Maternal Nonverbal and Verbal Scaffolding of Infant Attention during Toy-Centered Play:

Influences of Toy-Type, Age and Birth Status

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ABSTRACT

Maternal Nonverbal and Verbal Scaffolding of Infant Attention during Toy-Centered Play: Influences of Toy-Type, Age and Birth Status

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The purpose of the current thesis which consists of a three-part study was to investigate the *nonverbal* and *verbal* attention-scaffolding behaviours mothers employ during toy play with their infants, and to evaluate changes in these behaviours and infant gaze according to infant age, birth status and toy-type. Toy-types included books and toys with functional and/or social properties. Two groups of mother-infant dyads were investigated at 5½- as well as 12- and 18-months while they interacted during a free play period with toys; infants born fullterm, normal birthweight (FT-NBW) or preterm, very-low- birthweight (PT-VLBW). In Part I, nine maternal *nonverbal* behaviours (e.g. shake, point, demonstrate) and infant gaze direction were studied. At 5½ months, many nonverbal behaviours were used for longest with one of the toys that had functional properties, and infants gazed at toys with functional properties for longer. At 12 and 18 months, nonverbal behaviours were used for longer with a socially-oriented toy, and infants gazed at socially-oriented toys for longer. Mothers of PT-VLBW infants used some nonverbal behviours for longer at 5½ and 12 months.

In Part II, four categories of maternal *verbal* behaviours were studied (i.e. attention, labeling, characteristic and function). At 5½ months, attention verbalizations were used for the longest time overall, and in general, verbalizations were used for longer with toys that had functional properties compared to other toys. At 12 and 18 months, function verbalizations were used for longest with most toys, particularly books, and overall, verbalizations were utilized for longer with toys that had social compared to functional properties. At 5½ months, mothers of FT-NBW infants used labeling

verbalizations for longer and at 12 months, they used attention and function verbalizations for longer than mothers of PT-VLBW infants.

In Part III, the link between maternal nonverbal and verbal behaviours was evaluated by comparing how mothers used their time while engaged with nonverbal and verbal behaviours. Overall, mothers used nonverbal compared to verbal behaviours for significantly longer to scaffold their infants' attention towards toys. Together, this three-part study provides a greater understanding of the multimodal nature of maternal scaffolding, and the interplay between physical and social factors during mother-infant toy-centered play.

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"Life's a Great Balancing Act" , *Dr. Seus, Oh the Places You'll Go!*

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Chapter 1. General Introduction

Play is a basic human activity that is complex, multidimensional and variable (Fogel, Nwokah & Karns, 1993). The structure and function of play changes over the human lifespan such that in adulthood, play is generally regarded as something done for enjoyment or pleasure, and the value placed on work is greater than that placed on play (Rowlands, 1999). However, in infancy and childhood play is a primary way in which infants and young children learn about themselves, their social surroundings and the world, and playful interactions between children and caregivers have been shown to be fundamental to child growth (Power, 2000). According to an evolutionary perspective, play has a serious purpose in development because it enables infants and children to acquire environmentally adaptive behaviours in a relatively low-risk manner (Pellegrini, Dupuis & Smith, 2007). From this perspective, the function of play is viewed as developmental scaffolding. That is, playful engagement with the environment allows infants to acquire the skills, knowledge and experience that are necessary for adulthood (Sheridan, Foley & Radlinski, 1995; Smith, 1982). Parents engage their children in play in order to assist the development of their skills and as they grow, the scaffolding and time spent in play diminishes (Bateson, 2005).

Play has been acknowledged as central to infant and child development; however, its definition has been historically difficult (Gottfried, 1986; Johnson, Christie & Yawkey, 1999; Malone, 1999). Although play can typically be recognized, it is a challenge to describe what characteristics facilitate this recognition because play is wide-ranging, and consists of a varied repertoire of behaviours (Göncü & Gaskins, 2006). Play also occurs in a number of different forms, including exploratory, object-oriented, and imaginative, and can be solitary, parallel or social (Power, 2000). Social play between caregivers and their infants emerges soon after infants are born and predominates early caregiver-infant interactions. It is generally agreed upon that social

play includes structure and variation, positive emotional expression and lacks a recognizable purpose beyond its own boundaries (Smith & Vollstedt, 1985; Smith, Takhvar, Gore & Vollstedt, 1985).

Several other common qualities of play have been raised in the literature (Garvey, 1977; Malone, 1999; Rubin, Fein & Vendenberg, 1983). Firstly, play unfolds due to intrinsic motivation rather than extrinsic motivation such that play occurs because it is enjoyable and not as a result of external demands or reinforcers. Secondly, the focus of play is on the activity or interaction itself and not on the end result of the activity. Thirdly, play affords children opportunities to learn meaning and action associated with objects in a manner that is not bound by rules. Finally, infants and children are active participants in play and use the communicative abilities they have available to them to be actively involved with their play partners. The involvement of infants in play changes as they grow such that young infants' initial participation in interactions with their more experienced play partners and toys takes place through active visual, oral, and manual exploration of toys and onlooking.

During the latter half of the first year of life, infants become increasingly attentive to objects and they sustain visual exploration and attention to the external world. This change may be attributed to a number of developments including increasing manipulative and postural control, better vision, visually guided reaching, a more refined grasp, and the emerging ability to attend and coordinate social and object realms (Corkum & Moore, 1998; Cohn & Tronick, 1987; Doctoroff, 1996; Fogel, 1993; Fogel, Messinger, Dickson, & Hsu, 1999; Kaye & Fogel, 1980). Toy play becomes more frequent within caregiver-infant interactions as infants develop the physical and cognitive skills necessary to attend to both toys and a play partner. Caregivers serve an important role in facilitating joint attention and play with objects by introducing various objects and toys, and helping their infants attend to these objects through the use of various

communicative channels. In fact, caregiver direction and maintenance of infant attention have emerged as playing a central role in scaffolding (Pêcheux, Findji & Ruel, 1992; Hustedt & Raver, 2002; Landry, Garner, Swank & Baldwin, 1996).

Mothers utilize a number of nonverbal and verbal behaviours to assist their infants in attending to various aspects and features of the environment. For example, mothers encourage infants to attend to their immediate surroundings through orienting speech such as "*Look at the book*!" and/or nonverbally through showing objects, demonstrating actions and properties of objects, and pointing (e.g. Belsky, Goode & Most, 1980; Landry, Chapieski & Schmidt, 1986; Lawson, Parinello & Ruff, 1992). However, the specific nature of these nonverbal and verbal scaffolding efforts and the contribution of these behaviours to infant attention have not been adequately investigated. Studying the multimodal types of behaviours mothers use to encourage infant attention to objects is important because research has linked their attention-directing efforts to promoting infant skills and higher levels of infant functioning (Assel et al., 2002; Bigelow, MacLean & Proctor, 2004; Clarke-Stewart, 1973; Flom & Pick, 2003; Poehlman & Fiese, 2001; Schmidt & Lawson, 2002; Wijnorks, 1998). For example, maternal attention-directing gestures have been associated with more advanced levels of play (Belsky et al., 1980; Landry, Chapieski & Schmidt, 1996; Landry, Garner, Swank & Balswin, 1996), as well as to higher levels of object exploration (Landry et al., 1986), and focused attention in infants (Lawson et al., 1992). Furthermore, mothers' behaviours have been shown to be attuned to the infant's developmental competence, including their cognitive and motor capacities (Biringen, Robinson & Emde, 1994; Hart & Risley, 1992; Kindermann, 1993; Marfo, 1992) which are directly linked to infant age and birth status (fullterm or preterm). Research has shown that mothers modify their strategies by reducing their level of task regulation as their children exhibit increasing initiative (e.g. Pellegrini, Brody & Sigel, 1985). Younger, less competent infants receive more direct

structuring whereas older infants receive more distal support (Caissie & Cole, 1993; Clarke-Stewart & Hevey, 1981; Maccoby & Martin, 1983). Similarly, infants born preterm compared to fullterm, tend to have caregivers that are more directive and controlling during interactions (e.g. Doctoroff, 1996). While some research has shown age and birth status related changes in maternal support, few studies have examined how these factors contribute to the specific types of nonverbal and verbal maternal scaffolding behaviours used to direct attention towards toys during play interactions.

While the influence of the social caregiving environment is fundamental, less is known about the impact of nonsocial or physical environmental influences on maternal and infant behaviours during play (Wachs & Gruen, 1982). A central nonsocial component of play is toys; however, the contribution of toy-type has been relatively neglected in the area of caregiver-infant play. This is notable considering that much caregiver-infant play is centered on toys, and typically includes a variety of toy-types. Studying the influence of toy-types on caregiver and infant behaviour during toy play is essential because toys have an inherent attractiveness for infants which draw them into action and thus serve as an important source of skill development. Toys are also commonly the focus for social encounters and as such provide opportunities for direct and incidental learning. The paucity of research addressing the role of toys and toy-type is also puzzling given that toy-centered play provides learning opportunities that may have long term implications for the development of infants' language and attention skills, as well as their exploratory competence (Baldwin, 1991; Gitlin-Weiner, Sandgrun & Schaefer, 2000; Landry & Chapieski, 1989. Pêcheux et al.,1992; Tomasello & Farrar, 1986; Saxon, 1997). For example, the inclusion of objects in play by caregivers provides one of the earliest referential contexts that links meaning to language for infants (Bruner, 1987). Similarly, joint attention episodes around objects have been found to elicit longer and more frequent "conversations" between mothers and infants compared to episodes

when there was no joint focus of attention (Tomasello & Farrar, 1986). During the first year of life, when mothers encourage attention towards objects, infants have been shown to engage in more frequent object exploration, symbolic play and to have greater receptive and productive vocabularies (Baldwin, 1995; Bloom, 1993; Bornstein & Tamis-LeMonda, 1990; Carpenter, Nagell & Tomasello, 1998; Landry, Smith, Miller-Loncar & Swank, 1997; McCune, 1995; Ruddy & Bornstein, 1982; Tamis-Lemonda & Bornstein, 1989; Vibbert & Bornstein, 1989). Given the important developments that have been linked to joint focus on objects and toys, the examination of type of toys on mother-infant behaviours during play would make an important contribution to the field.

The present dissertation is a three-part study that was designed to contribute to research on toy play through the use of observational data that detailed maternal nonverbal and verbal attention-scaffolding behaviours and infant visual attention from 5½- to 18 months. The terms of maternal scaffolding, structuring and support are used interchangeably throughout this paper. Two groups of infants, fullterm, normal birthweight (FT-NBW) and preterm, very-low birthweight (PT-VLBW) infants, were included in each of Parts I, II and III of the study. Infants born preterm have difficulties in sustaining and sharing attention; as such, it is important to identify social and physical-environmental factors that may assist the development of these attentional skills. Part I of the study explored the nonverbal behaviours mothers use to scaffold infant attention and infant attention responses, and Part II examined the content of maternal verbal input. Part III evaluated the connection between maternal nonverbal and verbal behaviours. Together, Parts I, II and III evaluated (1) how mothers adjust their nonverbal and verbal behaviours according to infant age and birth status, and (2) the effect of toy-type on maternal behaviours and infant attention to provide an understanding of the influence of the physical play environment on maternal scaffolding behaviours and infant attention during playful interactions.

In order to provide a framework within which the present work is integrated, the pertinent literature will be reviewed beginning with theoretical approaches on maternal-infant play interactions. The theoretical discussion will be followed by a review of the literature examining infant attention and maternal-infant communication during play. Social and nonsocial influences on maternal-infant play will also be discussed. A review of research on the impact of infant characteristics, namely age and birth status on maternal-infant play and infant attention will follow, leading into a description of the present study. Interactions between caregivers and their infants at times include mothers and fathers, however, the abundance of research in the area of play has primarily focused on mothers. While father-infant interactions may follow the same developmental trajectories, the literature presented in the current review largely includes interactions between mothers and their infants. Furthermore, *mother* and *caregiver* are terms that will be used interchangeably throughout the present literature review.

Theoretical Approaches: Play, Infant Development and Social Communication

The study of infant play has been the focus of intensive empirical research over the past five decades. Although the specific topics of studies have varied, the underlying premise has been that play provides infants and children unique opportunities for learning and development to take place. Although play was once believed to be a phenomenon that was developmentally trivial and irrelevant to psychological development (Schlosberg, 1947), strong claims about the developmental importance of play by such theorists as Vygotsky (1978) and Piaget (1952) have predominated and have been supported by extensive research.

Prior to the 1960s, the prevailing belief was that infants were passive participants and recipients of external stimulation, and there was little recognition of caregiver-infant reciprocity during early interactions. Sander (1962), an infant psychiatrist, was influential in changing the view that the developing caregiver-infant relationship was a one-way

process in which caregivers were the sole contributors to that of a dyadic process which is directed by reciprocal and mutual influences from caregiver and infant. The conceptualization that development is a complex process which has multiple influences is represented in transactional models and systems theories (e.g. Belsky, 1981; Fogel, 2009; Fogel, King & Shanker, 2008; Fogel & Thelen, 1987; Sameroff & Chandler, 1975).

Vygotsky's work (1978) also emphasized the reciprocal influence between the caregiver and infant. He maintained that higher mental functions (e.g. language) are first learned in joint interactions and later internalized as intrapersonal capabilities (Schaffer, 1989; van der Veer & van Ijzendoorn, 1988). Vygotsky (1978) was also among the first theorists to propose the importance of adult guidance to support children's learning and development through his concept of the *zone of proximal development.* According to Vygotsky, learning and development are complementary, dynamically interacting processes. While infants' cognitive level sets a boundary for their learning to take place, through assistance of an adult, an infant's learning can improve. Less known among Vygotsky's writings is the focus he placed on the relations of children to their social and physical environments (Vygotsky, 1978). Vygotsky communicated several important ideas about how toys and objects serve to enhance a child's development (Wachs & Gruen, 1982). He believed that toys and objects helped provide the context for children to initiate action upon and attempt mastery over available objects. Thus, toy play between caregiver and children affords rich environments for the creation of *zones of proximal development.* Through toy play, Vygotsky believed that infants learn from their own activities as well as observation and imitation of peers and adults. As children grow, toys serve as a catalyst for imaginative play and pretend play. Unfortunately, most of Vygotsky's work emphasized the preschool years and as such he did not directly discuss how his concepts, particularly the *zone of proximal development,* applied to the infancy period.

Piaget also postulated that much of children's early learning occurs as a direct result of encounters with the physical environment (Piaget, 1952). The function of play in Piaget's framework is two-fold (Smith & Cowie, 1991), in that play allows children to both consolidate existing skills through repetition, as well as gain new skills while interacting with the environment. By and large, the focus of Piagetian psychologists has been on the child and the interactions of the child with the inanimate world of objects (Smith & Cowie, 1991). It follows that play materials and other physical objects that children can attend to and act upon become stimulus materials that contribute to the growth of various skills including their attention. While Piaget's approach gave credit to infants for their abilities to interact with the environment, his focus was primarily on the child and did not elaborate on social influences.

The importance of the social environment, namely the role of the primary caregiver was central in the work of Bruner. He and colleagues discussed the concept of *scaffolding* (Wood, Bruner & Ross, 1976) which refers to the support that adults provide children to enable them to successfully participate in an activity. Bruner emphasized the supportive and structuring role that caregivers play in compensating for abilities in their children that have not yet developed or are emerging. The pace at which caregivers adjust their scaffolding is related to the developmental skills of their infants (Bruner, 1983; Vygotsky, 1978). He argued that play provides a platform for the development and practice of behavioural routines that are subsequently integrated into more complex behavioural sequences. Through play and caregiver scaffolding, children gain mastery of their physical environments and are able to influence and control the environment in ways that children are unable to do in other contexts (Bruner, 1973).

Caregiver facilitation of development during infancy has also been highlighted by Fogel (1979) who described the caregiver as providing a *frame* for the occurrence of infant gazing. Kaye (1982) also compared an infant to an *apprentice* whose growth of

skills occurs under the guidance of a more experienced and responsive caregiver. For example, in the first year of life, infants' capacity for sustaining attention is more limited and infants are more dependent on their caregivers for assistance in this process. However, as infants grow, they become better able to sustain attention independently and share attention with others. There is a shift from caregiver regulation to co-regulation in numerous developmental areas (Maccoby & Martin, 1983). In particular, the emergence of abilities and competencies in the developing infant to attend to and coordinate social and object realms has a clear effect on not only the infant but also on the style of interaction within the dyad. As infants mature, caregivers must adjust their strategies to match the developmental levels of their infants. Consequently, research has begun to examine the types of strategies caregivers employ to communicate and scaffold during toy play with their infants (e.g. Colburne, 2000; Leiba, 2000; Schmidt & Lawson, 2002; Tsuneda, 2007; Yato, 2000, 2007).

Theoretical approaches to infant development have changed considerably over time, with a marked shift in considering the individual contribution of the caregiver or infant to the bidirectional and mutual influence between caregiver and infant. Some main themes that emerge from the varying theoretical perspectives are that child growth occurs within a context that encompasses both social and environmental influences and in order to fully comprehend developmental change, these factors must be taken into account. In particular, the scaffolding that caregivers provide while utilizing elements in the physical environment is fundamental because it introduces new experiences and meaning for infants. Such scaffolding is best studied in interactions that can capture the interplay between the social and physical world, such as in toy-centered play.

Infant Attention and Communication during Caregiver-Infant Dyadic Play

Much research has focused on dyadic interactions as a way of examining the growing infant and caregiver-infant relationship, and methods of communication within

the dyad (e.g. Tronick & Cohn, 1989). Face-to-face play predominates interactions between caregivers and infants in the first 6 months of life. Studies examining face-to-face interactions have shown that both caregivers and infants play significant roles influencing the flow of communication and different channels of communication are used by both infants and caregivers during these social exchanges (e.g. Cohn & Tronick, 1987; Gable & Isabella, 1992; Kaye & Fogel, 1980; Keller et al., 2008; Moreno, Posada & Goldyn, 2006). Such studies have shown that in addition to verbal input, mothers use nonverbal behaviours such as touch and gesture during dyadic interactions with their infants (Hertenstein, 2002; Stack & Muir, 1990; 1992). Infants also make use of nonverbal behaviours such as gaze and affective displays to communicate with their mothers (Stack & Arnold, 1998; Stack & LePage, 1996).

Infants' nonverbal communicative behaviours are thought to provide a window into important aspects of social, affective, and cognitive development in infancy (e.g. Adamson & Bakeman, 1991; Bates, 1979; Bruner, 1982; Stern, 1985). In early infancy, prior to infants' abilities to produce language, infants' affective displays, vocalizations and gaze behaviours have been identified as potent communicative signals. One of the earliest ways in which infants convey information about their state of arousal to their social partners is through the direction of their eye gaze (Field, 1977; Kaye & Fogel, 1980; Symons & Moran, 1987). The position of an infant's head and the direction of their gaze are powerful nonverbal communicative signals during early caregiver-infant interactive sequences (Stern, 1974; 1977; Webbink, 1986). It has been maintained that gaze serves as the underpinning for the growth of interpersonal relatedness (e.g. Brazelton, 1984; Kaye & Fogel, 1980; Stern, 1977), communication and emotional expression because infants soon after birth are able to partake in eye-to-eye contact with their caregivers (Johnson, 2005; Flom, Lee & Muir, 2007; Stern, 1977).

In infancy, the visual-motor system develops in a precocious manner compared to other systems of communication including speech, gesture and locomotion (Stern, 1974; 1977; White, Castle & Held, 1964). Infants perceive and process information through the visual modality and have autonomous control over the input of stimuli by being able to open and close their eyes (Stern, 1977). This is a unique characteristic compared to other sensory modalities which have no means for terminating incoming stimulation (Cappella, 1981; Stern, 1974). By 3 months, infants actively regulate their gaze towards mothers as a way of filtering perceptual input of stimulus events and in response to different circumstances in interactions (Stern, 1974; 1977). Between 3 to 6 months, infants gain additional visual control by being able to voluntarily shift attention between stimuli (Johnson, 2005; Johnson, Posner & Rothbart, 1991; Rothbart, Posner & Boylan, 1990). The ability to alternate gaze direction allows infants control over perceptual input including the stimulation they receive from their social partners (e.g. Barrat, Roach & Leavitt, 1992). 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 (e.g. Hsu & Jeng, 2008; Stack & Arnold, 1998; Stack & Muir, 1992).

As infants' visual capabilities mature, they become capable of assisting adults in the flow of interactions (Stern, 1977). Furthermore, as infants gain greater postural control and develop the capacity for reaching and grasping, the amount of time infants' gaze towards their mothers' faces declines and they become increasingly oriented towards objects and their nonsocial surroundings (Fogel, Dedo & McEwen, 1992; van Beek, Hopkins & Hoeksma, 1994). At around 6 months of age, cognitive processing is closely linked to infants' attentional capacity, including both sustained gaze and shifts in gaze to different aspects of their surroundings (Johnson, 2005; Posner & Peterson,

1990; Posner & Raichle, 1994). Thus, examining patterns of infant gazing can provide insight into their involvement in social interchange.

Taken together, research on dyadic interactions has revealed that infants are active participants in early play with their mothers. Gaze serves as a way to maintain contact between mother and infant and the direction of gaze is an important social signal that indicates an infant's willingness to engage or terminate social activities (Barrat et al., 1992; Kaye & Fogel, 1980; Stern, 1974). Furthermore, research has shown that social partners use a variety of behaviours to communicate with their infants during dyadic play and that infants are sensitive to the behavior of their social partners. Less is known, however, about the nature of communication between mother and infant during triadic play interactions that include the dyad and toys. In the second half of the first year, caregivers' 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 (Doctoroff, 1996; McCune et al., 1994). The shift in the nature of mother-infant interactions from dyadic to triadic points to the need to study mothers and infants within a triadic context that involves the dyad and objects.

Communication during Play: The Role of Mother, Infant and Toys

In the first year of life much of an infant's time is spent in dyadic interactions with the mother, however, a number of investigators have identified a change in social interaction that occurs at about 5 to 6 months (Kaye, 1982; Schaffer, 1984). At around this time, infants shift their interest from the focus of person-based activity to physical objects and events. As infants become increasingly interested in and attentive to objects and events, the interactions between infants and caregiver begin to involve topics other than the adult-child pair themselves. As a result, infants learn how to coordinate their attention and actions in a triadic situation that involves them, another individual, and an object. 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 (Adamson & Bakeman, 1991; Scaife & Bruner, 1975). Scaife and Bruner (1975) were the first to refer to this development as *joint attention* in their seminal research during which they studied whether young infants had the ability to attend to the same visual target as an adult. They found that 30% of 2-4-month-old infants followed the direction of gaze of a social partner with percentages steadily increasing so that by the end of the first year of life almost 100% of infants followed the direction of eye gaze of their social partner. This study was groundbreaking because at the time of their research, Piaget's egocentrism perspective prevailed, contending that infants were unable to take the viewpoint of others and as such unable to share attention with others (Butterworth, 1991; Van Hecke & Mundy, 2007). However, Scaife and Bruner's (1975) study and subsequent research has demonstrated that infants use their cognitive and attentional skills to jointly attend to their social and physical environments, and social partners play an important role in their attention processes (Gauvain, 2001).

