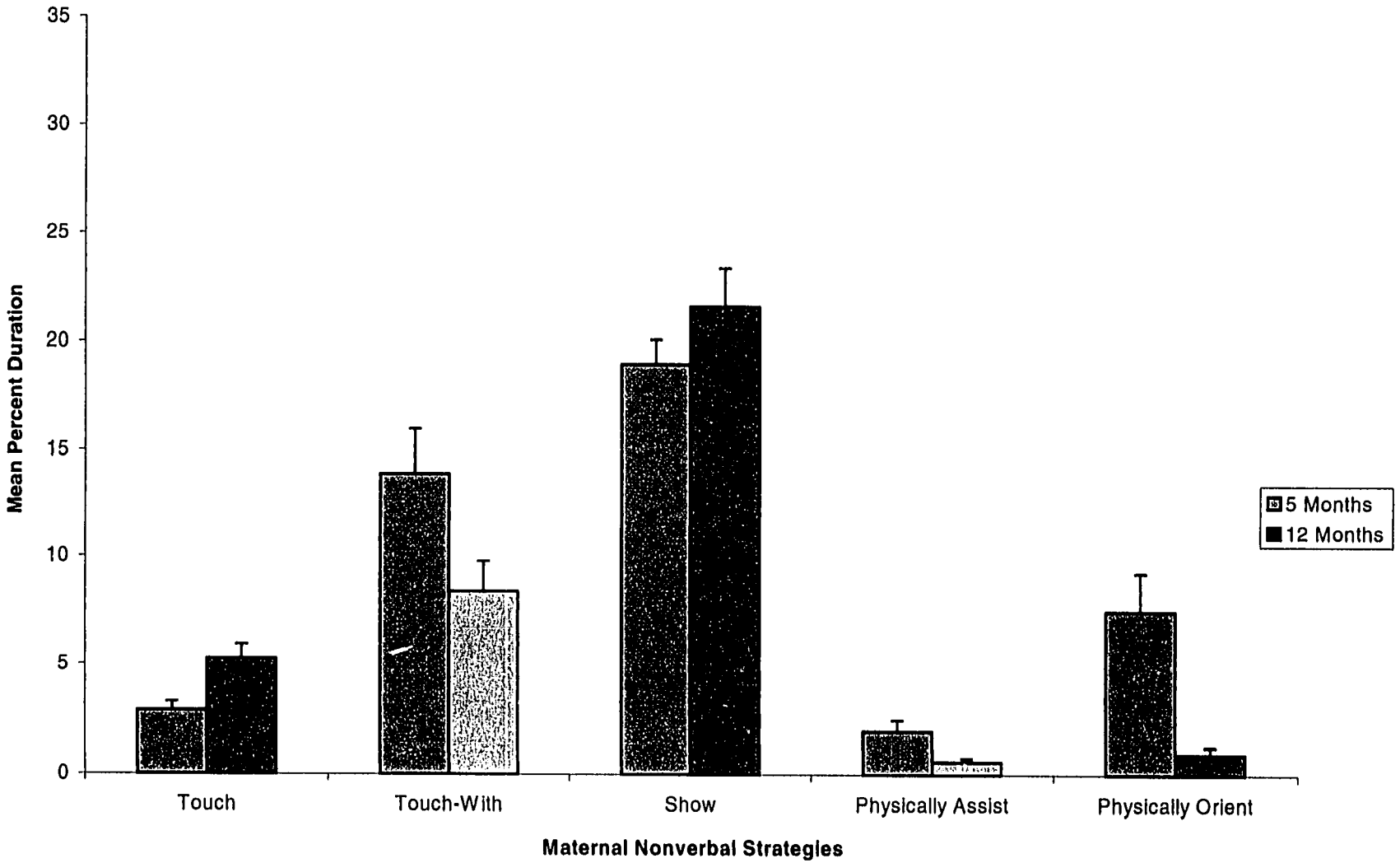

Figure 2. Mean Percent Duration of Less Active Maternal Nonverbal Strategies as a Function of Age (5 and 12 Months)

revealed a multivariate significant effect of Pillais Exact F (1,25) = 10.40, $p < .001$.

Univariate follow-up analyses yielded significant results for: touch, F (1, 25) = 8.91, $p < .01$; touch-with, F (1, 25) = 4.95, $p < .04$, physically assist F (1, 25) = 4.51, $p < .04$, and physically orient F (1, 25) = 20.20, $p < .00$. These findings indicate that mothers touched toys less frequently at 5 (M = 6.62) compared to 12 months (M = 10.96) but that their use of touch-with decreased from 5 (M = 13.96) to 12 months (M = 12.73). Mothers' use of the physically assist strategy decreased from 5 (M = 1.89) to 12 months (M = 1.20) as did their frequency of physically orienting their infant from 5 (M = 8.00) to 12 months (M = 1.12).

Infant Gaze

MANOVA on percent duration of infant gaze revealed a multivariate significant main effect of Pillais Exact F (1, 24) = 6.97, $p < .0001$. Univariate follow-up tests indicated a difference in gaze at toy, F (1,24) = 25.31, $p < .0001$ and No Code, F (1, 24) = 2.40, $p < .028$. Infants gazed at toys for less time when they were 5 (M = 30.78%) compared to when they were 12 months (M = 47.13%). In addition, the time which it was not possible to code for infant gaze decreased from 5 (M = 8.00%) to 12 months (M = 2.29%).

A MANOVA on frequency of gaze data revealed a significant multivariate effect, Pillais Exact F (1, 24) = 2.71, $p < .045$. Univariate follow-up revealed a difference in the No Code category over time F (1,24) = 9.49, $p < .005$. The frequency with which gaze could not be coded decreased from 5 (M = 4.44) to 12 months (M = 3.16).

Correlations between Maternal Nonverbal Strategies and Infant Gaze

A series of Pearson Zero Order correlations were conducted to examine the association between percent duration of maternal nonverbal strategies and infants' gaze at a toy(s) when mothers' hand(s) were in contact with it. At 5 months, infant gaze at toy when mothers' hands were in contact with it was significantly related to: touch-with, r (1, 24) = .49 p = .01; show, r (1, 24) = .50 p = .01 and the shake/wave, tap and point cluster, r (1, 24) = .44, p = .03. At 12 months, infant gaze at toy when mothers' hands were in contact with it was significantly related to demonstration of a toy's use or function, r (1, 24) = .55, $p < .01$. Correlations between frequency of maternal nonverbal strategies and infants' gaze at toy(s) did not reveal any new findings above and beyond those from the percent duration data.

Active and Passive Affection

A repeated measures MANOVA was conducted on shared engagement states which included passive and active affection. A MANOVA on the percent duration of shared states of engagement revealed an overall significant multivariate effect Pillais Exact F (1, 25) = 21.81, $p < .01$. Subsequent univariate follow-up tests revealed a significant difference in active affection F (1, 25) = 42.10, $p < .01$, illustrating that the amount of time that mothers' displayed active affection decreased significantly from 5 (M = 5.73%) to 12 months (M = 0.60%).