The main focus of experimental research investigating the development of joint attention has been on infants' following the direction of adult eye gaze and head turns (e.g. MacPherson & Moore, 2007). In addition to these factors, other nonverbal and verbal behaviours of caregivers are factors which can influence the sharing and focusing of infant attention. More naturalistic research has begun to integrate these factors into the study of infant attentional behaviours (Driscoll & Easterbrooks, 2007; Findji, 1993; Landry & Chapieski, 1988; Landry et al., 1986; Landry et al., 1996; Pêcheux et al., 1992; Tsuneda, 2007; Yato, 2000; 2007). In fact, the ability of infants to focus attention as well as coordinate their attention to objects with a caregiver is thought to relate not only to the infants' developing cognitive abilities but also parenting variables (Landry & Chapieski, 1988). The quality of shared attention interactions is dependent in part on caregivers' ability to adapt their efforts to their infant's cognitive and attentional capabilities (e.g.

Wood et al., 1976; Doctoroff, 1996; Gauvain, 2001; Rogoff, 1990). Both adults and infants are active participants in this process, however, the specific contributions of caregiver nonverbal and verbal behaviours have not been widely investigated in caregiver-infant toy play interactions. Further investigations that take into account the varied behaviours that caregivers employ to structure the attention of their infants and how they change over time are warranted.

The two main channels of communication that caregivers employ to scaffold infant attention are nonverbal through various actions and gestures, and verbal through their speech and verbalizations. Nonverbal actions are an important component of effective communication that convey meaningful information (Burgoon, 1985; Turner, 1997). Studies have increasingly begun to closely examine ways in which caregivers use nonverbal communication while interacting with their infants (Brand, Baldwin & Ashburn, 2002; Brand, Shallcross, Sabatos & Massie, 2007; Gogate, Bahrick & Watson, 2000). For example, similar to "motherese" or child directed speech, researchers have found evidence for "motionese" (Brand et al., 2002). That is, caregivers modify their infant-directed gestures and actions in order to help them process and learn about the complexities of human movement and action. Such studies demonstrate that as with verbalizations, caregivers make adjustments to their nonverbal communication.

Nonverbal communication is a powerful way that caregivers convey information to their infants and encompasses an array of behaviours and messages that have not been systematically and comprehensively investigated across different contexts. Limited research has directly investigated how caregivers nonverbally structure the attention of their infants during toy play. Caregivers have been shown to use a variety of nonverbal scaffolding behaviours, including pointing, showing and demonstrating functions and features of objects (e.g. Findji, 1993; Lawson et al., 1992; Pêcheux et al., 1992), however little is known about how these specific behaviours are employed. Studies

which have included caregiver nonverbal behaviours in the context of attention scaffolding or play have primarily included a general category of caregiver behaviours which have not distinguished between nonverbal and verbal acts (e.g. Findji, 1993; Tamis-LeMonda & Bornstein, 1989, 1990, 1993), or have categorized nonverbal behaviours into one category without specifically examining types of nonverbal behaviours (e.g. Lawson et al., 1992). For instance, Pêcheux, et al. (1992) studied maternal scaffolding of infant attention when infants were 5 and 8 months of age. Maternal encouragement of attention which included both verbal and nonverbal efforts was found to decrease over time. In a separate study, Lawson et al. (1992) considered a limited sample of maternal nonverbal behaviour and found that infant attention to objects was associated with maternal behaviour, such that when mothers joined infants for play, there was an increase in the duration of infant focused attention and a decrease in inattention. Although this study included nonverbal behaviours, it did not investigate possible differences in the types of nonverbal behaviours. Together these studies illustrate that caregivers actively use nonverbal behaviours to structure the attention of their infants. However, little research has provided a detailed account of caregiver nonverbal behaviours and a more wide-ranging account of the multimodal ways in which caregivers guide their infants' attention during play.

In addition to their nonverbal methods, caregivers actively use verbal guidance to communicate with infants and scaffold their attention. Abundant research examining adult speech during interactions with their infants has focused on how adults adapt their speech while communicating with infants, that is, identifying characteristics of "child-directed speech" (e.g. Davidson & Snow, 1995; Fernald, 1984). Other studies have focused on how caregiver verbal input relates to concurrent and later language development in infants and children (Belsky et al., 1980; Gros-Louis et al., 2007; Landry et al., 2001; Shimpi & Huttenlocher, 2007; Tamis-LeMonda et al., 2006). For example,

Belsky et al. (1980) randomly assigned mothers to a brief intervention when they were made more aware of their verbal and gestural interactions. Mothers in this group had infants with higher play skills than infants of mothers in a control group. In a separate study, Landry et al. (2001) found that mothers who were assigned to a treatment group where facilitators coached them to use verbal associations and more responsive interactive styles had infants with higher social and cognitive skills compared to infants in an attention control procedure. Other studies have also documented that caregiver verbal input and verbal scaffolding are related to higher vocabulary and cognitive development in infants and toddlers (e.g. Dieterich et al., 2006; Goldfield, 1987; 1990; 1993; 2000; Landry, Smith, Miller-Loncar & Swank, 2002; Stevens, Blake, Vitale & Macdonald, 1998).

While such studies reveal important information about caregiver verbal input and the contributions of verbal stimulation to child development, few investigations have directly examined how caregivers use their verbal input during play interactions to scaffold infant attention (Landry et al., 1986; Smith, Landry & Swank, 2000).

Caregiver speech towards infants during play is rich with information as caregivers convey their knowledge about the surroundings to their infants. In order to guide their infants' attention, caregivers use verbal encouragement by asking questions and giving directives as well as providing information about objects and toys by naming objects and discussing their properties, actions and functions. Caregivers also scaffold by using verbal hints and prompts that help infants understand the links between objects, actions and categories to help guide their attention and other exploratory behaviours (Dieterich, Assel, Swank, Smith & Landry, 2006; Smith et al., 2000). Landry et al. (1986) studied the relationship between maternal verbal attention-directing strategies and infant attention in three groups of 12-month-old infants. The three groups included a fullterm group, and a group of preterm infants at low or high medical risk.

Three specific verbalizations including questions, imperatives and attention verbs, were examined and were found to be used differently by mothers according to the birth status of their infants. More specifically, mothers of both preterm groups used attention-directing verbs more frequently than mothers of fullterm infants whereas mothers of fullterm infants used questions more often to direct attention than mothers of low risk preterm infants. Overall, mothers of high risk preterm infants used more verbal and nonverbal methods to direct their infants' attention compared to mothers of low risk preterm and fullterm infants. In a later study, Smith et al. (2000) found that maternal verbalizations detailing the relations between objects, concepts or functions when infants were at preschool age predicted their verbal and nonverbal abilities at age five. Although this study included a detailed account of caregiver verbalizations, the individual contribution or content of these verbalizations (i.e. specific categories of what caregivers are saying) was not investigated. Together these studies demonstrate the importance of caregiver verbalizations and support the need to provide a more comprehensive account of how caregivers verbally guide their infant's attention during toy play.

Taken together, research has demonstrated the importance of maternal scaffolding of infant attention (Findji, 1993; Landry et al., 1986; Pêcheux et al., 1992; Smith et al., 2000; Tamis-LeMonda & Bornstein, 1989, 1990, 1993). However, existing research has not extensively examined the specific nonverbal and verbal behaviours caregivers employ to structure the attention of their infants and many studies have not examined how these behaviours change according to important factors such as infant age and birth status. There is a need to comprehensively and systematically investigate the array of nonverbal behaviours and content of verbal stimulation caregivers use to scaffold infant attention during joint toy play with toys so that an accurate understanding of the multimodal ways in which caregivers communicate with their infants can be obtained. Furthermore, understanding how caregivers adapt these behaviours according

to infant age and birth status is also important in order to understand how caregivers can optimally support the developing skills of infants which change rapidly over time and can vary according to their status at birth.

Very-Low-Birthweight Preterm Infants

Medical and technological advances in prenatal, perinatal and postnatal care have contributed to an increase in the survival rate of preterm infants, especially those born very low birth weight (VLBW; Alexander et al., 2003; Barrera, Rosenbaum & Cunningham, 1987; Gardner & Karmel, 1983; Millar, Strachan & Wadhera, 1991; Molteno, Magasinger, Sayed & Karplus, 1990; Stoelhorst, et al, 2005). The World Health Organization (1990) has defined VLBW infants as born with birthweights below 1500 grams. Researchers of a Canadian population-based study reported that the survival rate was 87% for infants who weighed <1500 g at birth (96% for 1250–1499 g, 95% for 1000–1249 g, 86% for 750–999 g, and 62% for <750 g) (Lee et al., 2000). Studies have also shown that developmental outcomes for infants weighing below 750 grams at birth are poor relative to outcomes for children with birthweights ranging between 750 to 1499 grams (Breslau, Klein & Allen, 1988; Horwood, Mogridge & Darlow, 1998; Klebanov, Brooks-Gunn & McCormick, 1994). Such findings indicate that the severity of sequelae related to preterm births is greater for infants with increasing degrees of low birthweight.

Studies have estimated that of the 3.7 million annual live births in the United States, approximately 1.1% are PT-VLBW (Behrman, 1985; Bernbaum & Hoffman-Williamson, 1985). This estimate translates into approximately 36, 000- 41, 000 such births a year (Behrman, 1985; Bernbaum & Hoffman-Williamson, 1985; Minde, 2000). Similar percentages have been reported in Canada, with approximately 3, 900 such births yearly (Minde, 2000). The increased survival rates have heightened research emphasis on factors associated with the long term outcomes of infants born VLBW. Biological factors such as the degree of prematurity, birthweight and severity of perinatal

medical problems have been widely studied and linked to later physical, behavioural, and cognitive difficulties (Abernethy, Palaniappan & Cooke, 2002; Anderson & Doyle, 2003; Barrera et al., 1987; Breslau et al., 1988; Chien et al., 2006; Hack et al., 2002; Kopp, 1987; Minde, Perotta, & Hellman, 1988; Rickards, Kelly, Doyle, & Callanan, 2001; Salt & Redshaw, 2006; Taylor et al., 2004; Taylor, Klein & Hack, 2000; Zelkowitz, Papageorgiou & Allard, 1994; Zelkowitz, Papageorgiou, Zelazo & Weiss, 1995). Comparatively less is known about social and interactive factors relating to preterm births, in particular, play interactions between PT-VLBW infants and their caregivers. More closely examining these interactions in PT-VLBW infants is warranted because research has shown that outcomes for preterm infants are related to their risk status and the quality of mother-infant interactions (e.g. Assel et al., 2002; Landry et al., 2001; Poehlmann & Fiese, 2001; Schmidt & Lawson, 2002). Interactions between caregivers and PT-VLBW infants are affected not only by physical and biological factors related to prematurity but also by psychosocial variables relating to preterm births.

Early interactions between mothers and preterm infants are typically strained because infants undergo numerous medical treatments; they spend a great deal of time in incubators and are hospitalized for extended periods of time. For example, studies have shown that fullterm infants spend an average of 3.5 days in the hospital following birth whereas PT-VLBW infants are hospitalized for an average of 57 days (e.g. Millar et al., 1993). The fragility of infants in terms of their size and medical conditions often makes early interactions between caregivers and their infants more difficult compared to those between mothers and their healthy, normal birthweight infants. As such, preterm infants and their caregivers experience more limited opportunities to interact with each other and to develop their interactive skills. In addition, parents experience a considerable degree of stress around the preterm births of their infants (e.g. Hughes & McCollum, 1994; Hughes, McCollum, Sheftel & Sanchez, 1994; Thomson et al., 1993)

and some mothers experience comparable levels of psychological distress when their infants are one-year-old as they experienced at the time of their birth (Garel, Dardennes & Blondel, 2007). Caregiver distress has been shown to have an impact on the quality of caregiver-infant interactions (e.g. Muller-Nix, Forcada-Guex & Pierrehumbert, 2004; Madu & Roos, 2006; Wijnroks, 1999).

In general, early interactions between caregivers and preterm infants are different from those of caregivers and their fullterm infants (Goldberg & DiVitto, 2002; Wijnroks, 1998; Moore, Saylor & Boyce, 1998; Salerni, Suttora & D'Odorico, 2007). However, the underlying reason for the idiosyncratic nature of interactions between caregivers and their preterm infants compared to dyads where infants are born fullterm is unclear. Some reasons that have been attributed to these differences include caregiver factors such as their emotional and early separation experiences and to infant factors including their immaturity, fragility, and communicative abilities (e.g. Doctoroff, 1996; Field, Diego, & Hernandez-Reif, 2006; Greene, Fox & Lewis, 1983). PT-VLBW infants are less alert, responsive, display less clear distress signals, and become more easily stressed and overstimulated compared to fullterm infants (Als, 1982; DiVitto & Goldberg, 1979; Eckerman, Hsu, Molitor, Leung & Goldtein, 1999; Eckerman, Oehler, Hanna & Molitor, 1995; Field, 1977, 1979, 1983, 1987; Greene et al., 1983; van de Weijer-Bergsma et al., 2008). Some mothers of preterm infants provide high levels of stimulation to their infants while others are more withdrawn compared to mothers of fullterm infants (Minde et al., 1985). Field (1977, 1981) suggested that mothers may provide heightened levels of stimulation for their preterm infants as a way of eliciting reactions from their hypo-responsive infants. Some view mothers' increased level of behaviour with their preterm infants as overstimulating and intrusive because such behaviour typically results in more gaze aversion and less attention by preterm infants (Field, Dempsey & Shuman, 1981). An alternative interpretation of findings has been

that caregiver behaviour is adaptive and compensatory to the specific needs presented by preterm infants (Divitto & Goldberg, 1979). The varying needs of preterm infants are commonly related to their differing birthweights and perinatal medical complications and histories.

Many available studies have investigated heterogeneous samples of preterm infants, differing according to their gestational age and birthweight, as well as to type and severity of medical complications. Due to the fact that there is a great deal of heterogeneity associated with preterm births, it is critical to identify subgroups within populations of preterm infants and to individually investigate such subgroups in order to better understand how varying factors related to preterm birth may affect infant development and early infant-caregiver interactions. One important subgroup to investigate is PT-VLBW infants who are born weighing less than 1500 grams. Many studies have focused on infants who are born early with weights at birth above 1500 grams, however, infants born VLBW are a unique population with an added risk due to their exceedingly small size and related concurrent and subsequent medical and psychosocial difficulties. Yet there are PT-VLBW infants who are relatively healthy, experiencing few perinatal medical complications, making them an important subgroup of preterm infants to study. Surprisingly little research, however, has studied low risk, relatively healthy PT-VLBW infants and the interactions between these infants and their mothers. In particular, there has been limited focus on aspects of interactions that support infant attention during object play, especially with infants that are born PT-VLBW and relatively healthy.

Joint play activities provide a rich set of conditions for learning but place greater demands on infants' attentional capacity because they are novel (Bronfenbrenner, 1999) and require a shift in attentional focus from mother to toy and back to toy (i.e. a triadic process; Bakeman & Adamson, 1984). Infants' attentional capacity is critical to their

responses in joint toy play (Landry, 1995) and preterm infants experience difficulty developing the range of joint attention and interactional skills seen in most fullterm infants (Barnard, Bee & Hammond., 1984; Landry, 1995). Furthermore, preterm infants require longer periods of focused attention to process information compared to fullterm infants (Rose, 1983; van de Wejer-Bergsma et al., 2008). During both independent and joint toy play, 6-month-old medically high-risk preterm infants differed from low-risk and fullterm infants by showing fewer shifts of attention between toys but they did not differ on measures of sustained looking (Landry & Chapieski, 1988). Accompanying differences in attentional responses of preterm infants are variations in the behaviours that mothers of preterm compared to fullterm infants employ to manage their infants' attention. For example, Barrat et al. (1992) found that mothers of 4-month-old healthy preterms displayed higher levels of vocal, affective and attentional responsiveness than mothers of fullterm infants. Follow-up of these infants at 12 and 20 months revealed that by 20 months, mothers of preterm infants were less vocally responsive to their toddlers than were mothers of fullterm toddlers (Barrat, Roach & Leavitt, 1996). Mothers of preterm toddlers used controlling behaviours (manual assistance, intrusions in todddler's play, positive and negative feedback) more frequently over time than mothers of fullterm toddlers. These findings are consistent with other studies which have shown that mothers of preterm infants exhibit behaviours that are more directive and controlling (Doctoroff, 1996; Hanzlik & Stevenson, 1986; Muller-Nix et al., 2004; Pridham, Becker & Brown, 2000). Paralleling research examining play between mothers and fullterm infants, studies investigating preterm infants have not provided a specific and detailed account of the behaviours caregivers employ to manage the attention of their infants. While caregivers use various strategies to structure their infants' attention towards toys, research is warranted to evaluate changes in caregiver nonverbal and verbal attention scaffolding behaviours according to the birth status of their infants. Understanding the

contribution of specific caregiver scaffolding efforts with preterm infants is critical since preterm infants have significant difficulties with their attentional skills and the growth of these skills is integral to their later development (Landry, 1995; Landry, Garner, Swank & Baldwin, 1996; van de Weijer-Bergsma et al., 2008).

Environmental Influences on Caregiver-Infant Communication during Play: The Importance of Toys

The importance of early social experiences and influences on development has received considerable research focus; however, less attention has been given to the contributions of the nonsocial or physical environment. This is particularly notable during caregiver-infant play which includes important social and nonsocial factors. As previously discussed, the role of the caregiver during play has an important impact on caregiver and infant behaviour whereas little is known about the contribution of the physical play environment on infant behaviour. An important physical environmental factor which has received minimal research attention is type of toy. Type of toy has the potential of influencing the communication patterns between infants and their caregivers during play. The lack of consideration for the influence of toy-type is surprising given the demonstrated importance of toys and their relation to early cognitive development (Chase, 1992; 1994; Colburne, 2000; Elardo, Bradley & Caldwell, 1975; Gottfried & Brown, 1986; Wachs & Gruen, 1982).

Lewin (1936) proposed a quasi-mathematical model to emphasize the importance of environmental factors on the behaviour of individuals and to explain the relations among a person, the environment and the behaviour of an individual. In this model, behaviour (B) is a function of the relationship between the person (P) and the environment (E); B = f(P E). He also proposed that the environment can be viewed from two broad perspectives, molecular and molar. Infant-caregiver play can be affected by molar dimensions which include the socioeconomic status of the infant's family or

general cultural norms concerned with play (Bornstein et al., 1999.; Tamis-LeMonda, Uzgiris & Bornstein, 2002). For example, American compared to Japanese mothers label and describe properties, objects and events in the environment more frequently during play with their infants, and Japanese infants display more advanced symbolic play compared to American infants (Tamis-LeMonda, Bornstein, Cyphers, & Ogino, 1992). Molecular dimensions include those aspects of the environment that are readily discernable to participants such as toys, other play equipment, and play partners. Although not directly addressed in Lewin's work, his conceptualization of molecular dimensions includes both social and physical influences. Research has primarily addressed social molecular influences such as differences in the level of infant play in the presence or absence of a more mature play partner (e.g. Bigelow, MacLean & Proctor, 2004; Bornstein, Haynes, O'Reilly & Partner, 1996; Power, 1985). However, the social environment cannot be considered in isolation from the physical environment. Recognition of the important effects of the physical play environment has generally been lacking in studies of caregiver-infant play. For example, many researchers report that their studies were conducted during a "free play" session without providing details about the play setting nor specifying the toy sets used during the play periods (e.g. Bakeman & Adamson, 1984). It has been argued, however, that it is critical to consider the play environment in order to achieve an accurate understanding of factors influencing caregiver-infant behaviours during play (Gottfried, 1984; Gottfried & Brown, 1986; Malone, 1999). Given that a majority of studies do not specify elements within the physical play environment, comparing results of studies must be conducted with caution.

There are studies on play that include a wide variety of toys and describe them, however, results are reported in general without considering the possible influence of toy-type on caregiver and infant behaviour. For example, Bakeman and Adamson (1984) studied play between caregivers and infants with a number of toys, including a

telephone, picture book, wooden puzzle, colourful nesting cups, doll, rattle, and a soft plastic toy with wheels. While the authors included a range of toys in their study, they did not investigate relations between caregiver and/or infant behaviours and the toys available. Likewise, Bornstein, Tamis-LeMonda and colleagues have conducted numerous investigations of play between mothers and their infants and have used a standard set of toys, including a book, ball, blocks, nesting cups, teaset, toy telephone, toy vehicle, and a clown (Tamis-LeMonda & Bornstein, 1991; Tamis-LeMonda et al., 1992; Tamis-LeMonda, et al., 1996). Although toys were chosen to afford mother-infant pairs the opportunity to exhibit various levels of play ranging from unitary functional acts to sophisticated pretense, findings were reported for toy play in general and not based on type of toy.

The aforementioned sets of toys appear to be characteristic of toys incorporated in other studies investigating triadic play with infants. While it is clear that infants and their caregivers have had access to a wide variety of toys in studies of triadic play, the effect of toy type has not been considered in most studies. The inclusion of toy-type as a factor for investigation can enhance our understanding of factors that influence caregiver-infant communication during play and have the potential to make a significant and unique contribution to research on triadic play.

Books are one item commonly included in play studies. They have received research attention separate from play because reading is a critical skill which has considerable social and economic consequences for individuals later in life (Stadler & McEvoy, 2003). Investigations around book reading have focused on changes in parental book reading behaviours according to the age and competencies of children as well as links between parental book reading and infants' developing language and reading skills (e.g. DeBaryshe, 1993; DeTemple & Snow, 2003; Fletcher et al., 2008; Raikes et al., 2006; Senechal & LeFevre, 2002; Senechal, LeFevre, Hudson & Lawson,

1996; Senechal, Lefevre, Thomas & Daley, 1996; Stadler & McEvoy, 2003; Wheeler, 1983; Whitehurst, 1988; Whitehurst et. al, 1994). Wheeler (1983) found that mothers described pictures in books when infants were 17 months whereas they asked more questions with books one year later. Studies in this area have also revealed that text genre and book features influence parental behaviour. Senechal, Cornell and Broda (1995) examined parent behaviours while reading two types of books with their 9-, 17- and 27-month-old infants. In addition to finding differences in parents' behaviours according to the age of their infants and toddlers, the authors found that certain book features influenced maternal verbal behaviour. They found that books which contained no text compared to those that did, led to more verbal behaviours by parents. Similarly, Stadler and McEvoy (2003) found that parents of preschool-aged children varied their book reading strategies with two different types of texts, alphabet rhyming and narrative. A related study by Yont, Snow and Vernon-Feagans (2003) compared maternal behaviours during book reading and toy play and found that mothers used more conversation-eliciting behaviour during book reading whereas they directed and negotiated their child's attention more during toy play. Together these studies demonstrate that physical or nonsocial components such as book features create micro-contexts that contribute to differences in caregiver-infant interactions. Further research is warranted to gain a better understanding of these micro-contextual influences on caregiver scaffolding efforts and infant attention during play.