A MANOVA on the frequency of shared states of engagement revealed an overall significant multivariate effect Pillais Exact F (1, 25) = 31.83, $p < .01$. Univariate follow-up analyses revealed a significant difference in active affection F (1, 25) = 32.78, $p < .01$

and passive affection F (1, 25) = 56.95, $p < .01$. The results revealed that mothers displayed active affection less frequently when their infants were 5- ($M = 0.102$) compared to when they were 12-months-old ($M = 1.65$) . Furthermore, mothers displayed passive affection less frequently when their infants were 5- ($M = 0.17$) compared to when they were 12-months-old ($M = 4.92$).

Discussion

The present study was designed to address three objectives. The first was to investigate whether, and how, the use of maternal nonverbal strategies with 5- and 12-month-old infants changed as a function of age. This goal was accomplished by coding 10 different nonverbal strategies which mothers used to structure the attention of their infants. The second objective was to investigate infants' gaze behaviour and the relationship of these attentional behaviours to the types of strategies that mothers used; that is, whether the association between the strategies and infant gaze would change over time. This goal was achieved by examining infant gaze to toys when mothers were interacting with them in some way. The third objective was to investigate displays of active and passive affection between mothers and their infants and examine how they changed over time.

In general, the results from this investigation provided partial support for the hypotheses. First, it was hypothesized that mothers would use more active strategies when their infants were 5 compared to 12 months and that mothers would use the more sophisticated strategy of demonstrating the toy's use or function more frequently when their infants were 12 months. It was found that mothers used the active strategy of shake

and/or wave for longer and more frequently when their infants were 5 months of age compared to when they were 12 months of age. Mothers spent more time using the structured strategies of physical assistance, physical orientation, and give or offering of a toy at 5 compared to 12 months. Furthermore, mothers demonstrated a toy's use or function more frequently and for longer periods of time when infants were 12 months of age.

Second, it was hypothesized that infant gaze would be more highly associated with active strategies used by mothers such as pointing and shaking toys compared to the less active attentional strategies such as touching. It was also hypothesized that infant gaze would be more highly associated with instances when both mother and infant were touching a toy because this represents a time that infant and mother are more likely to be sharing attention to the same object. The findings of the present study indicated that at 5 months, infant gaze was most highly related to periods when both infants and mothers were touching a toy simultaneously. There was also an association between infant gaze and when mothers showed a toy and used the active strategies with a toy. At 12 months, infants gaze was significantly associated with toy demonstration.

Finally, it was hypothesized that both mothers' use of more active and passive forms of affection would decrease over time. It was anticipated that this would be the case because mothers would be more likely to emphasize the cognitive and teaching aspects of play over time, fostering more independent play in their infants thus decreasing their active and passive displays of affection. It was found that mothers spent more time in active affectionate displays at 5 than at 12 months, however, mothers engaged in active

and passive affection more frequently at 12 months.

Taken together, the results from the present study underscore the importance of studying nonverbal behaviours of both mothers and their infants, and suggest a significant role for such behaviours in mother-infant play interactions. Specifically, the results imply that mothers adjust the specific types of nonverbal strategies that they use with toys as a function of their infant's age, in order to optimally structure infants' attention during play. These findings are consistent with previous research using premature and Down Syndrome samples which has shown that mothers adjust their behaviours to the developmental level of their infants (McCune et al., 1994; Landry & Chapieski, 1988, 1989, 1990). In addition, it was demonstrated that during triadic interactions with their mothers and an array of toys, the associations between infant gaze and maternal strategies differed at 5 and 12 months.

The results from maternal nonverbal strategies, infant gaze and the association of infant gaze, and maternal strategies are discussed first, followed by a discussion of the affection findings.

Maternal Nonverbal Strategies and Infant Gaze

In a context where they are instructed to play with their infants as they normally would at home, mothers spent a large portion of this time engaged in techniques that acted to structure or direct the attention of their infants at both ages (77.5% at 5 months and 74.2% at 12 months). Additionally, these attentional strategies were frequently used by mothers with 5- and 12-month-old infants. Such a finding underscores one important contribution that mothers make to their developing infants' play. Over the first year of an

infant's life mothers take an active role in organizing this period of play time into interactions that help to structure the attention of their infants and into transactions that are opportunities for learning.

The concept of scaffolding (Bruner & Hickman, 1983) was mainly advanced to account for maternal support when infants are confronted with a problem to be solved such as a task that involves an object (Pêcheux et al., 1992). However, Pêcheux et al. (1992) maintain that maternal scaffolding at earlier ages may be applied to the monitoring of infants' attention by mothers. Although infants may be able to explore the external world from as young as 3 months (Berg & Berg, 1979), it may be difficult for infants to focus attention long enough to process all the information provided in the environment. As a result, parents often implement strategies to focus the attention of infants when their attention is waning. Pêcheux et al. (1992) maintain that helping an infant attend to and overcome the problem of waning attention can be considered genuine scaffolding. They also hold that if scaffolding is efficient, then infants learn to structure their own attention and consequently at a later point in time, help by parents is no longer required.

In the present study, the total percent duration that mothers spent using the attentional strategies was similar and high at both 5 and 12 months. This is in contrast to Pêcheux et al.'s (1992) finding that mothers' behaviours to encourage their infants' attention decreased over time. The inconsistency between the current findings and Pêcheux et al.'s (1992) results may be attributed to the fact that they did not examine as many individual maternal strategies as the present study. Furthermore, although the authors investigated some nonverbal attention strategies used by mothers, they also

included mothers' use of verbalizations to mobilize attention. By examining an extensive array of nonverbal maternal behaviours, the present study found differences in the amount of time and frequency with which mothers used nonverbal strategies as their infants developed.

Barnard, Bee and Hammond (1984) studied developmental changes in maternal interactions with preterm and term infants at 4, 8 and 24 months of age. They found that over time, mothers of the term infants displayed more techniques and higher levels of facilitation. Their techniques consisted of a sum of four different teaching techniques, including modeling, verbal directions, physical guidance, and physical forcing. Facilitation included the sum of mothers' timing, sensitivity, management of the materials, and positioning of the child. Among the cluster of teaching techniques and facilitatory behaviours that parallel strategies included in this study, were physical guidance and positioning of the child. However, in the present study, the amount of time and the frequency with which mothers used these two nonverbal strategies decreased over time. The discrepancy between the current results and those of Barnard et al. (1984) may be due to the fact that they analyzed their results using clusters of behaviours and included verbal and nonverbal techniques within the same categories.

While both Pêcheux et al.'s (1992) and Barnard et al.'s (1984) studies illuminate important differences in the interactive patterns of mothers and their infants and how they change over time, what these studies also show is that it is critical to study the individual components of mothers' behaviours. More specifically, it is important to independently evaluate the effectiveness of specific nonverbal strategies that mothers employ to

structure the attention of their infants and examine how they change over time. Although the present study was able to examine changes in mother-infant interactions from 5 to 12 months, it would be advantageous for future investigations to include additional time points in which to study mother-infant play interactions. Studying mothers and their infants at multiple time points would help to further elucidate the development of infant attentional behaviours and the specific qualitites and strategies of the caregiver that facilitate growth of these behaviours.

The present investigation examined specific nonverbal maternal behaviours longitudinally and found that the duration and frequency with which mothers used specific nonverbal strategies changed over time. Closer examination of the specific maternal strategies indicated that the amount of time with which mothers spent physically assisting, physically orienting their infants and giving or offering them a toy decreased from 5 to 12 months. As supported by Landry and Chapieski (1989), physical orientation of an infant by changing his or her posture and giving or offering of a toy to an infant are nonverbal techniques which are thought to provide the most structure to infant attention. This suggests that while in a free play setting with toys, mothers reduced the amount of time they spent using more structured techniques to guide the attention of their 12-month-old infants. This is consistent with the finding that as infants develop with age, they become able to sustain their attention to toys (Ruff & Lawson, 1990) and as a result, appear to require less structuring to encourage their focus on toys. Furthermore, past research findings have shown that over time, infants' exploratory competence increases (Belsky & Most, 1981). It is likely that mothers are attuned to this increase in competence

and allow their infants to independently explore toys visually or through manipulation. Accordingly, they use fewer of the more structured attention strategies to scaffold the attention of their infants at an older age.

The fact that physically orienting is a highly structured strategy is only one explanation as to why mothers reduce their use of it over time. Another possibility is that as infants grow older they have better control over their own posture (Fogel, 1993), making it less likely that mothers would physically orient the attention of their infants. Furthermore, as infants grow, they also become more mobile, allowing them to initiate play with toys more easily and to be more independent. The reduction in the amount of time that mothers used this strategy implies that they are attuned to the cognitive as well as physical developmental levels of their infants, and recognize that this type of strategy and the level of its structure is needed more at 5 than at 12 months. In their study of the effects of postural position on gaze in mother-infant face-to-face interactions, Fogel, Dedo and McCewen (1992) found that maternal manipulation of infant postural position is an essential component to examine in face-to-face interactions. The present study extends the findings of Fogel et al. (1992) by demonstrating that mothers' physical orientation of their infant's attention to toys by changing their postural position is also important within triadic interactions in young, less mobile infants.

Demonstration of a toy's use or function is an additional strategy which is thought to provide more structure to the attention of infants. Demonstrating a toy's use or function may be considered more cognitively demanding because it not only serves the function of structuring an infant's attention but it also conveys information about the

function of the toy or how the toy should be used (McCune et al., 1994). Mothers used the strategy of demonstrate more at 12 than at 5 months, providing further support for the notion that mothers adapt their behaviours to the developmental level of their infants. At 12 months of age, infants are cognitively more advanced and their skill level makes it more conducive to understanding how things work. As a result, mothers tend to use this more cognitively demanding strategy for a longer period of time.

As mentioned earlier, mothers decreased the amount of time and frequency with which they engaged in more structured attentional techniques. As such, the increase in time mothers spent demonstrating from 5 to 12 months may seem paradoxical. However, it is important to note that although this is a strategy that provides more structure to an infant's attention, it also gives mothers the opportunity to organize the interaction in ways that can also teach their infants about the function or use of a toy. Moreover, at 12 months, infant gaze was significantly related to toy demonstration, suggesting that demonstration was the most effective maternal technique at capturing infant attention at this age.

An examination of the amount of time that mothers spent using the strategy of demonstration revealed that at both 5 and 12 months, mothers used this strategy longer relative to any other strategy. This may be due to the fact that when in play interactions with their infants, mothers take an active role in: 1) encouraging the attention of their infants to toys through the use of this strategy; and 2) organizing this period of time in ways that allow them to transmit information about the toys that are in the interaction and to teach their infants different skills through toy demonstrations. For example, at 5

months, mothers often demonstrated to their infants how to hug and kiss, by hugging and kissing the plush bear. This teaches an infant about the more social and affective aspects of interaction. At 12 months, mothers often demonstrated the use of the Lego blocks by placing them together and building a tower and then taking the blocks apart. This allows children to learn about the functional use of a toy while practicing their motor and coordination skills. Such findings lend support to the notion that mothers use the free play interaction to scaffold their infants' attention and teach them.

Compared to demonstration, physical orientation, give and/or offering of a toy and physically assisting, the active attention gestures of shake, tap and point provide less structure. However, these strategies are more active in how they elicit or direct attention compared to the other strategies such as touch, show or touch-with which can be considered more passive attentional strategies.

It was hypothesized that mothers would use the active attention directing gestures more frequently and for longer amounts of time when infants were 5 months of age. It was believed that because younger infants sustain their attention for shorter periods of time, that mothers would be more likely to use these active strategies to direct their attention. This hypothesis was partially confirmed by the finding that mothers shook or waved a toy longer and more frequently at 5 months of age. Shaking or waving of a toy, although considered a less structured approach to directing infant gaze, is a highly active strategy and can be conceptualized as a behaviour that is more effective in directing and focusing attention. Mothers use of tapping increased in duration and frequency from 5 to 12 months, however, it is important to note that mothers used this strategy minimally at

both ages.

Mothers used the final active strategy, that of pointing, more frequently and for longer periods of time when their infants were 12-months-old. Similar to tapping, this strategy did not account for a large amount of mothers' behaviour relative to the frequency and the amount of time with which mothers used shaking or waving. However, the fact that mothers spent more time pointing and pointed more frequently at 12 than at 5 months is an interesting finding. Mothers may have been more likely to use this strategy at 12 months for several reasons. First, the type of play interactions that take place at 12 months provide a context within which pointing may be more likely to occur. At 12 months, books are an important feature of play interactions. In the present study for example, mothers of 12-month-olds spent a large portion of their time demonstrating, by turning the pages of the two available books and by reading to their infants. These books contained age appropriate pictoral and written content and it was observed that mothers would use the pointing gesture to direct the attention of their infants to the pages of the books.

A second explanation as to why mothers used pointing more and for longer at 12 months may be related to the cognitive complexity of this gesture. By 9 months of age, infants are capable of following simple points to objects that are near and to objects directly in front of them, and by 14 months they are able to follow more complex points, where the index finger and the target object are not in the same visual field (Messer, 1997). Accordingly, mothers may increase their use of pointing at 12 months because infants are more likely to follow these points with their eye gaze and are likely to have

begun using the pointing gesture themselves. This provides mothers with evidence that their infants understand this communicative gesture, making them more likely to use it. This explanation is consistent with previous findings that mothers and infants are both active partners in interactions and that mothers adapt their attentional strategies to the developmental and cognitive status of their infants (e.g. Landry & Chapieski, 1986).