Interestingly, the role of toy-type has not been uniformly neglected across all areas in the infant development literature. Toys have received considerable attention in the literature on socialization of gender and gender stereotypes (Cherney & London, 2006; Cherney, Kelly-Vance, Glover, Ruan & Ryals, 2003). Parental and child behaviour in relation to toys categorized as gender specific or neutral is often studied as a way of examining the development of gender schemas in children and the socialization of

gender and gender stereotypes by parents (Caldera, Huston & O'Brien, 1989; Caldera & Sciaraffa, 1998; Malone & Langone, 1998; O'Brien & Huston, 1985). For example, a study by Caldera and Sciaraffa (1998) investigated differences in the play behaviours of parents with their infants while playing with baby dolls and a stuffed clown. Although the focus of their research was on gender related differences in the type of play behaviours of parents and their toddlers, their study also revealed important information about the impact of toy-type on play behaviours. Parents were more likely to display nurturing and caregiving play behaviours with the doll compared to the clown, implying that different toy-types elicited different types of play behaviours by parents. Results from this study add to the literature, underscoring the importance of considering toy-type as a factor that influences parental behaviour during play.

Only two known studies have directly studied the influence of toy-type on infant attention or caregiver scaffolding behaviours during play. Di Francesco (2004) examined changes in 36-month-old infants' focused attention with two types of toys, toys that have a defined goal (i.e. puzzles), and goal-directed toys with a playful outcome (i.e. construction toys). The results revealed that infants focused their attention for longer periods with construction toys compared to puzzles likely because the construction toys had an added playful component which heightened infant interest and motivation to play with them. The focus of this study was on infant attention and each toy was presented in separate conditions. As such, it was not possible to address how different toy-types influence infant and mother behaviour when a variety of play materials are available simultaneously, as in a more typical play scenario. Colburne (2000) examined the influence of toy-type on the play behaviours of mothers and their 4- and 7-month-old infants during a more naturalistic play context. She found that mother-infant play and infant behaviours differed according to toy-types such as social and functional toys. For

example, the social toy resulted in the highest level of social play and the functional toy resulted in the highest level of functional play. Infant affect and gaze also differed according to toy-type; infants gazed at their mothers' faces longer during social play whereas infants' gazed longer at the toy during functional play. Together these studies demonstrate that the availability of different types of toys allow the creation of rich teaching and learning opportunities and highlight the importance of studying the influence of toy-type on the behaviours of mothers and infants during play.

The Present Research: Rationale and General Objectives

The current literature overwhelmingly supports the bidirectionality of communication between infants and mothers and demonstrates that toy-centered play is a primary context within which mothers and infants interact. However, more research is warranted to investigate the multimodal scaffolding behaviours of mothers during play with their infants. Consequently, the present research investigated specific nonverbal and verbal behaviours used by mothers to structure infant attention during toy-centered play and considered several factors that can affect this support.

Two important factors that can influence both maternal and infant behaviour is infant age and birth status. Little research has addressed changes in mothers' nonverbal and verbal attention scaffolding efforts according to infant age and birth status, in particular, how such scaffolding changes as infants' communicative abilities shift from preverbal to verbal. Furthermore, most available research has not only focused on older infants but when studying preterm infants, they have included a heterogenous group with varying degrees of medical complications. The general aim of the current study was to examine how mothers' communicative behaviours change with healthy, FT-NBW and PT-VLBW infants over time. The current study also included infant gaze direction for investigation. Infant gaze is a critical measure of infant attention and an important target

for examination because it is prominent in the limited behavioural repertoire of infants and is one of the few means available to index infant communication as infants develop from the preverbal to the verbal stage (Lawson & Ruff, 2001).

Toy-type is a third factor which can influence maternal and infant behavior. The value of examining maternal and infant behaviour across multiple interactive contexts has been frequently demonstrated as important in order to fully understand the growth of mothers and their infants (e.g. Black, Hutcheson, Dubowitz, Starr & Berenson-Howard, 1996; Landry, Smith, Miller-Loncar & Swank, 1998). The availability of different toy-types during play presents mothers and infants with multiple micro-contexts which have not been widely investigated. By exploring the influence of toy-type on maternal nonverbal and verbal behaviours, results from the present study can provide an important first step in understanding how mothers adjust their scaffolding behaviours according to the physical play environment.

The present dissertation was designed to examine the specific nonverbal and verbal attention-scaffolding behaviours mothers employ during play with their infants and how these behaviours changed according to infant age, birth status and toy-type. A free play period with age appropriate toys was selected to examine maternal and infant behaviours at 5½ as well as 12 and 18 months. Two groups of mother-infant dyads were studied, including infants born FT-NBW and PT-VLBW. The main objective of Part I of the study was to examine changes in maternal *nonverbal* behaviours according to infant age, birth status and toy-type. In order to comprehensively investigate the nonverbal ways in which mothers structure their infants' attention, a coding scheme delineating nine individual maternal nonverbal behaviours (e.g. shaking, pointing, demonstration of the use of a toy) was created. Comparisons were made of the duration of time mothers spent using each of these behaviours according to toy-type. Evaluation of infant gaze direction according to toy-type was also examined. Maternal and infant behaviours were

studied at the three ages in order to explore whether mother and infant behaviours changed across developmental time. Birth status-related differences in maternal nonverbal and infant behaviours were also investigated.

The aim of Part II was to investigate the use of maternal *verbal* behaviours to structure infant attention during toy-centered play. A coding scheme evaluating the content of maternal attention-scaffolding verbalizations was created and included four categories of verbalizations which encompassed mothers' use of highly attention-directing utterances as well as their descriptions of toy characteristics and functions. Differences in the content of maternal verbalizations were assessed according to toy-type to evaluate the impact of the physical play environment on caregiver scaffolding. Maternal verbalizations were also compared across time and according to infant birth status.

The main purpose of Part III of this study was to provide a preliminary understanding of the link between maternal nonverbal and verbal behaviours. That is, whether mothers used nonverbal or verbal behaviours for longer, shorter or similar amounts of time with particular toys, and whether the age and birth status of infants influenced the amount of time mothers utilized nonverbal compared to verbal behaviours during play with their infants. The examination of differences in maternal nonverbal and verbal behaviours according to infant age and birth status as well as toy-type were common aims across Parts I, II and III of this study. Taken together, this three-part study was designed to provide a greater understanding of the interplay between physical and social factors during mother-infant toy-centered play and the progression of play interactions over time. The longitudinal component of this study enables the investigation of the development of toy play across developmental time when infants' abilities and the caregiver-infant relationship are evolving. The examination of changes in mother-infant toy-centered play provides a window into the dynamic connection between the social

and nonsocial environment and the didactic opportunities created when these interconnections are considered.

Chapter 2, Part I. Maternal Nonverbal Attention-Scaffolding Behaviours and Infant Gaze

Joint toy play between caregivers and infants has been linked to many cognitive and social developments in infancy and early childhood (Adamson & Bakeman, 1991; McCune, Dipane, Fireoved, & Fleck, 1994). In the latter half of an infant's first year, play shifts from partner- to object-focused, as infants become more attentive to their nonsocial environment, and begin developing the ability to share attention between an adult and an object or event. Caregivers play a fundamental role in early toy play with their infants by providing a supportive framework that facilitates and enhances their infants' capabilities, in particular their capacity to sustain attention towards their social and nonsocial surroundings. As caregivers incorporate the use of objects and/or toys in play with their infants, they use various verbal and nonverbal behaviours to support their infants' attention towards themselves and toys (Doctoroff, 1996; Findji, 1993; Pêcheux, Findji & Ruel, 1992; Tsuneda, 2007; Yato, 2000; 2007).

Although growing research has demonstrated the importance of nonverbal communication in early caregiver-infant interactions (e.g. Calkins, Hungerford & Dedmon, 2004; Hertenstein, 2002; Moreno, Posada & Goldyn, 2006; Stack & Arnold, 1998; Stack & LePage, 1996; Stack & Muir, 1990), less is known about the nonverbal behaviours that caregivers use to focus the attention of their infants during play with toys. Similarly, little is known about how the types of toys available during play influence the nonverbal ways in which mothers scaffold their infants` attention. Identifying factors in both the social and nonsocial environment that influence caregiver and infant behaviour, in particular infant attention, is critical because caregiver attention-directing behaviours and infant attention have been closely linked to more advanced cognitive and language abilities (Assel et al., 2002; Choudhury & Gorman, 2000; Landry, Fletcher,

Denson & Chapieski, 1993; Poehlmann & Fiese, 2001; Ruff, Capozolli & Weissberg, 1998; Schmidt & Lawson, 2002; Tamis Le-Monda & Bornstein, 1989).

Numerous factors within an infant's early social environment are related to infant behaviour during play interactions with their caregivers, including caregiver characteristics such as age, maturity and presence of affective disturbance (e.g. Field, 2002; Fewell et al., 1996; Hart, Jones, Field, & Lundy, 1999). It is also well documented that infants play in more advanced ways and sustain their attention towards objects for longer when playing with a partner compared to playing alone (Bakeman & Adamson, 1984; Findji, 1993). In addition, research directly examining play between caregivers and infants has shown that specific caregiver behaviours such as manipulating and showing a toy, are linked to infant attention (Barrat, Roach & Leavitt ,1992; Findji, 1993; Pêcheux et al., 1992).

Beyond caregiver behaviours and characteristics, infant age and birth status have been shown to affect infant attentional skills and the behaviours that mothers use to manage their infants' attention. Results from studies have found that mothers decrease their scaffolding efforts as their infants grow and their skills become more sophisticated (Findji, 1993; Pêcheux et al., 1992). Research has also examined maternal scaffolding behaviours with infants born preterm. The relationship between risk status at birth, infant attention and maternal scaffolding was a question of particular interest in the present study because preterm infants have difficulties sustaining attention and are at risk for later developmental problems (Barnard et al., 1984; Landry, 1995; van De Weijer-Bergsma et al., 2008). During early interactions with their preterm infants, mothers have been found to be more active, stimulating, intrusive and at the same time more distant than mothers of fullterm infants (Barnard et al., 1984; Beckwith & Rodning, 1996; Caplan, Mason & Kaplan, 2000; Chapiesky & Evankovich, 1999; Crnic, 1983).

Barrat et al., (1992) found that mothers of 4-month-old healthy preterm infants displayed higher levels of attentional responsiveness than mothers of fullterm infants.

Preterm infants are a heterogenous group, differing according to their gestational age, birthweight, and degree of perinatal medical complications. Due to the heterogeneity associated with preterm births, it is critical to identify subgroups within populations of preterm infants. One important subgroup to investigate is very-low-birth weight preterm infants who are born weighing less than 1500 grams. A substantial proportion of PT-VLBW infants are born with numerous medical complications, yet there are PT-VLBW infants who are relatively healthy, experiencing few perinatal medical complications, making them an important subgroup of preterm infants to study. Such a subgroup is important to investigate in order to better understand the influence of early infant birth status, low medical risk and low birthweight on caregiver-infant interactions. Surprisingly little research, however, has been conducted with such samples of preterm infants. As a result, the current study included a group of relatively healthy very-low-birth weight preterm infants and their mothers.

While research has considered a number of infant characteristics and factors in the social environment that influence infant attention, little is known about how elements of the nonsocial environment impact early play between caregivers and infants. One important contextual factor embedded within caregiver-infant play is type of toy. Remarkably, while studies examining the development of caregiver-infant interactions have typically included a broad and standard array of toys, few have included type of toy as a variable for empirical investigation (Bakeman & Adamson, 1984; Bornstein & Tamis-LeMonda, 1990). Furthermore, numerous studies (Findji, 1993; Landry & Chapieski, 1989; Lawson, Parinello & Ruff, 1992; Yato, 2000, 2007) have reported their findings for toy play in general without considering the contribution of specific types of toys on mother and infant behaviour. As caregivers and infants share toys during play,

they must coordinate their attention to the toys and their actions with the toys. As such, the type of toys available is likely to have an effect on caregiver-infant communication. Identifying the role of toy-type on caregiver and infant behaviour during play is important because the function of different behaviours is best accomplished by examining them within the contexts they are embedded. More specifically, in order to fully understand infant attention and maternal behaviour, it is critical to consider the impact of toy-type, a pivotal contextual factor during play.

Over two decades ago, Wachs (1984) argued that there was a relative neglect of the physical compared to the social environment when studying infant development. He argued that ignoring elements of the physical environment leads to the oversimplification of statements that are made about development. Addressed by Wachs (1984) and later by Chase (1994) is the particular importance of studying the types of toys that are available during play because of infants' and children's inherent interest in them and because of the support they provide for learning in many developmental areas, including language, attention and cognition. The research support for the importance of social toy play on infant development and the notion that toys are an important part of toy play demonstrates the need for further investigations to consider the impact of these variables on caregiver behaviours and infant attention during joint play.

Some experimental research has considered the role of environmental or physical factors in their studies of infant attention. For instance, Deak, Flom and Pick (2000) studied the impact of type of visual target on joint visual attention in 12-and 18-month old infants, and found that distinctive, complex targets elicited more episodes of joint visual attention compared to identical, simple targets. Similarly, studies examining the habituation process in infants (i.e. decrement of attention when a stimulus is repeatedly presented) have also shown the importance of stimulus complexity in attracting and maintaining infant attention (e.g. Richard, Normandeau, Brun & Maillet,

2004). Infants require a longer time to habituate to more complex stimuli compared to less complex stimuli (Richard et al., 2004). Infants have also been shown to be less distracted by simple compared to multicompnent stimuli (Oakes, Tellinghuisen & Tjebkes, 2000; Tellinghuisen & Oakes, 1997). Together, these studies demonstrate the contribution of nonsocial factors to infant attention and highlight the need to understand how social and nonsocial variables jointly affect infant attention and the behaviours mothers use to structure their infants' attention during play.

When type of toy has been a consideration in research studies, it has typically been with the purpose of investigating the socialization of gender and gender stereotypes (Caldera & Sciaraffa, 1998; Malone & Langone, 1998; O'Brien & Huston, 1985). Furthermore, limited research in the area of language development has also considered toy-type as a variable (e.g. Senechal, Cornell & Broda, 1995) Recently, Yont, Snow and Vernon-Feagans (2003) found that mothers used more conversation-eliciting behaviour during book-reading whereas they directed and negotiated children's attention more during toy play.

Limited studies have considered the influence of toy-type on infant attention or caregiver scaffolding behaviours during play. Di Francesco (2004) found that the focused attention of 36-month-old infants was longer with toys that are goal-directed toy with a playful outcome (i.e. construction toys) compared to those that have a defined goal (i.e. puzzles). In addition, Colburne (2000) found that toy-type (i.e. social and functional toys) influenced the type of play between mothers and their infants. Together these studies demonstrate the importance of considering toy-type as a factor that influences the behaviours of mothers and infants during play.

The purpose of the present study was to investigate how toy-type influences the nonverbal behaviours mother employ to structure the attention of their infants during joint

toy play, and to examine the influence of toy-type on infant attention. There were four objectives: (1) to identify changes in the attention-directing nonverbal behaviours of mothers according to toy-type; (2) to identify changes in infant gazing behaviour according to toy-type. Examining gaze direction related differences according to toy-type is critical because toys are powerful learning tools for infants and the direction of their gaze can reveal information about the toys on which they focus their attention and which can support the growth of their cognitive abilities (Choudhury & Gorman, 2000; Ruff et al., 1998; Tamis-LeMonda & Bornstein, 1989); (3) to identify developmental changes in maternal and infant behaviours according to infant age. To address this question, mothers and infants were studied when infants were 5½ as well as 12 and 18 months-old; (4) to assess how infant risk status influences maternal and infant behaviours by examining two groups of infants, one that was born normal birthweight fullterm (FT-NBW), and another that was born PT-VLBW.

Several specific hypotheses related to these objectives were made. For example, it was hypothesized that at 5½ months, caregivers would use many active and less active behaviours for longer with the rattle and rings (toys with functional properties) compared to the other toys since such toys have many multimodal features that mothers can utilize to direct their infants attention towards. It was also hypothesized that at 12 and 18 months, mothers would use active and less active behaviours for longer with the doll and teaset, toys with social properties compared to the other toys. This was predicted because by 12 months, infants become increasingly socially interactive and mothers may be more inclined to engage their infants' attention towards toys that can complement their growing social skills. It was also expected that mothers would use the active strategy of *demonstrate* for longer with many toys, in particular books since mothers increasingly use play at these ages to teach their infants. Related to the second and third objectives, it was hypothesized that at 5½ months infants would gaze for longer

at most toys when mothers' hands were in contact with them. This was expected since younger infants have greater difficulty independently maintaining their attention towards toys and as such it was predicted that infants would gaze at toys for longer when mothers were providing external structuring (i.e. mothers' hands were in contact with the toys). However, by 12 months infants have gained greater attentional control and as such, it was expected that infants would gaze for longer at some toys independently compared to when mothers' hands were in contact with them. Furthermore and as related to objective 4, it was expected that greater group differences would emerge at 5½ compared to 12 and 18 months since the impact of birth status tends to be more prominent in younger infants. That is, mothers of 5½-month-old preterm infants were expected to use many attention structuring behaviours for longer with toys compared to mothers of fullterm infants. Nonetheless, it was hypothesized that at all three age groups, caregivers of PT-VLBW infants would use most nonverbal behaviours for longer with toys compared to mothers of fullterm infants since mothers of preterm infants have been shown to provide greater stimulation to their infants compared to mothers of fullterm infants. Overall, results from the present study were expected to contribute to a better understanding of the role of maternal and infant nonverbal communication during play.

Method

Participants

A sample of FT-NBW and PT-VLBW mothers and their infants were recruited from a teaching hospital in Montreal (Quebec, Canada). Participants were recruited from the same hospital to maintain similarity in socio-economic status (SES) and ethnic backgrounds. Mother-infant dyads were longitudinally studied at three time points, when infants were 5½ (Time 1), 12 (Time 2) and 18 (Time 3) months-old. Thirty-seven mothers and their fullterm infants participated at Time 1, 35 dyads at Time 2, and 31 dyads at

Time 3. Thirty-seven mothers and their PT-VLBW infants participated at Time 1, 34 dyads at Time 2, and 27 dyads at Time 3.

FT-NBW infants weighed at least 2 750g at birth, their gestational ages ranged between 38 and 41 weeks, and mothers and infants had uncomplicated medical histories. The PT-VLBW infants weighed between 800-1500g at birth and their gestational ages ranged from 26 to 32 weeks. Additional selection criteria limited the population to a sample of healthy infants who were living with their biological mothers and who did not fit any of the following exclusionary criteria: infants who suffered from a Grade IV intra-ventricular hemorrhage or other major medical complications, illnesses or syndromes (e.g. hydrocephalus, severe neurological impairment, hearing loss, retinopathy); infants who had been diagnosed with a congenital abnormality; infants who had experienced prolonged and/or repeated hospitalizations since the neonatal period; infants of diabetic or teenage mothers (<18 years); and mothers at psychosocial risk due to a history of inadequate prenatal care, drug-abuse, mental illness or rape.

To correct for prematurity in the PT-VLBW group, corrected age (i.e. postnatal age less the number of weeks the infant was premature) was employed. The FT-NBW and PT-VLBW dyads were matched on infant sex, maternal age (within 5 years) and maternal education. Table 1 presents key medical and demographic characteristics of the FT-NBW and PT-VLBW infants and their families.

Materials

The set-up for each testing session included a standardized presentation of age appropriate toys which were placed on a mat (1M x 1M) that was located on the floor. At 5½ months, a plush bear, rattle, Fisher Price Rock-a-Stack and plastic book were used, and at 12- and 18-months, a plastic telephone, tea set, doll, Lego blocks and two books were included. The overall classification of toys into social (bear, doll, teaset) or

functional (rattle, rings, and blocks) categories was also considered as previous literature has supported the classification of toys into such categories (Colburne, 2000). Appendix A provides further detailed information on the classification of toys into these categories.

Each free play session was timed using a stop watch. 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 setup 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.

Procedure

Observations took place in the homes of participants and the interactions were videotaped. Prior to commencing the study, each mother provided written informed consent (Appendix B). The experimenter and mother then located a quiet place in the home where the materials for the testing session could be set up, and mothers were asked to sit on the mat with their infants, across from the toys and facing the camera. At 5½, 12 and 18 months, before the start of each free play session, mothers were given the following instructions: "During this period, play with (CHILD) as you normally would at home. You can use the toys we placed on the mat if you wish, but there is no obligation to use them. Do you have any questions?" At 5½ months, the duration of play sessions was 8 minutes, and at 12 and 18 months, the duration of play was 15 minutes. A stopwatch was used to time the play and the onset and offset of the interaction was communicated to mothers by a light tap on the wall by the experimenter. Mothers were

also told that if at any time 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 questionnaire which consisted of a series of standardized questions on general demographic information and their infant's medical history. An Infant Scientist Award was provided to each mother in recognition of their infant's participation. A letter of appreciation with a summary of general findings was sent to all participants upon completion of the study.

Behavioural Measures and Coding

A coding scheme was developed to describe and evaluate the nonverbal behaviours mothers used with their 5½ - , 12- and 18-months-old infants in free play with different types of toys. Appendix C provides a detailed description of the coding process. The first 8 minutes of each play interaction was coded. Each play interaction was coded in second- by-second intervals and captured nine different nonverbal behaviours mothers employ to scaffold their infants' attention towards the toys. Table 2 provides brief definitions of the nine behaviours which were classified into active and less active categories. In addition, Appendix D includes a detailed description of the operational definitions and examples for all nonverbal behaviours.

The active category included: shaking or waving a toy(s), pointing towards a toy(s), tapping a toy(s), giving or offering a toy(s) and demonstrating the use or function of a toy(s). The less active category included: touching a toy(s), touching a toy with the infant, showing a toy(s), and physically assisting the infant with a toy(s). Similar categories for maternal nonverbal behaviours have been used in previous research (Landry, Chapieski & Schmidt, 1986; Leiba, 2000).

The direction of infants' gaze was also coded in second-by-second intervals. Infant gaze was coded according to the specific toy(s) infants were looking at when mothers' hand(s) were not in contact with a toy(s), and when their mothers' hand(s) were in contact with a toy(s). An away category was included to account for the time infants were gazing away from the mat area. Gaze categories similar to these have been reliably used in the past (Stack & Arnold, 1998; Stack & LePage, 1996). Appendix E includes operational definitions for infant gaze categories.

To reduce the potential bias arising from extraneous contextual cues during coding, all interactions were coded with no sound. The data were reduced into percent duration for each measure. To assess inter-rater reliability, an independent rater, blind to the hypotheses of the study, coded 20% of the records. Kappa coefficients were calculated to assess the reliability of onset and offset times for each measure (Cohen, 1968). The Kappa coefficients ranged from $r = 0.87$ to 0.96 for maternal nonverbal behaviours and $r = 0.88$ to 0.98 for infant gaze.

Results

Two separate sets of analyses were conducted with the data. The first set of analyses were carried out on the mother-infant interactions when infants were 5½ - months-old (Time 1). These analyses included *Toy* as the repeated factor. At 5½ months, *Toy* included bear, rattle rings and book, and at 12 and 18 months *Toy* included telephone, teaset doll, blocks and books. *Sex* (male and female) and *Group* (FT-NBW and PT-VLBW) were included as between-participants factors. The second set of analyses was conducted on mother-infant interactions at Times 2 and 3 when infants were 12-and 18-months-old. These analyses included *Age* and *Toy* as repeated factors, and *Sex* (male, female) and *Group* (FT-NBW and PT-VLBW) as between-participants factors.

The dependent variables for both sets of analyses were the percent duration of five active maternal nonverbal behaviours and four less active maternal nonverbal behaviours. Two Multivariate Analyses of Variances (MANOVA) were conducted on data from Time 1 and Times 2 and 3. The first MANOVA included five active maternal nonverbal behaviours used with toys including, *shake, tap, give, demonstrate and point.* The second MANOVA included four less active maternal nonverbal behaviours including, *touch, touch-with, show,* and *physically assist.* The analyses addressed the questions of how the nonverbal behaviours mothers used to structure their infants' attention changed according to type of toy, infant age and birth status. Table 3 presents the mean percent durations and standard errors for each toy according to maternal strategy at 5½ months.

Infant gaze was also measured during mother-infant interactions when infants were 5½, 12 and 18 months. A repeated-measures Analysis of Variance (ANOVA) was conducted on the percent duration of infant gaze at 5½ months, and 12 and 18 months. For each analysis, *Direction of Infant Gaze* was the repeated factor, and *Sex* (male, female) and *Group* (FT-NBW and PT-VLBW) were the between subjects factors. *Age* (12 and 18 Months) was an additional repeated factor for the ANOVA conducted at Times 2 and 3. Transformations were conducted on all dependent variables to control for significant skewness, kurtosis, and/or outliers (Tabachnick & Fidell, 1996). Figures represent raw data that is the mean percent duration of time mothers utilized nonverbal behaviours.

Results revealed no main effects or interactions of Sex for any of the dependent variables. Accordingly, infant Group remained the only between-participants factor for all analyses. Tukey univariate-analyses and Bonferroni correction were completed to follow-up any significant main effects and simple effect analyses were conducted to examine

interaction effects.

Five and a Half Months

Active Maternal Nonverbal Behaviours

A MANOVA revealed an overall main effect of *Toy*, Pillai's Exact F (15, 57) = 52.09, $p < .01$. Follow-up analyses revealed results for *shake*, F (3, 213) = 61.51, $p < .001$; *tap* F (3, 213) = 21.36, $p < .001$; *give*, F (3, 213) = 31.07, $p < .01$; *demonstrate*, F (3, 213) = 68.24, $p < .001$ and *point*, F (3, 234) = 48.87, $p < .001$. *Shake* was used for the longest amount of time with the rattle, one of the functional toys available at 5½ months. Mothers also used *shake* with the rings, considered a functional toy but for less time compared to the rattle, also categorized as a functional toy. *Shake* was used with the bear, a social toy, for the next longest amount of time after the rattle. Shake was used with the bear for longer compared to the rings and book. Although mothers used *tap* minimally with toys this behaviour was used longest with both the rattle and rings compared to the other toys. However, *tap* was used for significantly longer with the rings compared to the rattle. Likewise, mothers used *give* for a longer amount of time with the rattle and rings compared to the other toys. *Demonstrate* was used longer with the book compared to all other toys. Mothers also used *point* longer with the book, and the rattle compared to the bear and rings.

Overall the results revealed that many active maternal behaviours were used for longer with the rattle and rings, functional toys compared to the bear, a social toy and book. *Demonstrate* was the only active behaviour used for longer with the book compared to the other toys. Figure 1 represents the mean percent duration of active maternal nonverbal behaviours according to toy-type.

A main effect of *Group* was found, Pillai's Exact F (5, 67) = 4.45, $p <$. 01. The percentage of time mothers' of preterm infants shook toys (M = 4.44%) was longer than mothers of fullterm infants (M = 2.86%), F (1, 71) = 8.11, $p < .01$. Similarly, mothers of

preterm infants pointed towards toys (M = .54%) for longer than mothers of fullterm infants (M = .28%), F (1, 71) = 5.77, p < .05.

A *Toy by Group* interaction was also found, F (15, 57) = 3.07, p < .01. As illustrated in Figures 2 (a, b) mothers of PT-VLBW infants pointed longer at the book than mothers of FT-NBW infants, F (3, 213) = 7.83, p < .01.

Less Active Maternal Nonverbal Behaviours

A MANOVA revealed an overall main effect of *Toy,* Pillai's Exact F (12, 18) = 15.33, p < .001. Follow-up analyses revealed results for *touch*, F (3, 87) = 26.04, p < .01, *touch-with* F (3, 87) = 15.37, p < .05, show F (3, 87) = 5.67, p < .01 and *physically assist* F (3, 87) = 4.89, p < .01. *Touch* was used for longer with both the bear and rings compared to the rattle and book. However, mothers used *touch-with* for the longest amount of time with the book compared to all other toys. In general, *show* was used for longest with most toys compared to the other behaviours. In particular, mothers used *show* for longest with rings, a functional toy compared to all other toys. Similarly, *physically assist* was used minimally, although longer with the rattle and rings compared to the bear. Overall, the findings indicate that mothers used many less active behaviours for longer with the rattle and rings, functional toys compared to the other toys. Figure 3 represents the means of the percent duration of the less active maternal nonverbal behaviours according to each toy at 5½ months.

A main effect of *Group*, Pillai's Exact F (4, 75) = 3.30, p < .05 was also revealed, indicating, that the percentage of time mothers' of FT-NBW infants (M = .57%) *touched* toys was longer compared to mothers of PT-VLBW infants (M = .30%), F (4, 52) = 3.70, p < .01.

A *Toy by Group* interaction was also found, F (3, 234) = 2.03, p < .05. Follow-up analyses revealed significant results for *touch* F (3, 234) = 3.62, p < .01. Mothers of FT-NBW infants *touched* the rattle and rings for longer than mothers of PT-VLBW infants.

Twelve and Eighteen Months

Active Maternal Nonverbal Behaviours

A MANOVA revealed a main effect of *Toy*, Pillai's Exact F (20, 38) = 23.79, p <. 001. Follow-up analyses revealed significant results for *shake*, F (4, 228) = 133.42, p < .001, *tap* F (4, 228) = 9.54, p < .001, *give* F (4, 228) = 16.83, p < .01, *demonstrate* F (4, 228) = 33.30, p < .001 and *point*, F (4, 228) = 30.51, p < .001. Mothers used *shake* for longest with the teaset and doll compared to the other toys. *Tap* was used for the least amount of time with the telephone compared to all toys, and it was a behaviour that was used minimally with all the toys. *Give* was a behaviour that mothers used for longest with the teaset and doll and for less time with all other toys compared to the teaset and doll. *Demonstrate* was the behaviour that was used the longest with all toys by mothers. However, mothers used *demonstrate* for longest with the book compared to all other toys. Mothers also used *point* with book for longer compared to all other toys. Together these findings indicate that many active behaviours were used for longer with the teaset and doll, considered social toys and the books compared to the blocks, a functional toy. Table 4 presents data for maternal behaviours according to toy at 12 and 18 months.

A main effect of *Age*, Pillai's Exact F (5, 53) = 24.98, p <. 001 was found. Follow-up analyses revealed that mothers spent longer using *shake* at 12 (M= .35%) compared to 18 months (M= .30%), F (1, 57) = 108.75, p < .001. Similarly, the use of demonstrate decreased from 12 (M = 6.21%) to 18 months (M = 5.89%) F (1, 57) = 23.26, p < .001. However, mothers used *point* for longer when their infants were 18 (M = 1.16%) compared to 12-months-old (M = .85%), F (1, 57) = 5.50, p < .05.

An interaction effect of *Age by Group*, Pillai's Exact F (5, 53) = 3.15, p <. 01 was also found. Follow-up analyses revealed results for *tap* F (1, 57) = 5.91, p < .05, and *point* F (1, 57) = 8.18, p < .01. When infants were 18-months-old, mothers of FT-NBW infants used *tap* for longer (M = .23%), than mothers of PT-VLBW infants (M = .11%). At

12 months, mothers of PT-VLBW infants used *point* for longer (M = 1.29%), than mothers of FT-NBW infants (M = .59%).

A MANOVA revealed an overall multivariate interaction effect of *Age by Toy,* Pillai's Exact F (20, 38) = 8.99, p <. 001. Follow-up analyses revealed results for *shake* F (4, 228) = 92.42, p < .001, and *demonstrate* F (4, 228) = 39.40, p < .001. Mothers used *shake* with the teaset for longer at 18 compared to 12 months. Mothers shook the doll for longer when infants were 12 compared to 18 months. Mothers demonstrated the telephone for longer when infants were 12 compared to 18 months. Mothers, however, demonstrated books for longer at 18 compared to 12 months. Table 5 presents data for each toy according to maternal behaviours at 12 and 18 months. Figures 4a and b illustrate active behaviours according to toy at 12 and 18 months.

Less Active Maternal Nonverbal Behaviours

A MANOVA revealed a main effect of *Toy*, Pillai's Exact F (16, 42) = 50.77, p < .001. Follow-up analyses revealed results for *touch*, F (4, 228) = 10.30, p < .001, touch-with F (4, 228) = 11.23, p < .001, *show* F (4, 228) = 62.66, p < .001, and *physically assist* F (4, 228) = 7.86, p < .001. *Touch* was used for longest with the teaset and doll compared to all other toys. *Touch*-with was used for longest with the book. While *show* was the behaviour that was used the longest with all toys, *show* was also used the longest by mothers with the teaset and doll. *Physically assist* was a behaviour used for the least amount of time at 12 and 18 months. However, it was used for longer with the social toys and the telephone, a social-functional toy compared to the books. Overall, the findings demonstrate that many of the less active behaviours were used for longer with teaset and doll, both socially-oriented toys compared to other toy-types.

A main effect of *Age* was found, Pillai's Exact F (4, 54) = 6.73, p <. 001. Mothers touched toys for longer at 12 (M = .56%) compared to 18 months (M = .23%), F (1, 57) =

22.92, $p < .001$. Mothers also used *physically assist* for longer at 12 ($M = .19\%$) compared to 18 months ($M = .10\%$), $F(1, 57) = 8.08$, $p < .05$.

An *Age by Group* interaction was found, Pillai's Exact $F(4, 54) = 6.02$, $p < .001$. Follow-up analyses revealed results for *touch* $F(1, 57) = 4.68$, $p < .05$, and *show* $(1, 57) = 19.66$, $p < .001$. At 12 months, mothers of FT-NBW infants touched toys for longer ($M = .73\%$) than mothers of PT-VLBW infants ($M = .39\%$). At 12 months, mothers of PT-VLBW infants showed toys for longer ($M = 7.00\%$) than mothers of FT-NBW infants ($M = 4.89\%$). However, at 18 months, mothers of FT-NBW infants showed toys for longer ($M = 6.63\%$) compared to mothers of PT-VLBW infants ($M = 5.19\%$).

A *Group by Toy* interaction was found, Pillai's Exact $F(16, 42) = 1.89$, $p < .05$. Follow-up analyses revealed results for *show* $F(4, 228) = 4.52$, $p < .05$. Mothers of FT-NBW infants used *show* with the teaset for longer ($M = 10.07\%$) than mothers of PT-VLBW infants ($M = 9.08\%$). However, mothers of PT-VLBW infants used *show* for longer with blocks ($M = 4.86\%$) compared to mothers of FT-NBW infants ($M = 4.13\%$).

An *Age by Toy* interaction was found, Pillai's Exact $F(16, 42) = 4.61$, $p < .001$. Follow-up analyses revealed results for *show* $F(4, 228) = 4.63$, $p < .05$. The amount of time mothers used *show* with the blocks decreased from 12 to 18 months, as depicted in Figures 6 and 7.

Gaze

Five and a Half Months

A repeated measures ANOVA (with Greenhouse-Geisser correction) on the percent duration of infant gaze revealed a main effect of Gaze Direction, $F(12, 924) = 67.31$, $p < .001$. Follow-up analyses revealed that infants gazed longest at the rattle and rings compared to the other toys. However, infants gazed at the rings for longer than the rattle. Infants gazed at the bear for the least amount of time compared to any other toy.

The total amount of time infants gazed *away* was longer than the amount of time they spent gazing at the bear, rattle, and book.

When mothers' hands were in contact with the toys, infants gazed at the book for longest compared to any other toys. However, infants gazed at the bear for the least amount of time when mothers' hands were in contact with it, and gazed at the rings for longer than the rattle. Furthermore, the percentage of time infants gazed away was longer compared to the time they gazed at the bear, rattle or rings when mothers' hands were in contact with them.

Comparisons were made between the lengths of time infants gazed at toys independently, that is when mothers' hands were not in contact with the toys and when mothers' hands were in contact with the toys. The length of infants' gaze at the rattle and rings was longer when their mothers' hands were not in contact with them compared to when they were. In contrast, infants gazed at the bear and book for longer while mothers' hands were in contact with these toys. Table 6 summarizes the mean percent duration for gaze direction at 5½ months.

A main effect of *Group* was also found F (1, 77) = 9.01, $p < .01$. FT-NBW infants (M = 6.78%) gazed for less time at toys than PT-VLBW infants (M = 7.44%).

Twelve and Eighteen Months

A repeated-measures ANOVA (with Greenhouse-Geisser correction) on the percent duration of infant gaze revealed a main effect of *Age*, F (1, 45) = 11.76, $p < .05$. Overall, infants at 12 months gazed (M = 6.72%) longer than infants at 18 months (M = 6.63%).

A main effect of *Gaze Direction* was also found, F (14, 32) = 130.70, $p < .001$. Follow-up analyses revealed that infants gazed at the teaset, a social toy for longer than any other toy. Infants gazed at the doll, also a social toy for less time than the blocks. Infants gazed at the book for less time compared to all other toys. Infants gazed away

for longer compared to the amount of time infants gazed at the telephone, doll and books.

Infants gazed at the telephone for less time when mothers' hands were in contact with it compared to any other toy. Also, infants gazed at the teaset, doll and books when mothers' hands were in contact with these toys for longer compared to when mothers' were touching the blocks. The total amount of time infants gazed away was longer than the amount of time they spent gazing at the telephone and blocks when there was maternal hand contact.

Examination of the amount of time infants gazed at toys independently compared to when they gazed at the toys while the mothers' hands were in contact with them revealed that infants gazed at books longer when mothers' hands were in contact with them compared to when they were not. However, infants gazed at the teaset longer when mothers' hands were not in contact with the toy compared to when they were not. Table 7 demonstrates the mean percent durations of infant gaze.

A *Gaze Direction by Age* interaction was found, F (14, 630) = 2.21, $p < .001$. At 12 months, infants gazed at the blocks for longer compared to when they were 18 months. Likewise, they gazed at blocks with maternal hand contact for longer at 12 compared to 18 months. Infants gazed at the doll when their mothers' hands were in contact with it for longer at 12 than at 18 months. Table 8 presents the findings for infant gaze at toys at 12 and 18 months.

Discussion

The main objectives of this study were to evaluate differences in maternal nonverbal behaviours and infant attention according to toy-type, infant age and birth status. Results across all three time points revealed that the amount of time that mothers used nonverbal behaviours to structure their infants' attention was closely linked to the types of toys available during play interactions. At 5½ months, many maternal nonverbal

behaviours were used longer with the rattle and rings, both considered to be functional toys compared to the other toy-types. For example, mothers used *shake* for longest with the rattle while they used *tap* for longer with the rings. Although both behaviours are active ways in which to structure infant attention, it is clear that mothers adjusted how they use these behaviours depending on the type of toy they were playing with. Interestingly, at 12 and 18 months, mothers' use of both active and less active behaviours was typically longer with the teaset or doll, both social toys. The types of behaviours that mothers employed with the toys at 5½ relative to 12 and 18 months is likely related to the developmental level of infants as well as the match between infants' skills and the kinds of opportunities for exploration and practice of the emerging skills these toys provided.

At 5½ months, mothers may have been more likely to engage their infants with the rattle and/or rings because such functionally-oriented toys elicit play around the toys themselves. Functional toys fit infant abilities and interests better because at this age they actively explore their physical environment by shaking, turning, and manipulating object surfaces (Belsky & Most, 1981). Gaze findings were consistent with these results, showing that at 5½ months, infants gazed at the rattle and rings for longest, suggesting these are toys that infants have a greater interest in. Interestingly, when infants were 5½ -months-old, they gazed at the social toy for longer when mothers were engaged with the toy. This likely occurred because mothers used *shake*, a highly active behaviour which is effective at structuring infants' attention, for longer with the social toy compared to most other toys. By 12-months-old, infants have become increasingly mobile, and are more active, social participants in play with their mothers compared to when they were younger. As such, mothers were likely attuned to their infants' increased cognitive and physical competencies and engaged their infants with toys that were socially-oriented and elicited more social play. These findings are supported by results from infant gaze

which revealed that at 12 and 18 months, infants gazed at the teaset, a social toy, for considerably longer than all other toys. These findings support previous research that has shown that environmental or physical factors influence both caregiver and infant behaviour (Deak et al., 2000; Caldera & Sciaraffa, 1998).

A clear pattern that emerged at the three ages was mothers' increased use of particular behaviours with books, namely, *demonstration*, *point* and *touch-with,* underscoring the important relationship between maternal behaviour and toy-type. Specifically, mothers used *point* and *touch*-with for longer with books compared to nearly all other toys that were available. Previous research supports the finding that mothers commonly use *point* as a way to direct and sustain their infant's attention during book reading (Senechal et al., 1995; Yont et al., 2003). In addition to using the pointing gesture, mothers also simultaneously touched books with their infants for longer relative to other toys. Yont et al. (2003) found that book reading promoted more maternal bouts of joint focused attention compared to play with other types of toys. Simultaneously touching a toy with infants may be a nonverbal counterpart to such joint-focused discussions; that is, a nonverbal way in which mothers communicate, and encourage joint attention with their infants. Identifying possible ways in which mothers can contribute to the emergence of joint attention through their nonverbal behaviours is critical as joint attention skills in infants have been linked to many important developments in infancy and early childhood (Adamson & Bakeman, 1991; Mundy et al., 1990; Rocissano & Yatchmink, 1983). Furthermore, these findings are particularly important given that parents' encouragement of their infants' attention during interactions with books has been linked to the development of language and pre-literacy skills in infants and children (Fletcher & Reese, 2005; Stadler & McEvoy, 2003).

At 5½, 12 and 18 months, *demonstrate* was the active behaviour used the longest with the book compared to all other toys. 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 specific information about the function of the toy or how the toy should be used (Landry et al., 1996; McCune et al., 1994). As such, when engaging with a book during play interactions with their infants, mothers were sensitive to their infants' needs of requiring greater assistance in approaching and appropriately engaging with the book compared to other toys. Mothers also likely demonstrated books for longer because of their inherent qualities, that is, books tend to elicit activity that is both ludic and didactic (Senechal et al., 1995). In fact, Bruner (1983) and others (e.g. Fletcher & Reese, 2005; Ninio, 1980; 1983) have noted that early mother-infant interactions with books provide infants with opportunities to learn about conventions around book-reading such as illustration and labeling. Consequently, when engaging with a book during play interactions, mothers utilized *demonstrate* not only to structure the attention of their infants but also to teach them. For example, it was frequently observed that mothers showed their infants how to hold a book and turn the pages of a book. It also appears that maternal nonverbal behaviours were effective at increasing infant attention towards books because at all three ages, the amount of time infants gazed at books was substantially longer when their mothers were engaged with them compared to when they were not.

Taken together, these findings demonstrate that mothers actively organize play interactions in ways that scaffold the attention of their infants while teaching and guiding their development. The present findings also support the notion that toy-types are micro-contexts which are related to differences in maternal behaviour and infant attention (Caldera & Sciaraffa, 1998; Senechal, et al., 1995; Yont et al., 2003). This was clearly

evidenced by mothers modifying their nonverbal behaviours when engaging with different toy types, and infants gazing at toy types for different lengths of time. Results from the present study provide support for Wachs' (1984) position that the physical environment of infants has to be considered in order to achieve an accurate and representative understanding of infant and child development. We extend this argument by contending that the individual and joint influences of social and physical contexts must be taken into account when studying the development of infant attention and mother-infant play.

A second objective of this study was to address age-related changes in the nonverbal behaviours mothers use to focus the attention of their infants towards toys. Closer examination of maternal behaviours revealed that many of those which provided a high level of structure (i.e. physical assistance) and/or were highly attention-getting (i.e. *shake* and *demonstrate*) were used less by mothers from 12 to 18 months. However, mothers used *point* for longer over time. The increased use of *pointing* by mothers from 12- to 18-months is an interesting finding, and 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 close by, 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 (Tomasello, 2006; 2008). Accordingly, mothers may increase their use of pointing because infants are more likely to visually follow these points, and use the pointing gesture more frequently themselves. This provides mothers with evidence that their infants understand their communicative gesture, making them more likely to use it.

Some of the present findings are consistent with prior research which has found that maternal behaviours used to encourage their infants' attention decrease as they grow and become better able to sustain their attention (Belsky & Most, 1981; Pêcheux et

al., 1992; Ruff & Lawson, 1990). However, most of the literature that is available has not studied maternal nonverbal attention-directing behaviours in as detailed a manner as the current study. By examining an extensive array of nonverbal maternal behaviours, the present study clearly identified that the use of some maternal behaviours reduced over time, while the use of others increased or remained stable. Much prior research has concluded that mothers reduce their scaffolding over time. However, findings from the present study indicate that mothers do not necessarily reduce their scaffolding as their infants develop but rather, they actively adjust their behaviour according to the age and developmental level of their infants.

When taking into account toy-type, specific maternal nonverbal behaviours, and infant characteristics, the overall picture of scaffolding during mother-infant play becomes somewhat more complex. That is, mothers were shown to tailor their behaviours to the types of toys that they were engaging with in ways that consistently complimented their infants' competencies and development level. For example, mothers' demonstration of books for longer over time is reflective of their sensitivity to their infant's growing language capabilities. By 12 months, infants' vocabularies are increasing and they are expressing themselves more frequently through language. Furthermore, it has been shown that book reading is frequently used by parents as a way to promote their infants' language skills (e.g. Fletcher & Reese, 2005).