Although mothers use of pointing and tapping increased from 5 to 12 months, infants' gaze was related to all the attention gestures (i.e., pointing, tapping and shaking or waving) at 5 months and not at any of these attention gestures at 12 months. This may be due to the fact that these strategies are more stimulating and active, and as a result more effective at capturing the attention of infants at a younger age who are not yet able to sustain their attention to toys for as long compared to older infants.

The percentage of time that mothers and infants spent using the touch-with strategy decreased from 5 to 12 months. Interestingly, at 5 months this was the strategy most highly correlated to infant gaze at toy-hand. This suggests that when both infant and mother are engaged in simultaneously touching a toy, coordinated attention may be facilitated in a triadic context that involves mothers, infants and toys. Previous research has found that before 9 months of age, infants frequently watch adults engage with an object and that this may be a potential precursor to joint attention (Corkum & Moore, 1998). The relationship of infant gaze and mothers showing, and shaking, pointing or tapping toys at 5 months, supports Corkum and Moore's (1998) observations that young infants observe their mothers while interacting with toys, further suggesting that this skill may be a precursor to joint attention.

As previously mentioned, however, when both mothers and their infants are touching a toy simultaneously, infants at 5 months are more likely to gaze at this toy. Few studies have addressed maternal behaviours that may influence the emergence and development of joint attention skills in infants. Touching a toy simultaneously may be considered a strategy that mothers use with their young infants which facilitates the emergence and development of joint attention later in infancy. Mothers and infants spent more time touching a toy simultaneously at 5 compared to 12 months and it is during these periods of time that infant gaze at hand-toy is most highly associated.

In joint attention interactions, infants divide attention between toys and their mothers while independent play involves only attention to toys. Results from the present study suggest that within this free play setting, infants were capable of engaging in coordinated attention interactions, evidenced by the relationship between infant's gaze at hand-toy and mothers' use of touch-with, show, point, shake and/or wave and tap at 5 months and demonstration of toys at 12 months. Additionally, infants attended to toys for longer periods of time at 12 months, illustrating an increased ability to attend to toys more independently. This indicates that at 12 months, infants were able to engage in periods of joint interaction with their mothers while having periods of time with which they attended to toys for longer lengths of time and played independently.

The current study found that infants increased their attention to toys as they got older. This is consistent with Pêcheux et al. (1992) who also found an increase in the total proportion of time that infants spent attending to objects, at 5 to 8 months, respectively. In the present study, the mean percent duration of infant gaze at toy increased from 5 to

12 months. These findings illustrate that there is a significant increase in infants' abilities to focus attention on objects with age. Interestingly, the study by Pêcheux et al. (1992) revealed that at 5 months, infant attention was significantly related to the percent of time and number of occurrences of mothers' mobilizing behaviours. However, at 8 months there was no longer an association between infant attention and maternal mobilizing behaviours, suggesting that at 8 months maternal support in this context is no longer needed.

The findings from the present study were somewhat consistent with Pêcheux et al. (1992). At 5 months of age, infants' gaze at toy while a mother was interacting with it was associated to when mother and infant were touching a toy simultaneously. Infant gaze at toy while a mother was interacting with it was also associated with mothers' showing toys and using active attentional gestures with the toys. In contrast to Pêcheux et al.,'s (1992) study, however, over time, infants gaze was associated with mothers' demonstration of toys. At 12 months, toy demonstration was the strategy that mothers used most. As a result, the finding that infant gaze was associated with this strategy suggests that infants were still benefitting from maternal scaffolding of attention at this time and that demonstration seemed to be the most effective strategy to structure their attention at this age. These findings further illustrate the important information that can be revealed when studying mothers and their infants in play interactions that include toys.

To obtain a sample of interactions that were representative of how mothers and their infants interact within a triadic context, age appropriate toys were chosen. However, the number of toys used at 5 and 12 months differed. At 5 months, a plush bear, rattle,

rack-a-stack and plastic book were present while at 12 months a plastic phone, tea set, doll, plastic comb and brush, Lego blocks and two books were available to mothers and their infants. The difference in the number of toys may have influenced the number and types of strategies which mothers were more likely to use with their infants. However, it is important to note that although the number of toys may have differed at 5 and 12 months, all toy categories, including functional and social, were represented at both time points. For example, the rack-a-stack at 5 months and the Lego blocks at 12 months are toys that have more functional uses whereas the plush bear at 5 months and doll at 12 months, are toys that are more social in nature.

Two of the main objectives of the present study were to: 1) investigate the nonverbal maternal behaviours which mothers implement to scaffold the attention of their infants and 2) examine changes in infant gaze over time, the relationship of infant gaze to the types of strategies that mothers used to scaffold their infant's attention, and how these associations change across time. Face-to-face investigations have demonstrated the important effect of maternal nonverbal behaviours on dyadic interactions (e.g., Stack & Arnold, 1998; Stack & Lepage, 1996), pointing to the need to further research the role of nonverbal behaviours in triadic interactions. In the second half of the first year of life, mother-infant interactions become more triadic in nature and include the use of toys in these exchanges (e.g., McCune et al., 1994). Results from the present study provide evidence to support that mothers employ a variety of nonverbal strategies to scaffold the attention of their infants while playing with their infants in a free play context that includes toys. Furthermore, results demonstrate that mothers change the type, amount of

time, and frequency with which they use these strategies over time, adjusting their behaviours to the age of their infants. The findings from this study also illustrate that infants' gaze at toy increased with age and the relationship between mothers' nonverbal behaviours used to structure the attention of their infants and infant gaze changed over time.

It is important to note, however, that communicative interactions between mothers and their infants are complex and multimodal. Mothers express their communicative intentions through both verbal and nonverbal modalities. Likewise, the behaviours of infants are varied and there is a growing recognition that to represent the complexity of infant responding, multiple indices must be studied. While other studies have addressed maternal verbal behaviours, the present study did not investigate maternal verbalizations. As a result, it was not possible to isolate the role of verbal behaviour and the effect of maternal verbalizations on the direction of infant gaze. Future research in play should examine the various streams of communication available to infants and their mothers and the interplay of these various modalities in mother-infant play interactions. Furthermore, potentially important directions to pursue include the examination of co-occurrences of maternal strategies and infant behaviours and the sequencing of behaviours during triadic interactions. Sequential analyses of both maternal and infant behaviours can reveal which behaviours follow other behaviours during an interaction. For example, examining sequencing of behaviours would show how gaze direction was related to maternal strategies at specific times. Notwithstanding the importance of future directions, the present study was a first step in providing valuable information about the nonverbal

behaviours that mothers and infants use to communicate while in play interactions.