Mothers also adjusted their behaviours according to the birth status of their infants. The main differences were found at 5½ and 12 months. At 5½ months, mothers of PT-VLBW employed the active behaviours of *shake* and *point* for longer compared to mothers of FT-NBW infants, and at 12-months, mothers of PT-VLBW used *point* and *show* for longer with toys. These results are consistent with previous research which has shown that in the early months, mothers of preterm infants are more active and provide

a greater level of stimulation compared to mothers of fullterm infants (e.g. Barnard, Bee & Hammond, 1984; Van De Weijer-Bergsm et al., 2009). However, further research is required to extend our understanding of why mothers of preterm infants utilize particular attention-structuring behaviours for longer compared to other behaviours. Findings from infant gaze revealed that at 5½ months, PT-VLBW infants gazed at toys for longer than fullterm infants. This is in contrast to previous studies which have found that preterm infants have greater difficulty sustaining their attention towards toys (Doctoroff, 1996; Garner, Landry & Richardson, 1991; Landry, Garner & Denson, 1993; van de Weijer-Bergsma, 2008). One possible explanation for this difference is that mothers of 5½ - month-old preterm infants used several highly active and structuring attention-directing behaviours for longer with their infants which likely enhanced infants' gazing at toys for longer periods.

Fewer group differences emerged in maternal nonverbal behaviours when infants were 18- months-old. This may be because the developmental discrepancy between infants born preterm compared to fullterm decreases as they grow. Past studies have found that differences in maternal behaviour between preterm and fullterm infants reduce over time (e.g. Landry et al., 1986). This may be related to the fact that preterm and fullterm infants differ more when infants are younger which can affect maternal experience, attitudes and behavior with their infants (Muller-Nix et al., 2004). As such, mothers likely used different behaviours with their infants in the first year compared to when they were older due to the greater impact of their infants prematurity and immaturity at this age.

Although important group differences emerged in maternal nonverbal behaviours and infant gaze, they were fewer than expected. This may be largely explained by the fact that the sample of PT-VLBW infants that were included in this study was relatively

healthy and had few major medical complications. In addition, their ages were corrected so that they matched the ages of the fullterm group. The age correction is an important methodological factor which has not been considered in many previous studies comparing fullterm and preterm mother-infant dyads. Future studies should consider correcting the age of preterm infants as this may account for some of the differences found between the interactive behaviours of preterm and fullterm infants and their mothers. In addition, the present research matched both fullterm and preterm groups according to maternal age and education level, reducing potential group differences due to these factors. Findings from the present study add valuable information to the limited research available examining play interactions with toys between mothers and their PT-VLBW infants.

In summary, the present findings highlight the importance of considering the social and physical contexts which are present during mother-infant play. The bulk of research in the area of infant attention and maternal scaffolding of attention has neglected the impact of the physical play environment. Although each toy-type was represented at all ages, the number of toys differed at 5 compared to 12 and 18 months which precluded the empirical examination of changes in maternal nonverbal behaviours across all three ages. Further research would benefit from longitudinally studying the influences of the play environment over longer periods of time. Findings from the present study also underscore the important role of maternal nonverbal attention scaffolding and shed light on how mothers adapt their scaffolding efforts according to their infant's age and birth status. However, communication between mothers and infants is complex and multimodal, and there is growing recognition that to represent the complexity of infant and mother communication, multiples indices must be studied. In particular, mothers use both verbal and nonverbal behaviours to express their intentions. The present study did not investigate maternal verbal input which is a critical way in which mothers

communicate with their infants. It would be important for prospective investigations to consider maternal verbal scaffolding behaviours, and the interplay between maternal verbal and nonverbal behaviours. Furthermore, future research needs to pay closer attention to the joint influences of physical and social factors during mother-infant play.

Taken together, results from the present study provide evidence that nonverbal behaviours are an important part of the repertoire of maternal communication which encourage early attentional competencies in infants and help in their adaptation to the social world (Koester, Papousek & Papousek, 1989; Papousek & Papousek, 1987). The adjustments that mothers made to their nonverbal behaviours illustrates that they are attuned to the development and skill level of their infants and utilize the physical play environment in a manner which displays their sensitivity. However, changes in maternal nonverbal behaviours and infant gaze according to toy-type suggest that the micro-contexts created by the availability of different toys in play are a critical consideration for future studies.

Table 1.

Neonatal and family socio-demographic characteristics of FT-NBW and PT-VLBW infants

Characteristics	FT-NBW (n = 37)	PT-VLBW (n = 37)
Mother		
Maternal age (years)	29.71 (.77)	32.10 (.84)
Maternal education level (years)	14.95 (3.03)	14. 03 (3.05)
Maternal professional prestige	423.51 (27.86)	363.64 (27.43)
Infant		
Weeks gestation**	39.60 (.18)	28.82 (.38)
Birthweight (gm)**	3554.26 (77.13)	1106.72 (45.54)
Birthlength (cm)**	51.58 (.43)	37.23 (.61)
Head circum. (cm)**	35.06 (.28)	26.51(.42)
1-minute Apgar**	8.55 (.20)	5.45 (.40)
5-minute Apgar**	9.12 (.10)	7.61 (.26)
Days hospitalized*	3.60 (.69)	33.36 (5.50)
Corrected ages		
Postnatal age at 5½ months interaction (month, days)	5.41 (.25)	5.67 (.50)
Postnatal age at 12 months interaction (month, days)	12.51(.53)	12.59 (.59)
Postnatal age at 18 months interaction (month, days)	18.53 (.50)	18.68 (.59)

** FT-NBW differed from PT-VLBW $p < .001$; * FT-NBW differed from PT-VLBW, $p < .05$.

Note. Values enclosed in parentheses denote standard deviations.

Table 2.

Operational Definitions of Active and Less Active Maternal Nonverbal Behaviours

Nonverbal Behaviours	Definition
Active	
Shake	Moving object back and forth and/or up and down
Tap	Light stroke movement with the object or with a finger(s)/hands(s) on the object
Point	Extending a finger towards a toy, often to indicate the position or characteristic of a toy
Give	Placing a toy in the hand(s) or lap/leg area of the infant
Demonstrate	Illustrating the appropriate use or function of a toy
Less Active	
Touch	Bringing a hand(s) into contact with a toy
Touch-with	Bringing a hand(s) into contact with the toy when the infant is also touching the toy
Show	Holding a toy in a raised position in view of the infant
Physically Assist	Repositioning, holding or guiding infant hand(s) on a toy

Table 3.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours According to Toy at 5½ Months

	Bear	Rattle	Rings	Book
Nonverbal Behaviour				
Active				
Shake	4.74 (.82)	6.83 (.78)	1.75 (.29)	.36 (1.00)
Tap	.01 (.00)	.13 (.04)	.51 (.11)	.01 (.05)
Give	.11 (.03)	.77 (.11)	.75 (.11)	.32 (.07)
Demonstrate	1.11 (2.90)	1.89 (.30)	4.90 (.59)	13.09 (1.43)
Point	.28 (.12)	.67 (.19)	.13 (.05)	.57 (.14)
Less Active				
Touch	.57 (.12)	.22 (.04)	.80 (.14)	.23 (.03)
Touch-with	2.26 (.47)	3.23 (.40)	2.45 (.33)	6.08 (.72)
Show	4.46 (.56)	4.71 (.60)	8.34 (.88)	3.20 (.55)
Physically Assist	.08 (.04)	1.01 (.23)	.58 (.16)	.43 (1.00)

Note: Standard errors are included in parentheses

Table 4.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours According to Toy at 12 and 18 Months (Combined)

	Telephone	Teaset	Doll	Blocks	Books
Nonverbal Behaviour					
Active					
Shake	.01 (.03)	.68 (.12)	.72 (.19)	.01 (.02)	.06 (.03)
Tap	.03 (.02)	.45 (.12)	.16 (.04)	.22 (.06)	.22 (.04)
Give	.19 (.24)	.52 (.06)	.40 (.05)	.24 (.03)	.15 (.03)
Demonstrate	4.49 (.34)	5.96 (.58)	3.01 (.30)	5.98 (.65)	10.73 (1.28)
Point	.84 (.11)	.47 (.06)	.54 (.09)	.23 (.05)	2.93 (.44)
Less Active					
Touch	.15 (.03)	.62 (.10)	.43 (.06)	.39 (.09)	.39 (.11)
Touch-with	.76 (.15)	1.16 (.13)	1.90 (.26)	.61 (.12)	4.26 (.93)
Show	1.99 (.27)	9.88 (.93)	10.32 (.86)	4.90 (.53)	2.55 (.31)
Physically Assist	.13 (.04)	.21 (.06)	.25 (.06)	.09 (.03)	.04 (.02)

Note: Standard errors are included in parentheses

Table 5.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours According to Toy at 12 and 18 Months

	Telephone	Teaset	Doll	Blocks	Books
Active					
12 Months					
Shake	.11 (.05)	.49 (.12)	.82 (.25)	.17 (.06)	.04 (.15)
Tap	.05 (.03)	.50 (.15)	.18 (.05)	.29 (.09)	.02 (.05)
Give	.16 (.03)	.52 (.07)	.37 (.06)	.27 (.05)	.17 (.03)
Demonstrate	5.84 (.60)	6.31 (.65)	3.86 (.46)	6.36 (.76)	10.57(1.23)
Point	.85 (.15)	.31 (.06)	.53 (.09)	.20 (.05)	2.32 (.32)
18 Months					
Shake	.07 (.03)	.80 (.15)	.49 (.17)	.06 (.03)	.09 (.05)
Tap	.01 (.01)	.35 (.11)	.16 (.05)	.10 (.03)	.25 (.05)
Give	.21 (.04)	.47 (.07)	.38 (.05)	.20 (.05)	.14 (.04)
Demonstrate	3.65 (.40)	5.31 (.59)	2.51 (.37)	6.02 (.88)	11.38 (1.77)
Point	.86 (.14)	.70 (.11)	.58 (.11)	.26 (.07)	3.36 (.74)
Less Active					
12 Months					
Touch	.18 (.04)	.82 (.15)	.52 (.08)	.53 (.12)	.60 (.19)
Touch-with	1.45 (.26)	1.36 (.19)	2.08 (.30)	.76 (.14)	3.04 (.62)
Show	1.99 (.34)	9.45 (.97)	10.15 (1.03)	5.80 (.69)	2.62 (.30)
Physically Assist	.21 (.07)	.26 (.09)	.39 (.13)	.15 (.05)	.03 (.12)
18 Months					
Touch	.09 (.02)	.30 (.06)	.34 (.09)	.25 (.11)	.21 (.09)

Touch-with	1.33 (.19)	.98 (.15)	1.88 (.43)	.53 (.14)	5.22 (1.36)
Show	1.88 (.34)	10.26 (1.22)	10.48 (1.06)	4.56 (.74)	2.49 (.37)
Physically Assist	.21 (.07)	.19 (.07)	.20 (.37)	.01 (.01)	.03 (.12)

Note: Standard errors are included in parentheses

Table 6.

Mean Percent Duration of Gaze at 5½ Months

Toy	
Bear	1.50 (.27)
Rattle	9.71 (.96)
Rings	12.20 (1.16)
Book	8.10 (.94)
Toy-Combination	3.15 (.41)
Hand-Bear	4.58 (.81)
Hand-Rattle	9.50 (.76)
Hand-Rings	10.57 (1.00)
Hand-Book	12.13 (1.02)
Hand-Toy-Combination	.44 (.21)
Away	15.15 (10.67)
No Code	5.08 (5.92)
Ambiguous	.69 (1.05)

Note: Standard errors are included in parentheses

Table 7.

Mean Percent Duration of Gaze at 12 and 18 Months (Combined)

Toy	
Telephone	6.96 (.847)
Teaset	25.31 (2.12)
Doll	6.93 (.73)
Blocks	7.97 (.90)
Books	3.00 (.56)
Toy-Combination	7.20 (.44)
Hand-Telephone	4.10 (.28)
Hand-Teaset	9.12 (.92)
Hand-Doll	7.07 (.69)
Hand-Blocks	4.77 (.47)
Hand-Books	9.15 (1.44)
Hand-Toy-Combination	3.17 (.59)
Away	.351 (.10)
No Code	4.22 (.46)
Ambiguous	.81 (.15)

Note: Standard errors are included in parentheses

Table 8.

Mean Percent Duration of Gaze at 12 and 18 Months

Toy	12 Months	18 Months
Telephone	6.26 (.73)	6.45 (.91)
Teaset	23.29 (1.83)	27.37 (2.43)
Doll	6.47 (.70)	7.50 (.91)
Blocks	8.70 (.83)	6.44 (.94)
Books	2.73 (.47)	3.60 (.78)
Toy-Combination	4.22 (.41)	3.65 (.39)
Hand-Telephone	4.58 (.46)	3.38 (.39)
Hand-Teaset	9.50 (.92)	9.00 (.89)
Hand-Doll	10.57 (.66)	6.77 (.86)
Hand-Blocks	12.13 (.55)	3.67 (.42)
Hand-Books	8.13 (.96)	10.48 (1.63)
Hand-Toy-Combination	.68 (.14)	1.04 (.21)
Away	8.26 (4.49)	6.04 (5.09)
No Code	3.08 (4.09)	2.45 (5.0)
Ambiguous	.22 (.40)	.34 (.69)

Note: Standard errors are included in parentheses

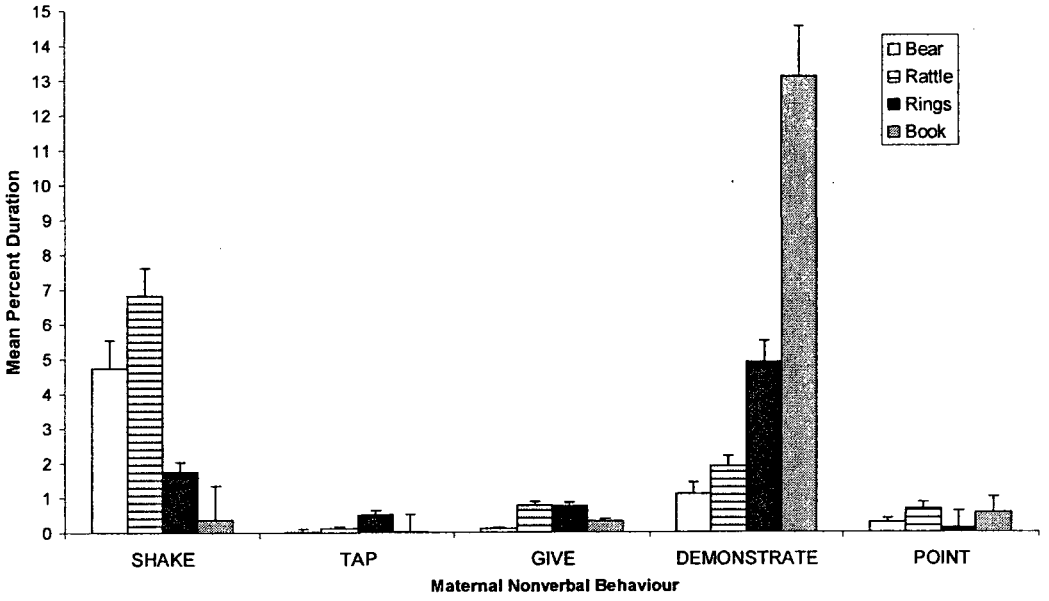

Figure 1. **Mean Percent Duration of Active Maternal Nonverbal Behaviours According to Toy at 5½ Months**

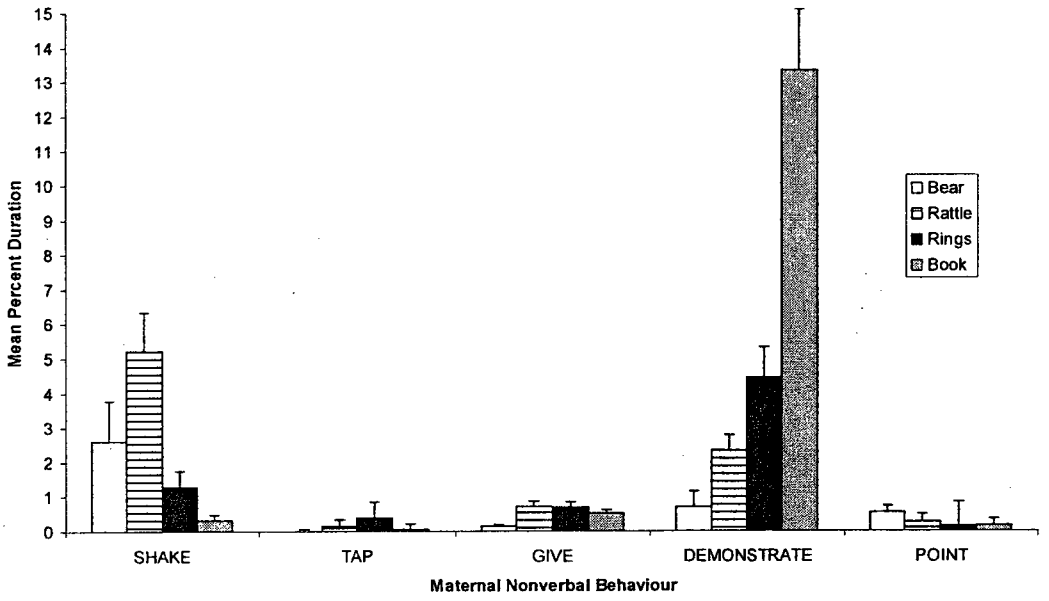

Figure 2a. **Mean Percent Duration of Active Maternal Nonverbal Behaviours According to Toy at 5½ Months in the FT-NBW Group**

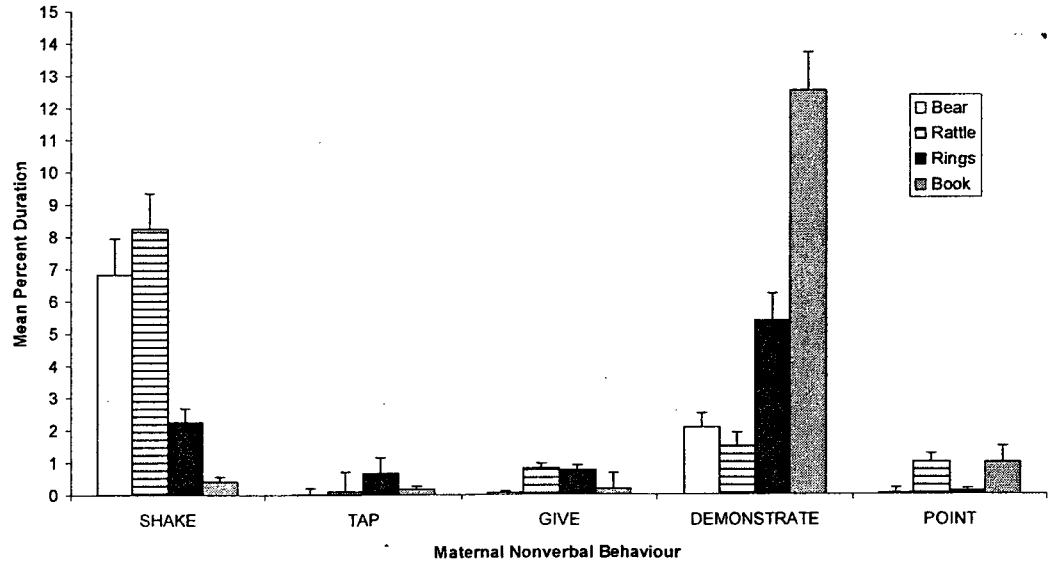

Figure 2b. **Mean Percent Duration of Active Maternal Nonverbal Behaviours According to Toy at 5½ Months in the PT-VLBW Group**

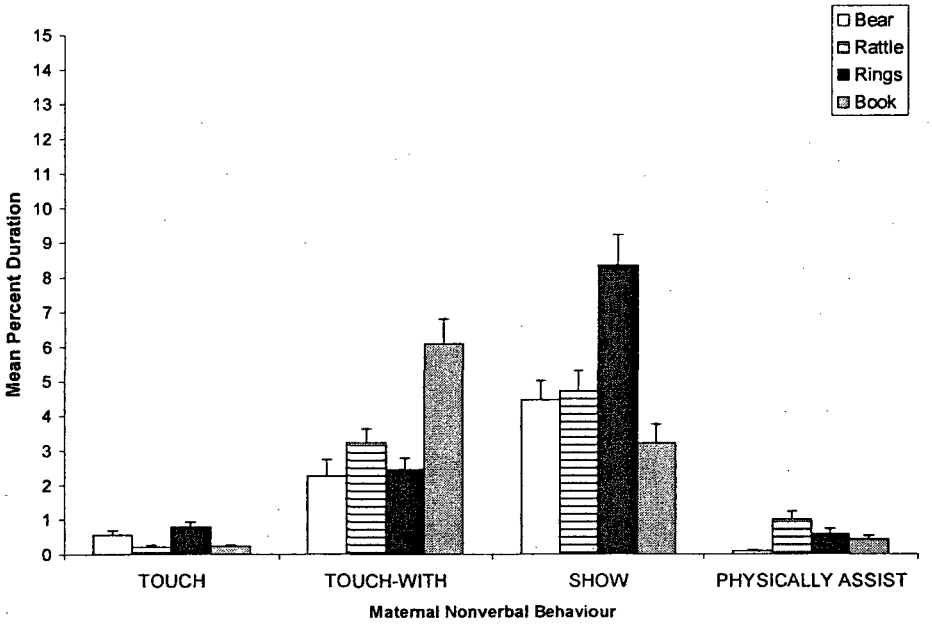

Figure 3. **Mean Percent Duration of Less Active Maternal Nonverbal Behaviours According to Toy at 5½ Months**

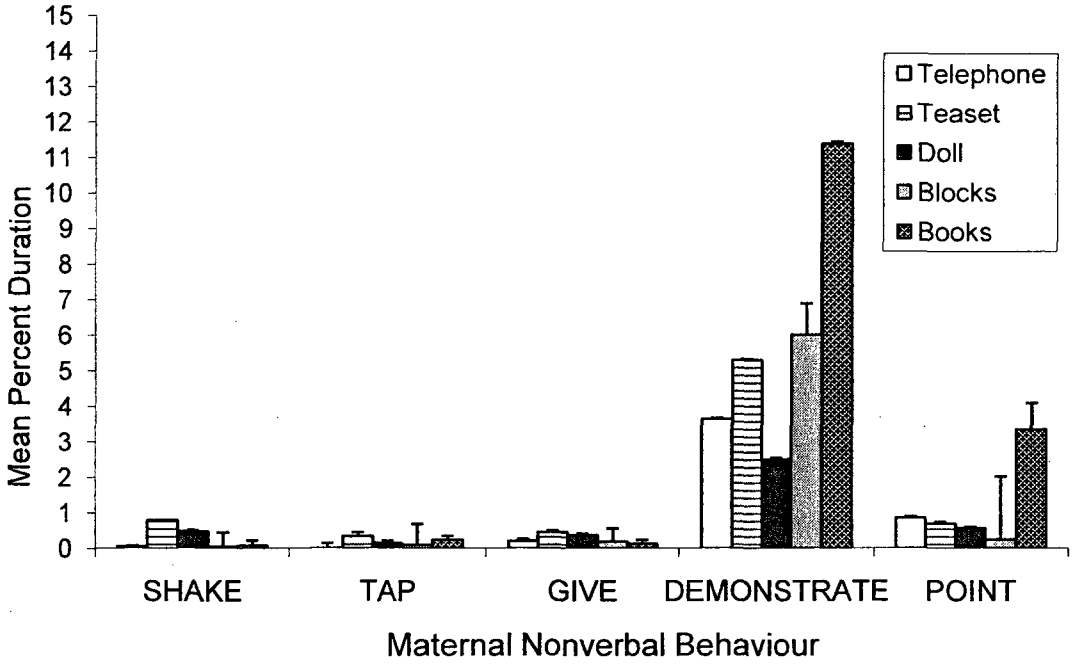

Figure 4a. Mean Percent Duration of Active Maternal Nonverbal Behaviours According to Toy at 12 Months