Affection and Affectionate Displays

In addition to the scaffolding behaviours of mothers and the emerging attentional abilities of infants which are evident in play interactions, affective components of play interactions between mothers and infants were examined in the present study. Affectionate behaviours, and physical proximity and contact are essential ingredients of early infant development (Zanolli, Saudargas & Twardosz, 1997). However, relatively little is known about the role of these behaviours in mother-infant play interactions and how they develop over time. Much of what is known about the development of affectionate nonverbal displays such as smiling and touch is from studies of face-to-face interactions (Zanolli et al., 1997).

The present study found that while mothers spent a significantly longer time displaying active affection such as kissing, hugging and rubbing their infants at 5 than at 12 months, their frequency of both active and passive affection increased over time. These results were not consistent with the hypothesis that the amount of time and frequency with which mothers displayed both passive and active affection would decrease over time. The increase in affectionate displays over time may be due to the fact that although mothers engaged in fewer active affectionate displays at 5 months, they spent a significantly longer time using these active affectionate behaviours. The increase in frequency of passive affection at 12 months may be because mothers and infants at this age were more likely to shift from periods of being in closer proximity to each other to times when they were further away. At 12 months, infants were more likely to shift their

own body position and move around on the mat, making mothers shift their proximity to their infants more often. This might explain why the frequency of passive affection increased from 5 to 12 months. Interestingly, no differences were found in the duration of time that mothers and infants remained in close physical proximity, suggesting that despite an infant's age, mothers maintained close contact with their infant throughout the play interaction.

In their study of cultural differences in physical contact between Hispanic and Anglo mother-infant dyads living in the United States, Franco et al. (1996), found that there were no overall differences in physical contact between the two cultures. However, Hispanic mothers displayed more close touch and more close affectionate touch compared to Anglo mothers who showed more distal touch. By examining their results in a more general context, however, their findings reveal that mothers engage in a high level of physical contact with their infants. The findings from the present study and those from Franco et al. (1996) illustrate that physical contact and proximity, and affectionate behaviours are recognized by mothers as essential ingredients of early communication with their infants.

The findings from the current investigation offer new information about some of the affectionate behaviours that occur between mothers and their infants in a free play setting and how they change as infants develop. These results point to important avenues to investigate in order to advance our understanding of the role of affection in mother-infant interactions. Additional studies are needed to further elucidate the nonverbal and verbal components of the mother-infant affectional system, especially within a free play

context. Furthermore, studying the development of nonverbal affectionate displays in infants such as kissing and hugging can provide important information about the role of infant affectionate behaviours in mother-infant interactions.

Mother-infant games are also periods of time in which affective sharing and mutual positive engagement between the dyad are present (Fogel, 1994). Although some research is available on the development of mother-infant games (e.g., Flanders, Cronk & Gourde, 1995), additional research can provide useful information about how infants learn the structure of games, and the nature of the alternation in participation around a joint focus of attention (Flanders et al., 1995). Furthermore, mother-infant games provide a context within which maternal scaffolding of infant game skills can be studied. This would be of particular importance because studies have shown a relationship between social games and language acquisition in children (e.g., Hodapp, Golfield & Boyatzis, 1984).

Concluding Remarks

Taken together, the findings from the present study underscore the important role of nonverbal maternal behaviours in scaffolding the attention of infants while in triadic play interactions and their influence on infant gaze responses. The present study provides further evidence that nonverbal behaviours are an important part of the repertoire of maternal behaviours which encourage early attentional competencies in infants and help in their adaptation to the social world (Papousek & Papousek, 1987; Koester et al., 1989). Mothers were found to adapt the specific types of nonverbal strategies that they used with toys as a function of their infants' age. The changes in the type of strategies that mothers

used and alterations in the amount of time and frequency with which they used these techniques attest to mothers' being attuned to the development of their infants, adapting their behaviours in a way that maximally supports their infants' development.

Mothers actively organize play interactions in a way that scaffolds the attention of their infants while teaching and guiding their learning and development of different skills. At the same time, mothers maintain their ability to communicate emotionally with their infants by framing the play time in a way which includes the sharing of affective information and sharing of positive states of engagement. Together, the results from the present study demonstrate the emergence of multiple components of play, including the cognitive, social and emotional aspects and how mothers integrate these various components of play in ways that are both sensitive and attuned to the developmental level of their infants. Furthermore, the present study implies the important contribution of mothers in structuring play interactions in a way which maximally benefits the cognitive, social and emotional growth of their infants.

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Appendix A

Consent Forms

Consent Form
Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social interchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes. In the first part, my baby will be seated in an infant seat directly facing me. The procedure will consist of several interaction periods, each lasting two to three minutes in length, during which time I will be asked to interact in different ways with my baby. During some periods I will be asked to interact with my baby as I normally do, while in others I will be asked to pose a neutral, still facial expression and remain silent for a brief period. There will be brief breaks separating the interaction periods. In the second part, my baby and I will play together on a carpeted floor for approximately 8 minutes in a designated area, during which time I will be asked to play with my baby as I normally would at home. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be asked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest of confidence and are not shown to others without my permission.

I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential. I am also aware that I may be asked to participate again when my baby is 12 and 18 months of age.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-7565), Dr. Lisa Serbin (848-2255) or Dr. Alex Schwartzman (848-2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Lianne Brown (340-8222). She can be contacted should you have any questions regarding your rights as a research volunteer:

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby _____ to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of infant: _____ Date: _____

Parent's signature: _____ Date: _____

Witness: _____ Date: _____

Consent Form
Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social interchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes, divided into two main parts. The first part will consist of a period of free play in which my child and I will play together for approximately 15 minutes. The second part will also be a play period, but it will include a series of different activities lasting approximately three minutes for each activity. These observation periods will be separated by short pauses. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be aked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest of confidence and are not shown to others outside of the research context without my permission.

I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-7565), Dr. Lisa Serbin (848-2255) or Dr. Alex Schwartzman (848-2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Lianne Brown (340-8222). She can be contacted should I have any questions regarding my rights as a research volunteer.

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby _____ to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of infant: _____ Date: _____

Parent's signature: _____ Date: _____

Witness: _____ Date: _____

Appendix B

Operational Definitions of Maternal Nonverbal Strategies

Operational Definitions for Maternal Nonverbal Behaviours
(Adapted from Landry and Chapieski, 1989)

1. Attention Directing Gestures: touch; touch with; shake/wave; tap; point

a) Touch:

1. Bringing a hand or hands into contact with an object . For example, when a mother moves a toy away from her infant, rearranges toys or repositions a toy.

2. Bringing numerous toys closer to the infant sequentially or simultaneously with no breaks is coded as a touch. Take context into account! Bringing one toy closer is coded as a show.