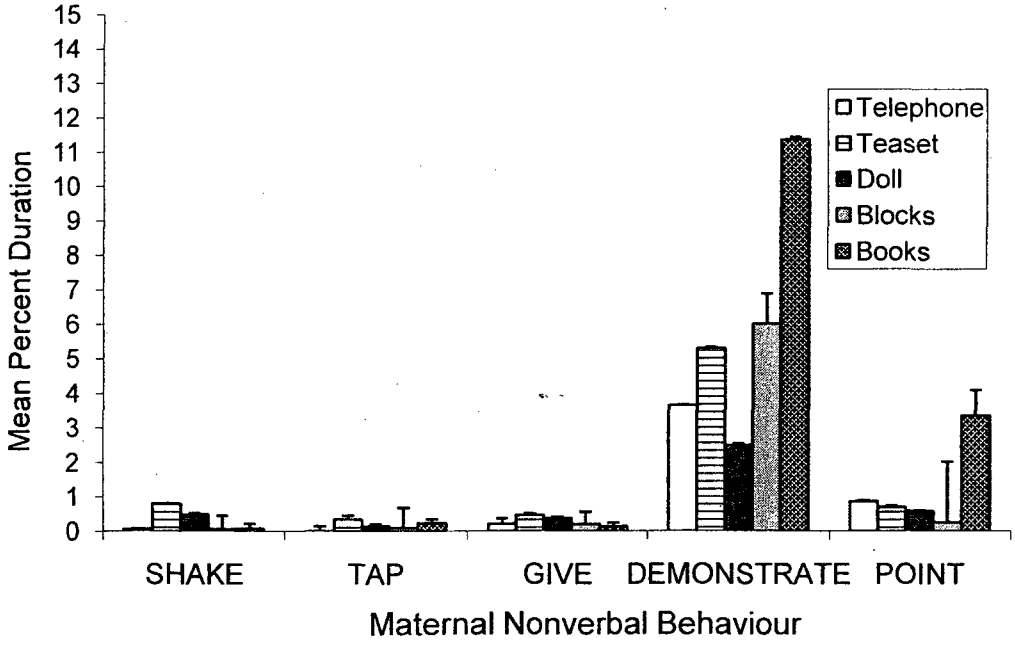

Figure 4b. Mean Percent Duration of Active Maternal Nonverbal Behaviours According to Toy at at 18 Months

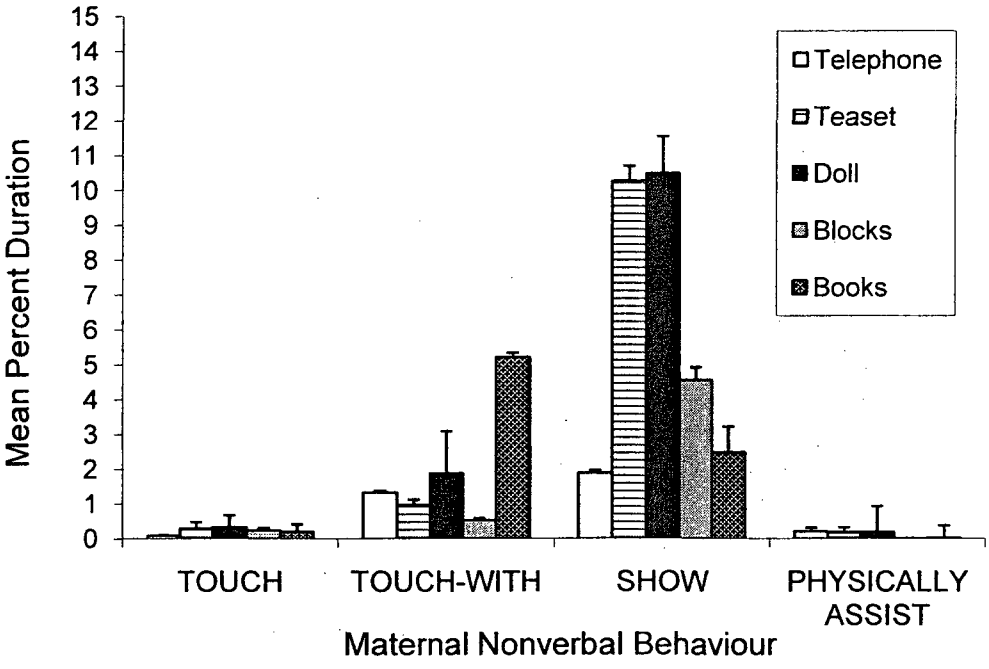

Figure 5a. Mean Percent Duration of Less Active Maternal Nonverbal Behaviours According to Toy at 12 Months

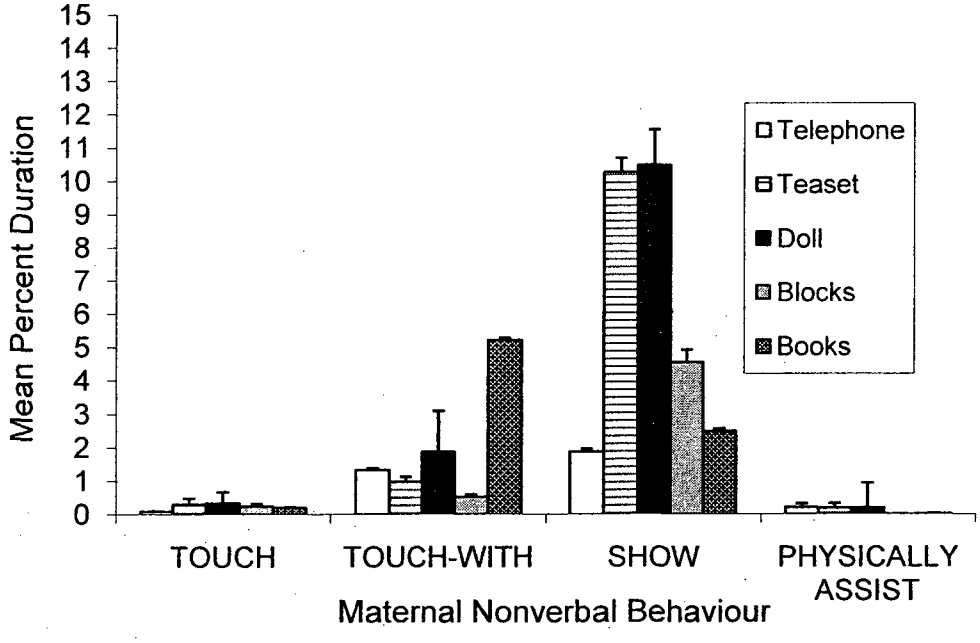

Figure 5b. Mean Percent Duration of Less Active Maternal Nonverbal Behaviours According to Toy at 18 Months

Chapter 2, Part II: Maternal Verbal Support during Mother-Infant Play

The communicative environment that caregivers create with their infants during toy-centered play is central to their emerging attentional skills. While caregivers use a variety of ways to communicate with their infants during play interactions, their verbal input is a powerful manner in which they convey important information, and scaffold the attention of their infants. Understanding how caregivers verbally guide their infants' attention is critical because infants' attentional abilities, and their ability to share attention with their caregivers on objects and events are predictors of their language development and later cognitive competence (e.g. Carpenter et al., 1998; Flom, Lee & Muir, 2007; Mundy et al., 2007; Mundy, Fox & Card, 2003; Sheinkopf, Mundy, Claussen & Willoughby, 2004; Tomasello, 1995). Furthermore, difficulties attending and focusing during play have been shown to be indicators of risk (Hart et al., 1999; Mundy, Sigman & Kasari, 1990).

Caregiver speech and verbalizations have been the focus of considerable research focus in some areas of infant and child development. For example, it is well documented that adults adapt their speech when interacting with infants and children (i.e. motherese or child-directed speech). Indeed, modifications in caregivers' verbal communication with infants have been shown to facilitate infant language learning and assist in the development of their cognitive abilities (Belsky, Goode & Most, 1980; Bono & Stifter, 2003; Dieterich et al., 2006; Newland, Roggman & Boyce, 2001; Schmidt & Lawson, 2002; Smith et al., 2000; Stevens et al., 1998). What is less well understood is how caregivers use their verbal input to support infant object-directed attention. Yet, infant object-directed attention is a critical skill that is known to develop with caregiver assistance.

Evidence exists indicating that caregivers scaffold their infants' attention by using a variety of attention-directing behaviours, including labeling objects, highlighting

features of objects, asking questions, showing, pointing and demonstrating objects' functions and uses (Landry, 1986; Landry & Chapieski, 1988, 1989; Leiba, 2000; Pêcheux, Findji & Ruel, 1992; Schmidt & Lawson, 2002; Tsuneda, 2007; Yato, 2000, 2007). However, much of the available research has categorized verbal and nonverbal behaviours jointly, and the few studies which have investigated verbal scaffolding have typically grouped caregiver verbal input into one category without individually examining the content of caregiver verbalizations (Findji, 1993; Flom & Pick, 2003; Schmidt & Lawson, 2002). For example, Flom and Pick (2003) conducted an experiment examining the influence of adult verbal and gestural behaviours on the joint attention of 18-month-old infants. They found that when verbal labels and gestures were used, infants spent a longer time engaging in joint attention with unfamiliar but not familiar objects. However, the addition of gestures to verbal information did not promote more episodes of joint attention. Other research which has addressed scaffolding in more naturalistic settings has also shown that caregivers use various strategies to manage the attention of their infants (Findji, 1993; Pêcheux, et al., 1992). Pêcheux et al. (1992) studied maternal scaffolding of infant attention when infants were 5- and 8-months-old. They found that maternal mobilizing of infant attention that included both verbal and nonverbal means, decreased over time and maternal behaviours were related to infant attention only at 5 months but not at 8 months.

Research has also documented differences in maternal scaffolding behaviours according to infant age and birth status, i.e. born preterm or fullterm (Barnard, Bee & Hammond, 1984; Barrat, Roach & Leavitt, 1992; 1996; Landry, 1995; Landry & Chapieski, 1989; Landry, Chapieski, Schmidt, 1986; Pridham, et al., 2000). In general, results from these studies have shown that caregivers of preterm infants provide more structure to their infants than caregivers of fullterm infants. It is particularly important to

study dyads in which infants were born preterm because the early experiences of preterm births can disrupt typical interactions between caregivers and their infants, and the continued fragile condition of many preterm infants can make caregiver-infant interactions more difficult (e.g. Garner & Landry, 1992, 1994; Landry, Garner & Denson, 1993). While these studies reveal important information about the ways in which caregivers adjust their scaffolding behaviours according to their infants' age and developmental level, more research is needed to elucidate the types of verbal scaffolding strategies that caregivers employ to structure the attention of their infants towards toys during play.

One known study to date has investigated specific verbal attention-directing strategies (Landry et al., 1986) with mothers and their fullterm and preterm infants. Landry et al. (1986) examined three specific verbalizations including questions, imperatives and attention verbs and found that mothers of fullterm infants used questions more often to direct attention than mothers of a low-risk preterm group, while mothers of both low-risk and high-risk preterm groups tended to use attention directing verbs more often than the full-term group. Although results from this study provided important preliminary information about how maternal verbal input is employed to structure infant attention, only a limited number of verbalizations were examined. Yet, caregiver verbalizations during toy-centered play are broad and include varied information, including attention-directing verbs and questions as well as information about the labels, properties, actions, and functions of toys (Bridges, 1979; Flom & Pick, 2003; Lockman & McHale, 1989). These descriptions and statements provide infants with critical information about their physical surroundings, including how objects and toys work while also highlighting toy features and characteristics. The importance of object-directed verbalizations on infant abilities is supported by a later study conducted by

Smith, Landry and Swank (2000) which found that verbalizations specifying relations between objects, concepts or functions used by mothers with their preschool aged children predicted children's later verbal and nonverbal cognitive abilities. These studies support the important influence of maternal verbal input on the attention and cognitive abilities of children, and underscore the need to investigate caregiver verbal stimulation more closely. As such, the aim of the current study was to extend our understanding of caregiver verbal scaffolding by elucidating the types of attention-directing and object-directed verbalizations caregivers employ to promote the attention of their infants towards objects in play.

Caregiver-infant toy play is an ideal context for studying caregiver verbalizations because attention-directing behaviours emerge more prominently during play compared to other contexts such as feeding (Findji, 1993). Play situations also allow caregivers and infants to interact with and share attention with the same toys. The sharing of attention around toys is important since caregivers create a multitude of didactic and playful experiences for their infants with toys, and the inclusion of different types of toys in play maximizes learning opportunities for infants, including gaining knowledge about themselves, others and the world (Gibson, 1988; Marino, 1988; McCollum, Stayton & Marfo, 1988; Pridham et al., 2000). Furthermore, research has shown that in addition to verbal means, caregivers communicate and structure their infants' attention with a variety of nonverbal behaviours and they adjust these behaviours according to the developmental needs of their infants (e.g. Findji, 1993; Leiba, 2000; Pêcheux et al., 1992; Yato, 2000). Such research also illustrates the importance of closely investigating the verbal ways in which caregivers support their infants' attention.

In the present study, examining how specific maternal verbalizations changed according to different toy-types during play was a particular question of interest because different toy-types present micro-contexts which have been shown to be related to

changes in both maternal and infant behaviour (Calderra & Sciaraffa, 1998; Di Francesco, 2004; Senechal, Cornell & Broda, 1995; Yont, Snow & Vernon-Feagans, 2003). By exploring the influence of toy-type on maternal verbal stimulation, results from the present study would provide an important first step in understanding how mothers change their verbal input according to the physical play environment. This information can contribute by elucidating the interplay between physical and social environmental factors that influence infant attention.

To date, few studies have examined the verbal scaffolding mothers provide their infants during play with toys. Investigating the content of maternal verbal input is critical as it can elucidate the type of information mothers convey to infants in order to encourage their attention to the environment. Consequently, the present study longitudinally explored the type of verbalizations mothers use to orient their infants' attention towards toys during playful interactions in two separate samples of mothers and their 5½, 12- and 18-month-old infants, one born fullterm, normal birthweight (FT-NBW), and the second preterm, very low birthweight (PT-VLBW). The preterm birth status of infants has been shown to influence their attentional skills and early interactions with their mothers. As such, we were particularly interested in how maternal verbal scaffolding differed according to infant levels of biological risk.

The purpose of the present study was to examine the verbal support that mothers provide their infants to structure their attention towards different toy-types during play. Four specific categories of attention-directing and object-related verbalizations that mothers employ were explored, including: (1) attention-directing verbs and imperatives that draw attention to toys and play with toys (attention *verbalization*), (2) labeling objects as a whole (*labeling verbalization*), (3) highlighting object properties and characteristics of toys (*characteristic verbalization*), and (4) discussing and describing the functions of toys (*function verbalization*). The main goals of this study

were to investigate changes in these maternal verbalization categories according to infant age (5½, 12 and 18 months), and birth status (FT-NBW and PT-VLBW), and to examine differences in maternal verbal input according to different toy-types. It was hypothesized that *attention* verbalizations would be used for longer compared to the other verbalizations at 5½ months, whereas it was expected that *attention* verbalizations would be used for less amount of time at 12 and 18 months. It was also expected that mothers would use verbalizations, particularly *attention* and *labeling* verbalizations for longer with functional toys at 5½ months, and *characteristic* and *function* verbalizations for longer with social toys at 12 and 18 months. Finally, mothers were expected to use *function* verbalizations with books for longer compared to other verbalizations. Together, results from the present study were expected to elucidate the role that verbal communication plays in the structuring of infant attention by mothers during toy-centered play. Examination of the interplay between biological, social and nonsocial factors can extend our knowledge of important factors that influence scaffolding during mother-infant play.

Method

Participants

See Part I for details.

Materials

See Part I for details.

Procedure

See Part I for details.

Behavioural Measures and Coding

A coding scheme was developed to describe and evaluate the attention-structuring verbalizations mothers used with their 5½ -, 12- and 18-month-old infants in

free play with different types of toys. Each play interaction was coded second-by-second and captured four different categories of verbal scaffolding behaviours that mothers employed to promote their infants' attention towards toys. Appendix F includes the operational definitions for each category. The first category was *attention verbalizations* which included general attention-directing utterances and/or verbs (e.g. *Look, look at that!*). The second was *labeling verbalizations* which included labeling or naming a whole toy (e.g. *What a nice book!*). The third, *characteristic verbalizations* was naming a part, feature or characteristic of a toy such as its colour, shape or size (e.g. *The rings are blue, red and yellow*). The final category was *function verbalizations*, included labeling or naming the function of a toy or the action that is completed with a toy (e.g. *Shake the rattle*). The data were reduced into percent duration for each measure. To assess inter-rater reliability, an independent rater, blind to the hypotheses of the study, coded 20% of the records. Kappa coefficients were calculated to assess the reliability of onset and offset times for each measure (Cohen, 1968). The Kappa coefficients ranged from r = 0.85 - 0.92 for maternal verbalizations.

Results

Two repeated measures Multivariate Analyses of Variance (MANOVAs) were conducted to address the questions of how specific attention-directing maternal verbalizations changed according to type of toy as well as infant age and birth status. The first analysis was carried out with data from mother-infant interactions when infants were 5½ -months-old. This analysis included *Toy* as a repeated factor, and *Sex* and *Group* as between-participants factors. The second analysis was conducted with data from mother-infant interactions when infants were 12-and 18-months-old. This analysis included *Toy* and *Age* as repeated factors, and *Sex* and *Group* as between-participants factors. The dependent variables for both MANOVAs was the percentage of time mothers used attention, labeling, characteristic and function verbalizations.

Transformations were conducted on all dependent variables to control for significant skewness, kurtosis, and/or outliers (Tabachnick & Fidell, 1996). Results revealed no main effects or interactions of *Sex*. Accordingly, infant *Group* remained the only between-participants factor for all analyses. Univariate-analyses with Bonferroni correction were completed to follow-up any significant main effects, and simple effect analyses were conducted to examine interaction effects.

Five and a Half Months Analyses

Results from the first MANOVA revealed a main effect of *Group,* Pillai's F (4, 65) = 4.38, $p < .01$. Mothers of FT-NBW infants used labeling verbalizations ($M = .41\%$) for longer compared to mother of PT-VLBW infants ($M = .20\%$), F (1, 68) = 16.70, $p < .001$.

Mothers' verbalizations also changed according to *Toy-type*, Pillai's F (12, 57) = 16.19, $p < .001$. Specifically, follow up analyses revealed significant results for attention, F (3, 204) = 16.19, $p < .001$; labeling, F (3, 204) = 14.99, $p < .001$; characteristic, F (3, 204) = 17.59, $p < .01$; and function verbalizations, F (3, 204) = 34.09, $p < .001$. Mothers used attention verbalizations for longer with the rings ($M = 2.45\%$) compared to the rattle ($M = 1.45\%$), bear ($M = .85\%$), and book ($M = 1.42\%$). Attention verbalizations were also used for the least amount of time with the bear compared to all other toys, F (3, 204) = 14.99, $p < .001$. However, labeling verbalizations were used for longer with the bear ($M = .62\%$) compared to both functional toys, rattle ($M = .06\%$), and rings ($M = .21\%$). In addition, labeling was used for less time with the rattle compared to all other toys. Characteristic verbalizations were used for longest with the rings ($M = 1.05\%$) compared to all other toys. Characteristic verbalizations were also used for longer with the social toy, the bear ($M = .37\%$), compared to the rattle ($M = .13\%$) and book ($M = .12\%$) Function verbalizations were used for longer with the book ($M = 2.45\%$) compared to the other toys, including the bear ($M = .30$), rattle ($M = .53\%$), and rings ($M = .57\%$). Mothers

also used function verbalizations for longer with the rings compared to the bear. Figure 6 depicts maternal verbalizations according to toy-type.

Twelve and Eighteen Months Analyses

Results of a three-way repeated measures multivariate analysis of variance (MANOVA) indicated differences in maternal verbalizations based on infant *Group, Age* and *Toy-type*. A *Group* main effect was found, Pillai's, F (4, 64) = 4.11, $p < .05$, and indicated significant results for the following verbalizations: attention, F (1, 67) = 13.52, $p < .001$; labeling F (1, 67) = 11.89, $p < .01$; and function, F (1, 67) = 6.55, $p < .05$. Mothers of FT-NBW infants used attention, labeling and function verbalizations (M = .70%; M = .79%; M = 1.95%), respectively for longer than mothers of PT-VLBW infants for attention, labeling and function verbalizations (M = .40%; M = .61%, and M = 1.68%), respectively.

Mothers also changed their verbalizations according to the *Age* of their infants, Pillai's, F (4, 64) = 4.87, $p < .01$. In particular, mothers increased the amount of time they used function verbalizations from 12 (M = 1.38%) to 18 months (M = 2.25%), F (1, 67) = 9.76, $p < .01$.

Findings also showed that *Toy-type* influenced maternal verbalizations, Pillai's, F (16, 52) = 14.79, $p < .01$. More specifically, significant results were found for attention, F (4, 268) = 25.49, $p < .001$; labeling F (4, 268) = 40.49, $p < .001$; characteristic, F (4, 268) = 39.58, $p < .001$, and function, F (4, 268) = 20.65, $p < .001$. Mothers used attention verbalizations with the teaset (M = 1.05%) for longest compared to all toys. Attention verbalizations were also used longer with the blocks (M = .64%) compared to the telephone (M = .30%) and books (M = .35%). Labeling was used for longest with the social toys, the doll (M = 1.64%) and teaset (M = .79%) compared to the other toys. However, mothers used labeling for longer with the doll compared to the teaset. Likewise, characteristic verbalizations were used for longer with the social toys, the doll

(M = .81%) and teaset (M = .79%) compared to all other toys. These verbalizations were also used for longer with the blocks (M = .16%) compared to the telephone (M = .06%). Characteristic verbalizations were used for the least amount of time with the book (M = .01%) compared to all toys. Function verbalizations were used for the longest amount of time with the telephone (M = 2.62%) and books (M = 2.75%) compared to the doll (M = 1.54%), teaset (M = 1.72%), and blocks (M = .44%). These verbalizations were also used for the least amount of time with blocks compared to other toys.

Results revealed an *Age by Group* interaction, Pillai's, F (4, 64) = 3.70, $p < .05$. At 12 months, mothers of FT-NBW infants used attention verbalizations (M = .76%) for longer than mothers of PT-VLBW infants (M = .28%), F (1, 67) = 6.13, $p < .05$. Mothers of FT-NBW infants also used function verbalizations (M= 1.80%) for longer than mothers of PT-VLBW (M= .96%) at 12 months, F (1, 67) = 5.75, $p < .05$.