3. This code is only used when the mother is **not** interacting with the toy to: show, wave/shake, tap, or point.

4. This code is only used when the mother is **not** physically assisting or physically orienting her infant or giving/offering a toy to her infant.

b) Touch with:

1. Bringing a hand or hands into contact with an object when the infant is also touching the object. For example, touching the rattle while the infant is playing with it.

2. When the infant brings his/her hand into contact with the toy when the mother is touching, showing, shaking/waving, taping, or pointing at it.

3. Touching the infant with an object. For example, placing rings on the infant's arm or leg (this example would also include a simultaneous show code).

c) Show:

Holding or moving an object in the view of the infant but not waving/shaking, tapping, or pointing to the object. For example, when a mother brings a toy within the field of vision or brings a toy within the reach of her infant.

d) Shake/Wave:

Holding an object in the view of the infant while moving it back and forth and/or in up and down movements.

e) Tap:

Touching an object or part of a body with a finger(s) in a light stroke movement. The finger(s) is often moved in a sequence of a touch, no-touch, touch.

f) Point:

Extending a finger to indicate the position, characteristic etc. of a toy or object. The finger is frequently extended in a static position, moved side to side or moved along the object. Points may be accompanied by a tap.

3. Physically Orient:

Physically directing the infant by repositioning the body i.e. changing the infant's posture or repositioning part of the infant's body (e.g. arm or leg). When there is a change in posture, record what posture the infant was placed in.

4. Physically Assist:

Physically assisting the infant by repositioning the hand, holding the infant's hand/wrist/arm and guiding an action, or molding the infant's hand to an object. Record this code in the column of the toy which the mother is assisting her infant with. For example, when a mother holds her infant's wrists and shakes while holding the rattle. If the mother is physically assisting a function of the toy, then a simultaneous code of demonstration is to be coded.

5. Give/Offer:

Placing an object in the *hand(s)* of or on the *lap/leg* area of the infant.
To differentiate give/offer from touch with, a give/offer is frequently accompanied by the infant holding his/her hand out or placing his/her hand on a toy and the mother letting go of the toy within a few seconds after the infant grasps the toy.
If mother releases the toy in less than or equal to three seconds, then it is coded as a give/offer. If the mother releases the toy in more than three seconds then it is coded as a touch with.
Ambiguous instance: mother gives/offers but child does not take it with his/her hand. This is coded as a touch with when both are touching the toy.

6. Demonstrate: Illustrating the appropriate use or function of an object:

5 months	12 months
Rattle: **Roll ball on rattle** **Shake rattle** **Book:** **Open/Close book** **Turn pages of book** **Hold book open** **Squeeze book (noise/ no noise)** **Rings:** **Take rings off stand** **Put rings back on stand** **Rocking the Rack-a-stack back and forth** **Stack rings on the ground** **Bear:** **Hug, Kiss or Caress**	**Telephone:** **Hold phone to own or infants ear** **Talk on phone** **Hang up phone** **Press buttons on phone** **Books:** **Open/Close book** **Hold book open** **Turn pages of book** **Doll & comb/brush set:** **Cradle doll** **Comb/brush dolls hair** **Feed doll** **Hug or Kiss doll** **Wave hands of doll** **Brush/comb infants hair with brush/comb** **Tea set:** **Stir with spoon** **Eating with spoon/plate** **Drink with cup** **Pour into cup (sugar pot/creamer) with kettle** **Add sugar/milk to cup** **Put cup on plate/saucer** **Open and close lid on kettle/sugar pot** **Blocks:** **Put Lego pieces together** **Pull Lego pieces apart**

Appendix C

Operational Definitions of Active and Passive Affection

Operational Definitions of Active and Passive Affection

1. **Active displays of affection:** kiss; hug; caress/rub; pat; squeeze; tickle; shake, rock, poke

- Any display of physical affection that is done with a toy (e.g tickle infant with the rattle) is to be coded under the appropriate toy column. Any display of affection without the use of a toy is to be coded under the infant column.

- A code of *touch with* is not to be coded when the mother actively displays physical affection with a toy. It is assumed that the mother is touching the infant with the toy.

- Often a mother's hand may be somewhat obscured by the position her infant is in. When necessary, confirm a display by looking at the movement of the mother's arm(s) up till the elbow.

2. **Passive affection:**

- When the mother touches her infant (excluding active physical affectionate touches) and/or maintains close physical proximity with her infant. For example, this coded is recorded when the infant is sitting between the mother's legs and they are touching.

Appendix D

Operational Definitions of Infant Gaze

Operational Definitions for Infant Gaze

(1) **Face:** Infant is looking at the mother's face and surrounding facial area.

(2) **Toy:** Infant is looking at a toy.

(3) **Toy Combination:** Infant is looking in a direction where there is more than one toy, and it cannot be differentiated which toy the infant is looking at. This code was also used when within a 1-second interval, the infant's gaze shifts to > 2 toys.

(4) **Hand/Toy:** Infant is looking at a toy while mother's hand(s) are in contact with the toy.

(5) **No Code:** Infant gaze cannot be coded because infants' eyes are not visible.

(6) **Ambiguous:** This code is used when the direction of infant gaze cannot be determined.

Appendix E

Detailed Coding Criteria

Mother-Infant Interactions Within a Free Play Context

Play is an important context in which an infant's cognitive, and socioemotional development takes place. Early caregiver-infant interactions are often in the form of dyadic play which involves the infant and caregiver, and triadic play which includes the addition of an object(s) or toy(s). These play interactions help infants learn about and participate in communication with their caregivers. They also allow infants to learn about how to attend to another person or object in the environment and how to coordinate their attention between an object and a person. Accordingly, early caregiver-infant play interactions are affected by the caretaker's ability to adapt their behaviours and strategies to the infant's changing cognitive and attentional abilities.

The present coding scheme was developed in part, to describe and evaluate the attentional strategies which mothers use with their 5-and 12-month-old infants in a free play situation which includes toys. The goal of the present coding scheme is to capture the specific nonverbal or physical/gestural strategies which mothers employ to scaffold their infant's attention while playing with them. To obtain a detailed account of the strategies which mothers use with their infants, each play interaction (5 and 12 months) is coded by one-second intervals. In addition, segmenting the play into discrete units allows for comparisons to be made at each age group and also allows for comparisons to be made across developmental time.

The coding system consists of five main categories of strategies which mothers use to scaffold the attention of their infants while in a play context with toys. These categories include: 1) attention directing gestures which includes the subcategories of touching a toy(s), touching a toy with the infant, showing, shaking/waving, taping or pointing to a toy, 2) physically assisting the infant with a toy, 3) physically orienting the infant, 4) giving or offering a toy to the infant and 5) demonstrating the appropriate use or function of a toy.