Results also revealed a *Toy-type by Group* interaction, Pillai's, F (16, 52) = 4.81, $p < .001$. Follow-up analyses indicated significant results for all verbalization types, including: attention F (4, 268) = 6.98, $p < .001$; labeling F (4, 268) = 10.36, $p < .001$; characteristic F (4, 268) = 5.64, $p < .01$, and function, F (4, 268) = 3.51, $p < .05$. Mothers of FT-NBW infants used attention verbalizations for longer with the teaset (M = 1.50%), doll (M= .50%) and books (M = .48%) compared to mothers of PT-VLBW infants for teaset, doll and books (M = .60%; M = .33%; M = .22%, respectively). Mothers of FT-NBW infants used labeling verbalizations for longer with the teaset (M = 1.21%), blocks (M = .41%) and books (M = .64%) compared to mothers of PT-VLBW infants (teaset, M = .36%; blocks, M = .14%, and books, M = .19%). In addition, mothers of FT-NBW infants used characteristic verbalizations for longer with the doll (M = 1.14%), compared to mothers of PT-VLBW infants (M = .45%). Mothers of FT-NBW infants used function verbalizations for longer with the teaset (M = 1.94%), blocks (M = .62%), and books (M =

2.98%) compared to mothers of PT-VLBW infants, (M = 1.14%; M = .26%; M = 2.52%), for teaset, blocks and books respectively.

An *Age by Toy-type* interaction was also found, Pillai's, F (16, 52) = 4.36, p < .001. At 12 months, mothers used labeling verbalizations with the doll (M = 2.08%) for longer than at 18 months (M = 1.21%), and their use of labeling increased with books from 12 (M = .32%), to 18 months (M = .50%), F (4, 268) = 7.08, p < .001. Mothers use of characteristic verbalizations with the teaset decreased from 12 (M = .98%) to 18 months (M= .64%) whereas their use of these verbalizations with the doll increased from 12 (M = .38%) to 18 months (M = 1.21%), F (4, 268) = 11.23, p < .001. Mothers' use of function verbalizations with the teaset increased from 12 (M = .78%) to 18 months (M = 2.30%). Likewise, their use of these verbalizations with books increased from 12 months (M = 1.35%) and 18 months (M = 4.15%), F (4, 268) = 6.43, p < .01.

Finally, an *Age by Toy-type by Group* interaction was found, Pillai's, F (16, 52) = 2.56, p < .01. Univariate follow-up analyses revealed significant results for labeling F (4, 268) = 7.41, p < .001, characteristic F (4, 268) = 6.13, p < .001, and function verbalizations, F (4, 268) = 5.64, p < .01. At 12 months, mothers of FT-NBW infants used labeling for longer with the teaset (M = 1.27%), blocks (M = .46%) and books (M = .64%) compared to mothers of PT-VLBW infants (teaset, M = .13%; blocks, M = .01%, and books, M = .00%). In contrast, at 12 months, mothers of PT-VLBW infants used labeling for longer with the doll (M = 2 .81%) compared to mothers of FT-NBW infants (M = 1.34%). At 18 months, mothers of FT-NBW infants used labeling verbalizations for longer with the teaset (M = 1.15%) than mothers of PT-VLBW infants (M = .59%).

At 12 months, mothers of FT-NBW infants used characteristic verbalizations for longer with the doll (M = .48%) and blocks (M= .75%) compared to mothers of PT-VLBW (doll, M = .01%, and blocks, M = .00%). However, mothers of PT-VLBW infants used characteristic verbalizations for longer with the teaset (M = 1.48%) compared to mothers

of FT-NBW infants (*M* = .48%). At 12 months, mothers of FT-NBW infants used function verbalizations for longer with the teaset (*M* = 1.51%), blocks (*M* = .71%) and books (*M*= 2.70%) compared to mothers of PT-VLBW infants (teaset, *M* = .05%; blocks, *M* = .00%, and books, *M* = .00%). Figures 7 a and b illustrate mothers verbalizations according to group and toy-type at 12 months, and Figures 8 a and b depict data from 18 months.

Discussion

The present study was designed to investigate how mothers adapt their verbal scaffolding according to the physical play environment and to infants' characteristics during a free play situation. Overall, the results showed that mothers varied the amount of time they used specific object-oriented, attention-directing verbalizations according to toy-types, infant age and birth status.

The most striking findings of this study were related to the effect of toy-type on maternal verbalizations. At 5½ months, attention verbalizations were used for the longest time overall compared to the other verbalizations. It was expected that attention verbalizations would be used for longer compared to other verbalizations because young infants sustain their attention for short periods of time, and as such, mothers would be more likely to use active attention directing verbs and utterances for longer to direct their attention. The results also revealed that characteristic and attention verbalizations were used for longer with the rings, a toy with functional properties compared to the other toys. It was expected that mothers would use verbalizations for longer with functional toys at 5½ months because these toys tend to elicit play and attention around the toys themselves, and at this age, infants do not yet have the cognitive and motor abilities to engage in play that is social and reciprocal. The rings were a particularly popular toy at this time point because it was multicomponent with a number of features, including pieces of varying size and colour that mothers drew attention to through their use of attention and characteristic verbalizations. Mothers frequently utilized the inherent

properties of this toy to teach their infants about colour, size, shape and numerosity. It was commonly observed that mothers prefaced and followed a characteristic-related statement with an attention-getting verb or utterance as a way of more actively calling attention to the various features of the toy. For example, mothers often stated "Look at the big blue ring, look". Although this study did not specifically address how attention and characteristic verbalizations related to each other over time, the results demonstrated that toy-type is an important factor that influences the types of scaffolding verbalizations mothers use during play with their infants.

In contrast to the findings at 5½ months, attention verbalizations were used minimally with most toys at 12 and 18 months. As infants get older they become better able to independently sustain their attention for longer periods of time. Such a finding lends support to the notion that mothers are attuned to growth in their infants' attentional abilities and adjust their behaviours by making less use of active verbalizations, which are highly attention directing over time. However, at 12 and 18 months, function verbalizations were used for longest overall compared to other types of verbalizations, and their use by mothers increased over time. Function verbalizations may be considered verbalizations that are more cognitively demanding because they not only serve the purpose of structuring an infants' attention but they also convey information about the function of a toy or how a toy can be used (McCune et al., 1994). As infants get older they become cognitively more advanced and their skill level makes it conducive to understanding how things work. As a result, mothers spent a longer time including content in their verbal input that was more cognitively demanding as their infants developed, demonstrating that mothers are sensitive to the development of their infants and adjust their verbal input accordingly.

A prominent finding that emerged at 5½ as well as at 12 and 18 months was that mothers used function verbalizations for the longest amount of time with books. Upon

closer examination of the findings at 5½ months, it became apparent that mothers used function verbalizations for at least four times longer with the book compared to the other toys. At 12 and 18 months, function verbalizations were used for nearly twice as long with the books relative to some of the other toys. The fact that function verbalizations, which included reading as well as naming and describing pictures in the book, were used substantially longer with books than with the other toys is consistent with previous work. Research has shown that parents of young children frequently read to their children, and use labeling substantially more during picture book reading compared to other contexts such as play and mealtimes (Fletcher & Reese, 2005; Namy, Acredelo & Goodwin, 2000; Ninio & Bruner, 1978; Poulin-Dubois, Graham & Sippola, 1995). It is important to note that mothers' use of function verbalizations with books grew by over threefold from 12 to 18 months, illustrating that book reading becomes an increasingly important focus for parents as their infants develop. Mothers likely increased their focus on reading and discussions around how books work because by 18 months infants are expressing themselves more frequently and are demonstrating greater interest in and understanding of books. Mothers are attuned to these changes and engage their infants in verbal interactions around books for longer as a way of supporting and stimulating their language and cognitive growth.

Interestingly, research has shown that caregivers' use of language is more complex and their level of abstraction is greater during book reading compared to other contexts (Crain-Thoreson, Dahlin & Powell, 2001; Hoff-Ginsberg, 1991; Lewis & Gregory, 1987, Sorsby & Martlew, 1991). Given these findings, it would have been expected that all verbalization types, not only function verbalizations would have been used for longer with books. The difference in findings between the present study and other research comparing book reading to toy play may be due to the types of verbalizations that were studied and the level of specificity in which maternal language

was measured. The present study focused on specific verbalizations that captured how mothers structured the attention of their infants towards objects during play compared to other studies which have provided more general measures of caregiver attention scaffolding including nonspecific accounts of caregiver verbal messages (e.g. Bigelow MacLean & Proctor, 2004; Findji, 1993; Namy et al., 2000). The discrepancy in findings may also be due to context, such that in the present study, mothers and infants had books and toys available to them at the same time whereas in other studies, interactions with books and toys were examined in separate conditions (e.g. Yont et al., 2003).

Changes in the focus of mothers' verbal scaffolding according to toy-type over time clearly demonstrates the awareness mothers have of their developing infants. This was illustrated by the increased use of function verbalizations with books over time. A further example is that at 12 and 18 months, three of the four verbalization types (attention, labeling and characteristic) were used for longest with the teaset or the doll, both socially-oriented toys. This is in contrast to the findings at 5½ months, at which time verbalizations were used relatively minimally with the bear, a social toy. Mothers likely directed their verbal input for longer towards the teaset and doll at 12 and 18 months because as infants enter into the first year of life, they become more interactive and increasingly socially active, and they show greater ability and interest in engaging with social-oriented toys. Mothers were sensitive to the social advances of their infants and were verbally engaging and drawing attention to toys that tend to elicit social play.

Also noteworthy is that teaset and doll, both social toys included at 12 and 18 months had a number of features and components that were frequently highlighted by mothers during play with their infants. For example, mothers labeled parts of the teaset such as cup and saucer, and the physical features of the doll such as their eyes, ears and nose. Mothers commonly labeled toys and features of toys as ways of teaching infants information that was relevant and generalizable to their environment. Age-related

changes in maternal verbal input according to toys also revealed that mothers spent a longer time verbalizing on the uses of the teaset compared to its characteristics over time. In fact, mothers used function verbalizations with the teaset for nearly three times longer at 18 compared to 12 months. The teaset is a social toy that naturally elicits interaction between mothers and infants, and the increased use of function verbalizations by mothers is likely related to the highly social nature of the toy combined with advancements in infants' social and interactive skills. As infants grow, they become more active play partners, coordinating play with partners and exchanging toys (e.g. Tomasello, 1995). Interestingly, mothers spent less time labeling the doll but more time verbalizing about the characteristics of the doll as their infants grew from 12 to 18 months. Again, mothers frequently highlighted features of the doll as a way of teaching infants to name and identify parts of their own body. By 18 months, mothers appear to be sensitive to their infants' growing vocabularies and increased abilities to both acquire and produce labels and names.

These findings clearly demonstrate that toys are a critical component of mother-infant play and through their verbal stimulation, mothers encourage and support their infants' attention which permits them to actively explore their environment. A limitation of the current study is the different number of toys available at 5½ compared to 12 and 18 months. The difference in number of toys may have influenced the way in which mothers used their verbal scaffolding behaviours, and made it difficult to empirically examine longitudinal changes across all three time points. However, it is important to note that toy categories were represented at each time point which allowed for important comparisons to be made. Furthermore, a different number of toys were selected at 5½ compared to 12 and 18 months in order to provide appropriate opportunities for stimulation and to encourage age appropriate play.

Group-related differences in mothers' verbal scaffolding also emerged from the results of the present study. At 5½ months, mothers of FT-NBW infants used labeling verbalizations for longer than mothers of PT-VLBW infants. However, mothers of both groups used attention, characteristic and function verbalizations for comparable amounts of time. Interestingly, group differences emerged more prominently at 12 compared to 18 months. At 12 months, mothers of FT-NBW infants used attention and function verbalizations for longer overall than mothers of PT-VLBW infants. Differences according to toy-types revealed that compared to mothers of PT-VLBW infants, mothers of FT-NBW infants used labeling, and function verbalizations for longer with books as well as social and functional-oriented toys. Likewise characteristic verbalizations were used for longer by mothers of FT-NBW infants with social (doll) and functional toys compared to mothers of PT-VLBW infants. However, mothers of PT-VLBW infants used labeling with the doll and characteristic verbalizations with the teaset for longer compared to mothers of FT-NBW infants. By 18 months, mothers in both groups of infants displayed similar patterns of verbal stimulation.

These results were somewhat unexpected because many studies have shown that caregivers of preterm infants use more structuring during social interactions with their infants than caregivers of fullterm infants (e.g. Barnard et al., 1984; Beckwith & Rodning, 1996; Caplan, Mason & Kaplan, 2000; Chapiesky & Evankovich, 1999; Crnic, 1983; Landry et al., 1993). It is important to consider that much of this research has considered scaffolding to include both verbal and nonverbal behaviours. It is possible that mothers of preterm infants provide higher levels of scaffolding using nonverbal compared to verbal channels of communication. This was supported by results found by Leiba and Stack (in preparation) in which preterm mothers used nonverbal attention scaffolding behaviours for longer when infants were 5½ and 12 months compared to mothers of fullterm infants. Yet, other research has shown that caregivers of fullterm

infants provide comparable levels of verbal support in some instances compared to caregivers of preterm infants. For example, Barrat, Roach and Leavitt (1996) found that mothers of fullterm and healthy preterm infants provided similar levels of supportive behaviours with their 12-and 20-month old infants. A common variable linking the results of Barrat et al.'s (1996) findings to those of the present study is that infants were born preterm but relatively healthy and at low medical risk. This points to the central importance of taking into account the varied biological factors associated with preterm births, including their birthweight and health status. Furthermore, the multimodal nature of behaviours which make up scaffolding also necessitate that caregiver scaffolding behaviours are clearly defined. The consideration of such methodological and sampling factors is particularly critical when studying at-risk populations since they can contribute to substantial differences in our understanding of the impact of risk on caregiver-infant interactions.

Findings from the current study illustrate that verbal communication is a critical component of maternal scaffolding of infant attention and that it is essential to investigate the content of maternal verbal support in order to accurately understand how mothers utilize this mode of communication during play interactions with their infants. It would be important for future research to continue to investigate the contributions of maternal verbal behaviours and to consider the joint contributions of maternal verbal and nonverbal support on infant attention during toy-centered mother-infant play. The adjustments that mothers made to their verbal support according to infant age and birth status as well as toy-type attests to mothers being attuned to the development of their infants and to utilizing the physical play environment in a way that optimally supports their infants' development. Results from the present study provided new and valuable information about the influences of infant characteristics and the physical play environment on mothers' verbal scaffolding. Mothers impart critical information and

learning opportunities to their children through their verbalizations during playful interactions and as such, additional research is warranted to broaden our knowledge about factors which can influence their verbal communication.

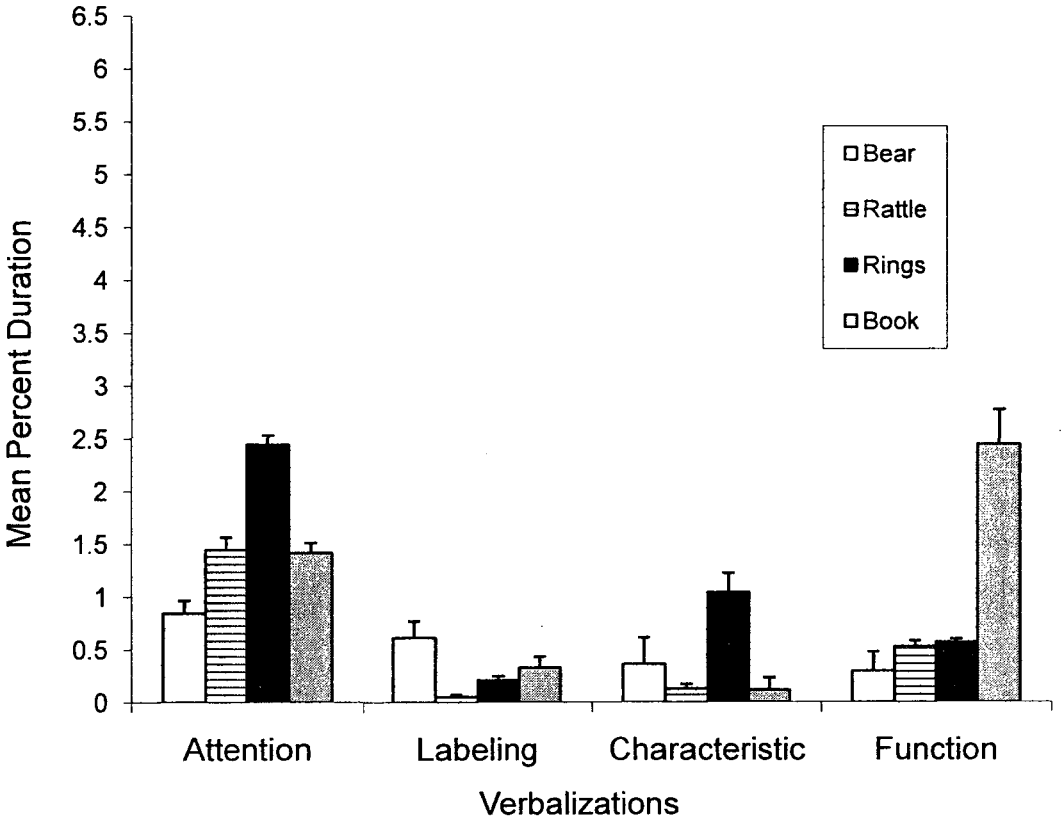

Figure 6. Mean Percent Duration of Maternal Verbalizations According to Toy at 5½ Months

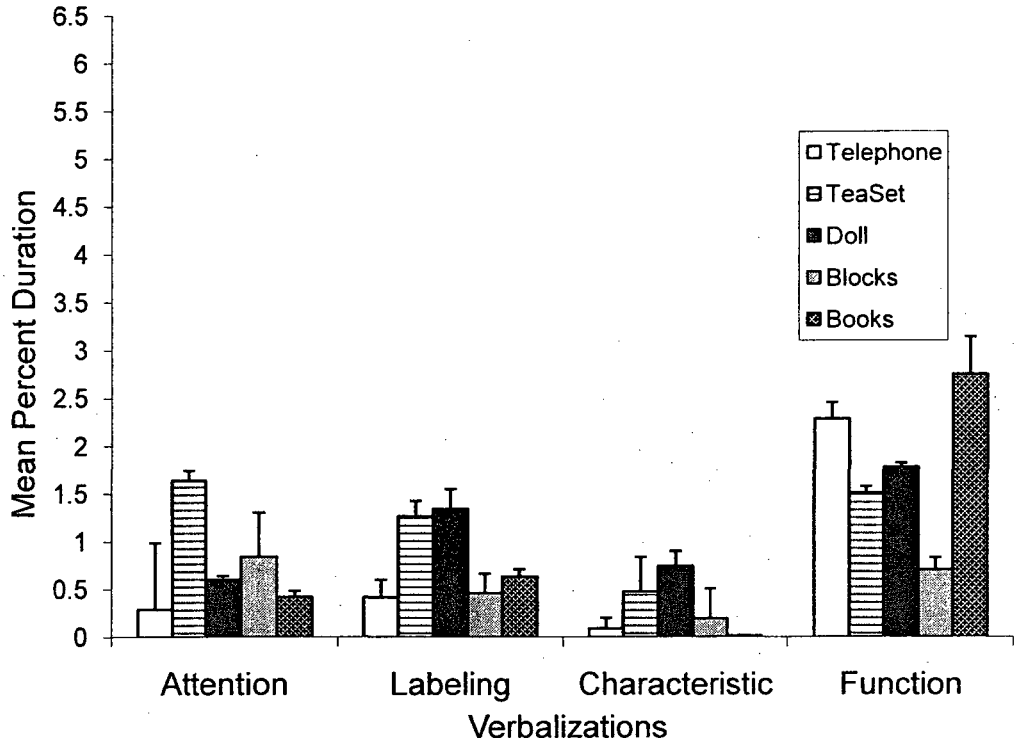

Figure 7a. Mean Percent Duration of Maternal Verbalizations According to Toy at 12 Months in the FT-NBW Group

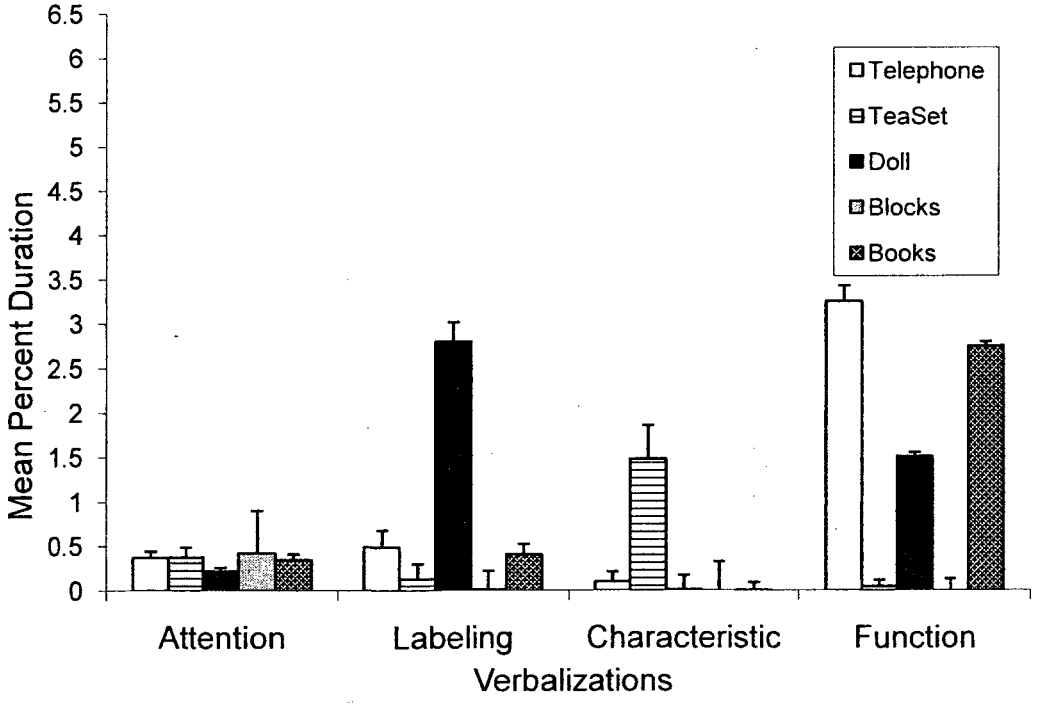

Figure 7b. Mean Percent Duration of Maternal Verbalizations According to Toy at 12 Months in the PT-VLBW Group