The coding system also consists of two main categories of affection measures that record when mothers and infants are engaged in shared positive affective interactions. These categories include: 1) active physical affection which includes the subcategories of kiss, hug, caress/rub, pat, squeeze, tickle, shake, rock or poke the infant, and 2) passive affection includes when the mother touches her infant (excluding active physical affectionate touches) and/or maintains close physical proximity with her infant.

Maternal behaviours that are not within the field of vision of the infant are not to be coded and affection measures that are not within the view of the camera are not to be coded. When obtaining start and stop times of all the measures, the coder should try to obtain times that accurately represent the physical strategies of mothers and the relational measures while leaving the minimum number of seconds unaccounted for. Each play session is coded with a time line that consists of minutes (**01**:20:12), seconds (01:**20**:12) and frames (01:20:**12**), with a total of thirty frames per second. Minutes and seconds are

recorded when indicating start and stop frames, but frames are not recorded. Frames must be taken into account because they are crucial for rounding purposes and to obtain an accurate measurement of the duration of behaviours. The fifteenth frame is used as the midpoint. Start and stop times of behaviours are coded as the following: behaviours that start or stop between 1 and 14 frames are rounded down to the nearest second (for example, 00: 06: 13 ~ 00:06 and 00:06:03 ~ 00:06), behaviours that start or stop between 15 and 29 frames are rounded up to the nearest second (for example, 00:06: 20 ~ 00:07; 00:06:15 ~00:07). The purpose of this scheme is to record distinct maternal and relational behaviours by second. However, because pauses occur in the natural flow of play this scheme allows for breaks and pauses. Accordingly, brief pauses of one or less than one-second *between* behaviours are not to be coded. For example, shake - pause - shake. If the pause between behaviours is equal to or less than one second then a code of shake is continued through this one second interval. If the break is greater than one second then the appropriate code is recorded.

All interactions are coded with no sound. Segments requiring re-coding with sound are to confirm two forms of physical affection (tickle and kiss) when necessary. Some of the codes in the scheme are not mutually exclusive and as a result should not be coded simultaneously. Show should not be coded with any of the following codes: shake/wave, tap or point. These are more defined attentional strategies, which describe more specifically what is done with a toy while the mother is *showing* it. Show should not be coded with demonstrate because it is understood that while a toy's use or function is demonstrated that the toy is also being *shown* to the infant. Physically assist should not be coded with the touch with code unless the mother is also touching the toy with her hand (not the same one she is assisting with if she is only using one hand).

Functional maternal behaviours are not to be coded. For example, blowing the infant's nose, removing a hair from the infant's body or wiping the infant's mouth are instances of maternal behaviours that should not be coded. Touches that occur because of play interaction should not be coded. For example, when a mother touches a toy on her way to picking up another toy.

Appendix F

MANOVA and Univariate Follow-Up Summary Tables for Maternal Nonverbal Strategies, Infant Gaze, and Active and Passive Affection

Table F1

Multivariate Analysis of Variance and Univariate Follow-up Tests for Percent Duration of Active Maternal Nonverbal Strategies

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.91	5	21	41.99**

Shake

Source	SS	df	MS	F
ANOVA				
Age	13.58	1	0.54	75.28**

Tap

Source	SS	df	MS	F
ANOVA				
Age	9.26	1	0.37	7.57*

Give/Offer

Source	SS	df	MS	F
ANOVA				
Age	42.87	1	1.71	7.52**

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

Table F1 continued

Demonstration

Source	SS	df	MS	F
ANOVA				
Age	2954.35	1	118.17	69.45**

Point

Source	SS	df	MS	F
ANOVA				
Age	16.6	1	0.66	17.16**

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

Table F2

Multivariate Analysis of Variance and Univariate Follow-up Tests for Percent Duration of Less Active Maternal Nonverbal Strategies

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.71	5	21	10.71**

Touch

Source	SS	df	MS	F
ANOVA				
Age	209.24	1	8.37	8.91**

Touch-With

Source	SS	df	MS	F
ANOVA				
Age	31.98	1	1.28	7.65**

Show

Source	SS	df	MS	F
ANOVA				
Age	2070.55	1	82.82	1.07

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

Table F2 continued

Physically Assist

Source	SS	df	MS	F
ANOVA				
Age	18.18	1	0.73	4.51*

Physically Orient

Source	SS	df	MS	F
ANOVA				
Age	43.05	1	1.72	19.45**

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

Table F3

Multivariate Analysis of Variance and Univariate Follow-up Tests for Percent Duration of Less Active Maternal Nonverbal Strategies

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.71	5	21	10.71**

Touch

Source	SS	df	MS	F
ANOVA				
Age	209.24	1	8.37	8.91**

Touch-With

Source	SS	df	MS	F
ANOVA				
Age	31.98	1	1.28	7.65**

Show

Source	SS	df	MS	F
ANOVA				
Age	2070.55	1	82.82	1.07

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

Table F3 continued

Physically Assist

Source	SS	df	MS	F
ANOVA				
Age	18.18	1	0.73	4.51*

Physically Orient

Source	SS	df	MS	F
ANOVA				
Age	43.05	1	1.72	19.45**

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

Table F4

Multivariate Analysis of Variance and Univariate Follow-up Tests for Frequency of Less Active Maternal Nonverbal Strategies

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.71	5	21	10.40**

Touch

Source	SS	df	MS	F
ANOVA				
Age	209.25	1	8.37	8.91**

Touch-With

Source	SS	df	MS	F
ANOVA				
Age	2001.29	1	80.05	4.95*

Show

Source	SS	df	MS	F
ANOVA				
Age	2070.55	1	82.82	1.07

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

Table F4 continued

Physically Assist

Source	SS	df	MS	F
ANOVA				
Age	18.19	1	0.73	4.51*

Physically Orient

Source	SS	df	MS	F
ANOVA				
Age	607.41	1	24.3	20.20**

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

Table F5

Multivariate Analysis of Variance and Univariate Follow-up Tests for Percent Duration of Infant Gaze

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.69	6	19	6.97**

Face

Source	SS	df	MS	F
ANOVA				
Age	18.21	1	0.76	2.85

Toy

Source	SS	df	MS	F
ANOVA				
Age	3165.65	1	131.9	25.32**

Hand/Toy

Source	SS	df	MS	F
ANOVA				
Age	4378.38	1	182.43	2.1

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

Table F5 continued

Toy Combination

Source	SS	df	MS	F
ANOVA				
Age	295.04	1	12.3	0.66

No Code

Source	SS	df	MS	F
ANOVA				
Age	57.51	1	2.4	5.46*

Ambiguous

Source	SS	df	MS	F
ANOVA				
Age	10.36	1	0.43	0.39

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

Table F6

Multivariate Analysis of Variance and Univariate Follow-up Tests for Frequency of Infant Gaze

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.46	6	19	6.97*

Face

Source	SS	df	MS	F
ANOVA				
Age	36.55	1	1.52	0.47

Toy

Source	SS	df	MS	F
ANOVA				
Age	3259.88	1	286.6	3.56

Hand/Toy

Source	SS	df	MS	F
ANOVA				
Age	854.92	1	135.83	3.72

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

Table F6 continued

Toy Combination

Source	SS	df	MS	F
ANOVA				
Age	281.76	1	35.62	0.41

No Code

Source	SS	df	MS	F
ANOVA				
Age	74.17	1	11.74	9.49*

Ambiguous

Source	SS	df	MS	F
ANOVA				
Age	10.36	1	3.09	2.62

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

Table F7

Multivariate Analysis of Variance and Univariate Follow-up Tests for Percent Duration of Active and Passive Affection

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.65	2	24	21.81**

Active Affection

Source	SS	df	MS	F
ANOVA				
Age	15.31	1	0.61	42.10**

Passive Affection

Source	SS	df	MS	F
ANOVA				
Age	22088.97	1	883.56	0.48

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

Table F8

Multivariate Analysis of Variance and Univariate Follow-up Tests for Frequency of Active and Passive Affection

Source	Pillais	df	$df_{(error)}$	Multivariate F
MANOVA				
Age	0.73	2	24	31.83**

Active Affection

Source	SS	df	MS	F
ANOVA				
Age	8.04	1	0.32	32.78**

Passive Affection

Source	SS	df	MS	F
ANOVA				
Age	129.18	1	5.17	56.95**

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

Appendix G

Raw Means for Percent Duration of Maternal Nonverbal Strategies, Infant Gaze, and Active and Passive Affection

Table G1

Raw Means for Percent Duration of Maternal Nonverbal Strategies

	5 months	12 months
Touch	2.87 (0.40)	5.26 (0.68)
Touch With	13. 91 (2.10)	8.39 (1.40)
Show	19.01 (1.10)	21.63 (1.78)
Shake/Wave	6.40 (0.82)	0.87 (0.29)
Tap	0.61 (0.20)	1.40 (0.41)
Point	0.86 (0.25)	3.87 (1.20)
Give/Offer	2.12 (0.35)	1.68 (0.35)
Demonstrate	22.30 (3.85)	29.56 (2.04)
Physically Assist	1.96 (0.50)	0.59 (0.16)
Physically Orient	7.50 (1.75)	0.94 (0.33)

Note. Numbers in parentheses indicate standard errors

Table G2

Raw Means for Frequency of Maternal Nonverbal Strategies

	5 months	12 months
Touch	6.62 (0.84)	10.96 (1.29)
Touch-With	13. 96 (1.33)	12.73 (1.27)
Show	19.01 (1.10)	22.15 (1.73)
Shake/Wave	10.50 (1.20)	2.15 (0.58)
Tap	1.12 (0.37)	2.96 (0.65)
Point	1.77 (0.41)	6.08 (0.99)
Give/Offer	5.58 (0.83)	5.81 (0.70)
Demonstrate	11.89 (1.08)	18.39 (1.71)
Physically Assist	1.89 (0.49)	1.20 (0.30)
Physically Orient	8.00 (1.30)	1.12 (0.28)

Note. Numbers in parentheses indicate standard errors

Table G3

Raw Means for Percent Duration of Infant Gaze

	5 months	12 months
Face	3.59 (1.14)	1.60 (0.42)
Toy	30.78 (2.49)	47.13 (2.02)
Hand/Toy	32.24 (2.70)	37.77 (1.71)
Toy Combination	6.16 (0.80)	5.35 (0.70)
No Code	8.00 (2.48)	2.29 (0.62)
Ambiguous	0.78 (0.32)	0.38 (0.10)

Note. Numbers in parentheses indicate standard errors

Table G4

Raw Means for Frequency of Infant Gaze

	5 months	12 months
Face	6.96 (1.64)	5.20 (1.13)
Toy	49.12 (4.85)	57.48 (2.27)
Hand/Toy	31.28 (2.71)	37.64 (1.73)
Toy Combination	12.28 (1.49)	11.20 (1.30)
No Code	4.44 (0.94)	3.16 (0.83)
Ambiguous	1.56 (0.43)	1.16 (0.32)

Note. Numbers in parentheses indicate standard errors

Table G5

Raw Means for Percent Duration of Active and Passive Affection

	5 months	12 months
Active Affection	5.73 (1.50)	0.60 (0.15)
Passive Affection	67.35 (4.55)	73.08 (6.32)

Note. Numbers in parentheses indicate standard errors

Table G6

Raw Means for Frequency of Active and Passive Affection

	5 months	12 months
Active Affection	0.10 (0.13)	1.65 (0.39)
Passive Affection	0.17 (0.02)	4.92 (0.63)

Note. Numbers in parentheses indicate standard errors

Appendix H

Transformed Means for Frequency of Maternal Nonverbal Strategies, Infant Gaze, and Active and Passive Affection

Table H1

Transformed Means for Percent Duration of Maternal Nonverbal Strategies

	5 months	12 months
Touch-With	3.53 (0.24)	2.66 (0.23)
Shake/Wave	2.41 (0.15)	0.64 (0.14)
Tap	0.48 (0.12)	0.94 (0.14)
Point	0.63 (0.14)	1.57 (0.20)
Give/Offer	--	1.12 (0.13)
Demonstrate	4.45 (0.36)	--
Physically Assist	1.03 (0.19)	0.53 (0.11)
Physically Orient	2.29 (0.30)	0.68 (0.14)

Note. Numbers in parentheses indicate standard errors

Table H2

Transformed Means for Frequency of Maternal Nonverbal Strategies

	5 months	12 months
Shake/Wave	2.41 (0.15)	0.63 (0.14)
Point	--	6.08 (0.99)
Demonstrate	--	5.21 (0.31)
Physically Assist	1.03 (0.19)	0.53 (0.11)
Physically Orient	--	0.68 (0.14)

Note. Numbers in parentheses indicate standard errors

Table H3

Transformed Means for Percent Duration of Infant Gaze

	5 months	12 months
Face	1.42 (0.26)	1.00 (0.16)
No Code	2.12 (0.36)	1.17 (0.19)
Ambiguous	0.54 (0.14)	0.43 (0.09)

Note. Numbers in parentheses indicate standard errors

Table H4

Transformed Means for Frequency of Infant Gaze

	5 months	12 months
Face	2.13 (0.32)	1.89 (0.26)
No Code	--	1.46 (0.21)
Ambiguous	--	0.76 (0.16)

Note. Numbers in parentheses indicate standard errors

Table H5

Transformed Means for Percent Duration of Active Affection

	5 months	12 months
Active Affection	1.99 (0.22)	0.59 (0.10)

Note. Numbers in parentheses indicate standard errors

Table H6

Transformed Mean for Frequency of Active Affection

	5 months	12 months
Active Affection	--	1.00(0.16)

Note. Numbers in parentheses indicate standard errors