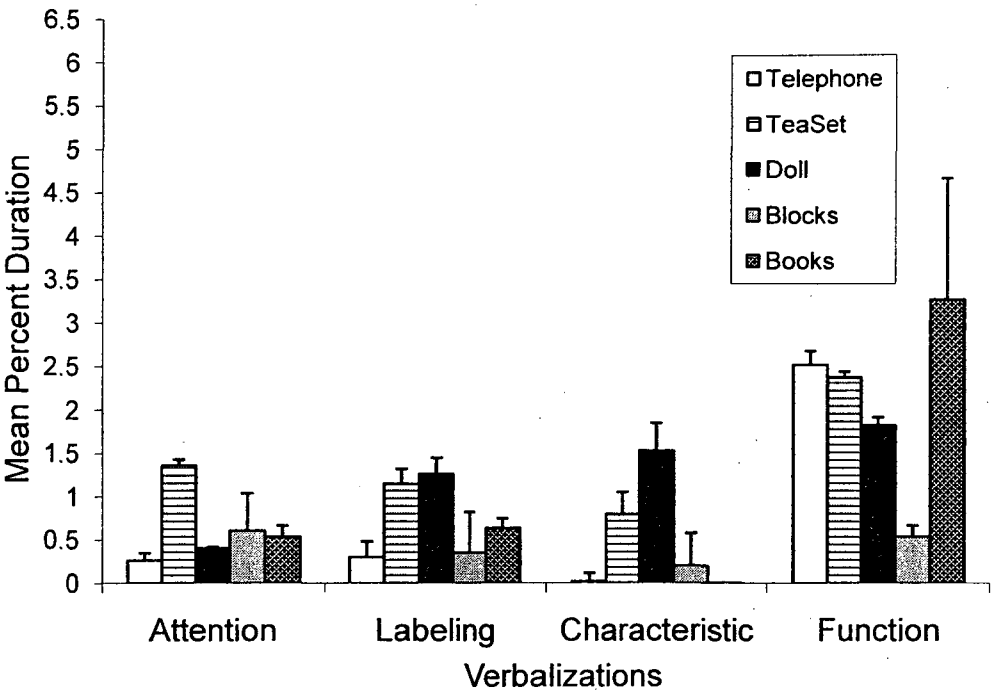

Figure 8a. Mean Percent Duration of Maternal Verbalizations According to Toy at 18 Months in the FT-NBW Group

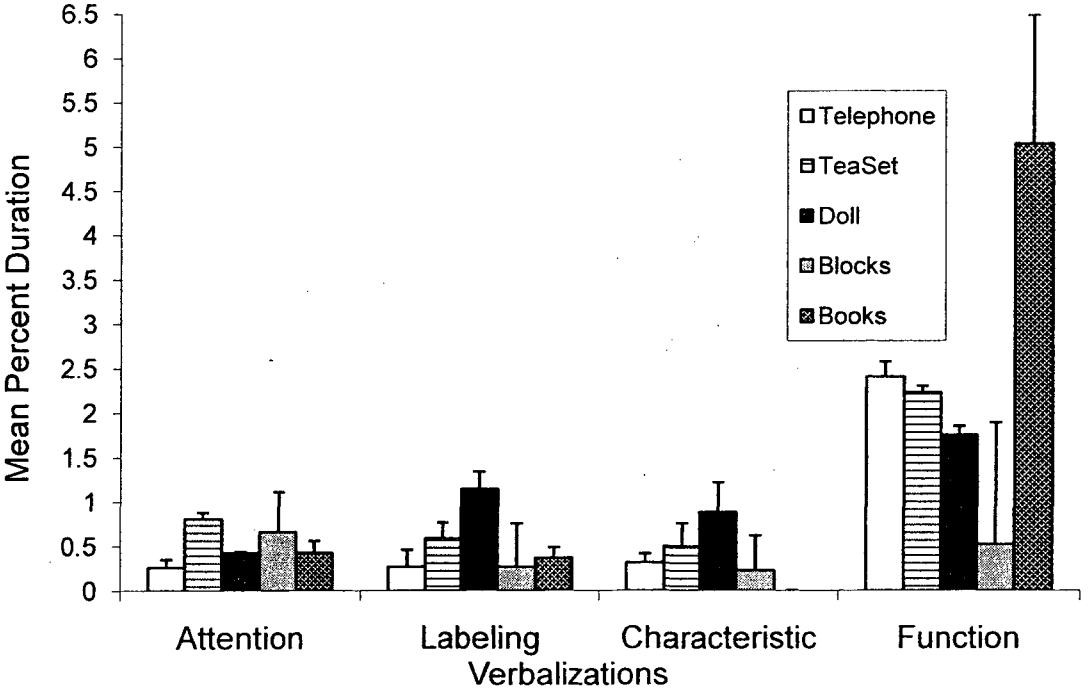

Figure 8b. Mean Percent Duration of Maternal Verbalizations According to Toy at 18 Months in the PT-VLBW Group

Chapter 2, Part III. Bridging the Gap Between Maternal Nonverbal and Verbal Scaffolding

Results from Parts I and II of the present research underscored the multimodal nature of maternal attention-scaffolding and revealed the important individual contributions of maternal nonverbal and verbal channels of communication during mother-infant toy centered play over time. The findings from Parts I and II of the present research are particularly notable since, as previously discussed, a great deal of existing research studying maternal scaffolding of infant attention has considered nonverbal and verbal behaviours together and has not differentiated nor compared these two channels of communication. It is well understood that caregivers communicate with their infants in multiple ways and that such methods of communication can occur independently or together. The main purpose of this section is to provide a preliminary understanding of the link between the nonverbal and verbal behaviours that mothers utilize to scaffold their infants' attention during toy play. The main objective of this section was to evaluate how mothers used their time when engaged with nonverbal and verbal behaviours during play with their infants. That is, did caregivers use nonverbal or verbal behaviours for longer, shorter or similar amounts of time with particular toys, and did the age and birth status of infants influence the amount of time mothers utilized nonverbal compared to verbal behaviours during play with their infants. A set of analyses were conducted to provide comparisons between maternal use of nonverbal and verbal behaviours with toys during play and to evaluate how these changed according to type of toy, infant age and birth status.

Two separate sets of analyses were conducted with the data from the study. The first set of analyses was carried out on the mother-infant interactions when infants were 5½ -months-old (Time 1). These analyses included *Toy* as the repeated factor, and *Sex*

(male and female) and *Group* (FT-NBW and PT-VLBW) as between-participants factors. The second set of analyses was conducted on mother-infant interactions at Times 2 and 3 when infants were 12-and 18-months-old. These analyses included *Age* and *Toy* as repeated factors, and *Sex* (male, female) and *Group* (FT-NBW and PT-VLBW) as between-participants factors.

The dependent variables for the analyses included maternal verbalizations which was a pooled measure of the four verbal categories. This measure was obtained by adding the percent duration of all four verbal categories into one global verbal category. The dependent variables also included a combined measure of the five maternal nonverbal active behaviours (*shake, tap, give, point and demonstrate*) and the five less active nonverbal behaviours (*touch, touch-with, show and physically assist*). The global nonverbal measure was achieved by adding the percent duration of all active and less active dependent variables.

Two Multivariate Analyses of Variances (MANOVA) were conducted with data from Time 1, and Times 2 and 3. The first MANOVA included as its dependent variables the combined category of maternal verbalizations and a combined category of active maternal nonverbal behaviours. The second MANOVA included the maternal verbalization category and a combined category of maternal less active maternal nonverbal behaviours.

Transformations were conducted on all the dependent variables to control for significant skewness, kurtosis, and/or outliers (Tabachnick & Fidell, 1996). Results revealed no main effects or interactions of Sex for any of the dependent variables. Accordingly, *Group* remained the only between-participants factor for all analyses. Univariate-analyses with Bonferroni correction were completed to follow-up any

significant main effects and simple effect analyses were conducted to examine interaction effects.

Five and a Half Months

Active Maternal Nonverbal Behaviours

A MANOVA revealed an overall main effect of *Toy*, Pillai's Exact F (7, 59) = 21.54, $p < .001$. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (7, 455) = 16.38, $p < .001$. Mothers used active behaviours for longer with the rattle (M = 9.93%) and book (M = 13.91%) compared to their use of verbalizations with the rattle (M = 2.16%) and book (M = 4.31%).

Less Active Maternal Nonverbal Behaviours

A MANOVA revealed an overall main effect of *Toy*, Pillai's Exact F (7, 21) = 19.73, $p < .001$. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (7, 189) = 10.58, $p < .001$. Mothers used less active behaviours for longer with both functional toys, the rattle (M = 9.93%) and rings (M = 8.11%) compared to their use of verbalizations, (M = 2.16% and M = 4.28%, for rattle and rings, respectively). Figure 9 and Table 9 present the means of the percent duration of active and less active maternal nonverbal behaviours and maternal verbalizations according to toy-type.

Twelve and Eighteen Months

Active Maternal Nonverbal Behaviours

A MANOVA revealed a main effect of *Toy*, Pillai's Exact F (9, 43) = 33.20, $p <$ .001. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 459) = 24.30, $p < .001$. Mothers used active nonverbal behaviours for longer with the telephone (M = 5.52%), teaset (M = 8.03%), doll (M = 4.50%) compared to verbalizations with the telephone (M = 3.19%) and the teaset (M = 3.89%). Mothers also used active nonverbal behaviours for longer with the blocks (M = 6.97%) and books

(M = 13.60%) compared to their use of verbalizations with blocks (M = 1.45%) and books (M = 3.74%).

An interaction effect of *Toy by Group*, Pillai's Exact F (9, 43) = 8.02, p <. 01 was also found. Follow-up analyses revealed significant results for maternal use of nonverbal and verbal behaviours according to infant *Group*, F (9, 459) = 3.88, p < .05. For the FT-NBW group, active nonverbal behaviours were used for longer with the teaset (M = 8.77%), blocks (M = 6.04%) and books (M = 12.59%) compared to verbalizations with the teaset (M = 5.24%), blocks (M = 1.89%) and books (M = 4.23%). Likewise, for the PT-VLBW group, active behaviours were used for longer with the telephone (M = 6.57%), teaset (M = 5.22%), blocks (M = 7.90%) and books (M = 14.62%) compared to verbalizations with the telephone (M = 3.23%), teaset (M = 2.54%), blocks (M = 1.01%) and books (M = 3.25%).

A MANOVA revealed an overall multivariate interaction effect of *Toy by Age,* Pillai's Exact F (9, 43) = 26.47, p <. 001. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 459) = 16.30, p < .001. At 12 months, mothers used active nonverbal behaviours for longer with the teaset (M = 8.63%), blocks (M = 6.90%), and books (M = 13.53%) compared to verbalizations with the teaset (M = 3.27%), blocks (M = 1.42%), and books (M = 1.84%). At 18 months, mothers used active nonverbal behaviours for longer with the telephone (M = 4.95%) and blocks (M = 7.04%) compared to verbalizations with the telephone (M = 2.65%), and blocks (M = 1.48%). However, they used verbalizations for longer with the doll (M = 4.55%) compared to nonverbal behaviours (M = 3.68%).

A three way interaction effect of *Toy by Age by Group*, Pillai's Exact F (9, 43) = 3.71, p <. 001 was found. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 459) = 2.09, p < .001. At 12 months, mothers of PT-VLBW infants used verbalizations for longer with the telephone (M = 4.32%)

compared to mothers of FT-NBW infants (M = 3.15%). However, at 12 months, mothers of FT-NBW infants used verbalizations for longer with the doll (M = 4.62%) compared to mothers of PT-VLBW infants (M = 4.59%). At 12 months, mothers of PT-VLBW infants used active behaviours for longer with blocks (M = 7.92%) and books (M = 5.48%) compared to mothers of FT-NBW infants with blocks (M = 5.31%) and books (M = 4.91%). In contrast, at 12 months, mothers of FT-NBW infants used active behaviours with the teaset (M = 13.23%) for longer than mothers of PT-VLBW infants (M = 11.39%). At 18 months, mothers of PT-VLBW infants used active behaviours for longer with the books (M = 7.01%) compared to mothers of FT-NBW infants (M = 6.13%).

Less Active Maternal Nonverbal Behaviours

A MANOVA revealed a main effect of *Toy*, Pillai's Exact F (9, 43) = 39.68, p <. 001. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 459) = 28.56, p < .001. Mothers used less active nonverbal behaviours with the teaset (M = 12.02%), doll (M = 12.30%), blocks (M = 6.17%) and books (M = 5.89%) for longer compared to using verbalizations with the teaset (M = 3.89%) and doll (M = 4.58%) as well as the blocks (M = 1.45%) and books (M = 3.74%).

An interaction effect of *Toy by Group*, Pillai's Exact F (9, 43) = 4.43, p <. 01 was also found. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 459) = 3.73, p < .05. Mothers of FT-NBW infants used less active behaviours with the teaset (M = 14.14%) and doll (M = 10.83%) for longer compared to verbalizations with the teaset (M = 5.24%) and doll (M = 4.93%). Mothers of PT-VLBW infants also used less active behaviours for longer with doll (M = 13.77%), blocks (M = 7.19%) and books (M = 6.25%) compared to the amount of time they used verbalizations with these toys (doll, M = 4.23%; blocks, M = 1.01%, and books, M = 3.25%). Table 10 presents the mean percent duration of active and less active maternal

nonverbal behaviours and maternal verbalizations according to toy-type and group status at 12 and 18 months.

A MANOVA revealed an overall multivariate interaction effect of *Age by Toy,* Pillai's Exact F (9, 43) = 26.47, p <. 001. Follow-up analyses revealed significant results for maternal nonverbal and verbal behaviours, F (9, 51) = 40.27, p < .001. At 12 months, mothers used less active nonverbal behaviours for longer with doll (M = 11.79%), blocks (M = 6.61%), and books (M = 5.20%) compared to verbalizations with the doll (M = 4.61%), blocks (M = 1.42%), and books (M = 1.84%). At 18 months, mothers used less active behaviours for longer with the teaset (M = 11.71%), doll (M = 12.81%), and blocks (M = 5.73%) compared to verbalizations with the teaset (M = 4.51%), doll (M = 4.55%), and blocks (M = 1.48%). Table 11 and Figures 10a and b illustrate the results of active and less active maternal nonverbal behaviours and maternal verbalizations according to toy-type at 12 and 18 months.

Discussion

The main objectives of this section were to compare mothers' use of nonverbal attention scaffolding behaviours to their verbal scaffolding behaviours, and how they changed according to toy-type, infant age and birth status. The most prominent findings across all three time points indicated that the amount of time that mothers used nonverbal behaviours to structure their infants' attention was longer than their use of verbalizations with numerous toys. At 5½ as well as 12 and 18 months, mothers used both active and less active maternal nonverbal behaviours for longer with functional toys relative to verbalizations with these toys. Mothers also used nonverbal behaviours for longer with social toys at 12 and 18 months compared to verbalizations to structure their infants' attention.

An additional interesting finding that emerged from the results was maternal scaffolding efforts with the books. Although mothers used nonverbal behaviours at 5½

as well as 12 months for longer with books compared to verbalizations, by 18 months, they were using both channels of scaffolding for similar amounts of time. Mothers likely used similar amounts of nonverbal and verbal scaffolding with books because by 18 months infants are demonstrating greater interest in and understanding of books. By this age, infants frequently independently hold books, turn their pages and look at the pages. Mothers tend to facilitate infant attention through their nonverbal assistance such as holding a book with their infant and pointing to pictures in a book but also through verbal scaffolding such as labeling pictures, reading and discussing books. Furthermore, maternal verbal scaffolding also increases at this age because by 18 months, infants are frequently expressing themselves more and demonstrating greater comprehension through language. As such, mothers are attuned to these changes and engage their infants in verbal interactions around books for longer as a way of supporting and stimulating their language and cognitive growth.

The results also showed that a similar pattern of results emerged between mothers of fullterm and preterm infants. That is, both groups of mothers engaged in nonverbal scaffolding with their infants for longer compared to their verbal efforts to encourage infant attention towards toys. At 5½ months, no differences were found between maternal use of verbal and nonverbal scaffolding according to the birth status of their infants. By 12 and 18 months, mothers of preterm infants, tended to scaffold their infants' attention with nonverbal behaviours for longer than verbalizations and with somewhat more toys compared to mothers of fullterm infants. At 12 months, mothers of preterm infants used active nonverbal strategies for longer with the telephone and blocks compared to verbalizations. At 18 months, they used active strategies for longer with books relative to verbalizations. This may be related to mothers of preterm infants being sensitive to the specific needs of their infants at this age and detecting that their infants required this additional support. Furthermore, mothers may have also wanted to ensure

the usefulness of their scaffolding efforts by employing nonverbal behaviours to which infants are likely to respond regardless of their developmental level.

Together, these results highlight mothers' dynamic use of both nonverbal and verbal means to focus their infants' attention towards toys and the importance of nonverbal communication in toy-centered play interactions. Although growing research investigating dyadic interactions between mothers and infants have shown the importance of nonverbal communication in early mother-infant interactions, available research has placed relatively less focus on the nonverbal ways in which mothers structure the attention of their infants during triadic interactions involving the dyad and toys. The present findings highlight that although nonverbal and verbal behaviours are both employed by mothers during interactions with their infants, nonverbal communication is a central part of the repertoire of maternal behaviours during interactions that extend beyond the dyad to include toys. Furthermore, the present results underscore that studying the relationship between nonverbal and verbal caregiver behaviours is critical to obtain an accurate view of the multimodal nature of maternal scaffolding. Future research should continue to investigate the different channels of communication that are utilized within mother-infant play interchanges.

Table 9.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Maternal Verbalizations According to Toy at 5½ Months

	Bear	Rattle	Rings	Book
Active Nonverbal Behaviours	5.96 (.80)	9.93 (.89)	8.11 (.89)	13.91 (1.23)
Less Active Nonverbal Behaviours	7.42 (.82)	8.73 (.91)	11.65 (1.13)	9.36 (1.00)
Verbalizations	2.13 (.31)	2.16 (.23)	4.28 (.46)	4.31 (.45)

Note: Standard errors are included in parentheses

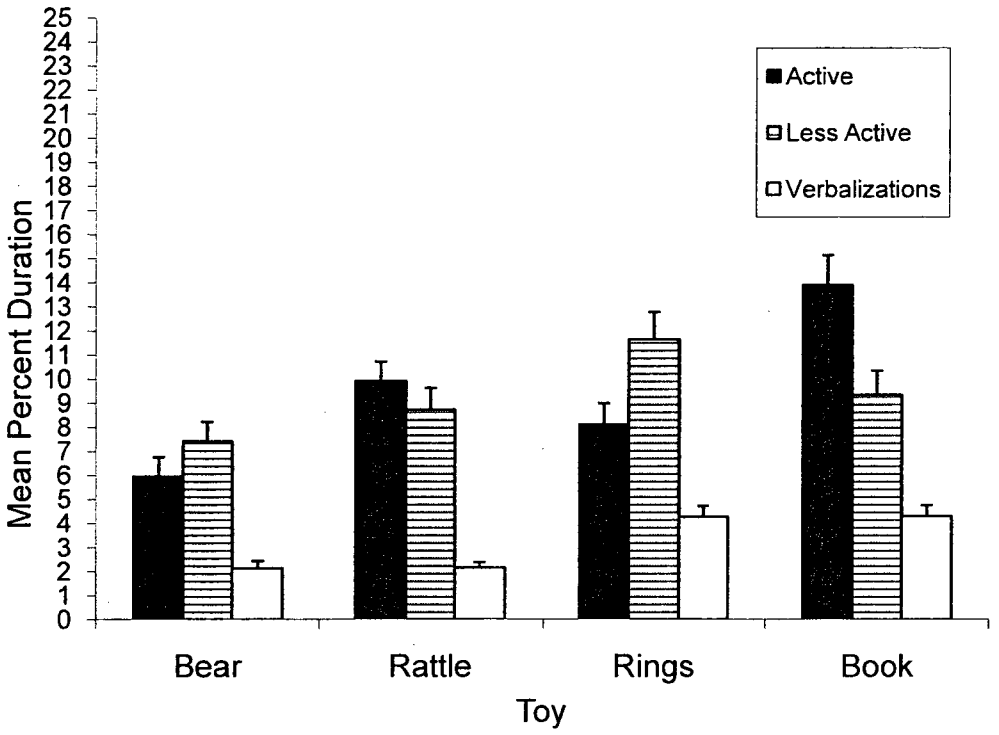

Figure 9. Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Verbalizations at 5½ Months

Table 10.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Maternal Verbalizations According to Toy and Group at 12 and 18 Months

	Telephone	Teaset	Doll	Blocks	Books
12 months, FT-NBW					
Active Nonverbal	5.05 (.76)	9.78 (1.22)	3.93 (.72)	6.44 (1.14)	12.10 (1.86)
Less Active Nonverbal	2.86 (.80)	13.26 (1.68)	8.54 (1.32)	5.31 (1.11)	4.91 (.88)
Verbalizations	3.15 (.53)	4.60 (.55)	4.62 (.67)	2.35 (.36)	3.68 (.54)
12 months, PT-VLBW					
Active Nonverbal	7.16 (.90)	7.49 (1.45)	6.72 (.86)	7.36 (1.35)	14.96 (2.21)
Less Active Nonverbal	4.74 (.95)	11.39 (1.99)	15.03 (1.57)	7.92 (1.32)	5.48 (1.05)
Verbalizations	4.32(.63)	1.95 (.65)	4.59 (.79)	.49 (.43)	0.00 (.64)
18 months, FT-NBW					
Active Nonverbal	3.91 (.68)	7.77 (1.06)	3.63 (.58)	5.63 (1.22)	13.09 (2.84)
Less Active Nonverbal	3.87 (.69)	15.03 (1.74)	13.12 (1.65)	4.99 (1.11)	6.14 (1.39)
Verbalizations	3.15 (.48)	5.88 (.83)	5.24 (.85)	1.43 (.26)	4.77 (1.72)
18 months, PT-VLBW					
Active Nonverbal	5.99 (.80)	7.08 (1.26)	3.72 (.69)	8.45 (1.45)	4.27 (3.37)
Less Active Nonverbal	3.74 (.82)	8.39 (2.06)	12.51 (1.96)	6.46 (1.33)	7.01 (1.65)
Verbalizations	2.15 (.57)	3.13 (.99)	3.87 (1.01)	1.53 (.31)	6.50 (3.04)

Note: Standard errors are included in parentheses

Table 11.

Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Maternal Verbalizations According to Toy at 12 and 18 Months

	Telephone	Teaset	Doll	Blocks	Books
12 months					
Active Nonverbal	6.10 (.59)	8.63 (.95)	5.32 (.56)	6.90 (.88)	13.53 (1.44)
Less Active Nonverbal	3.79 (.62)	12.33 (1.30)	11.79 (1.02)	6.61 (.86)	5.20 (.68)
Verbalizations	3.73 (.41)	3.27 (.43)	4.61 (.52)	1.42 (.28)	1.84 (.42)
18 months					
Active Nonverbal	4.95 (.53)	7.43 (.83)	3.68 (.45)	7.04 (.95)	13.68 (2.20)
Less Active Nonverbal	3.81 (.54)	11.71 (1.35)	12.81 (1.28)	5.73 (.87)	6.57 (1.08)
Verbalizations	2.65 (.37)	4.51 (.64)	4.55 (.66)	1.48 (.20)	5.63 (1.33)

Note: Standard errors are included in parentheses

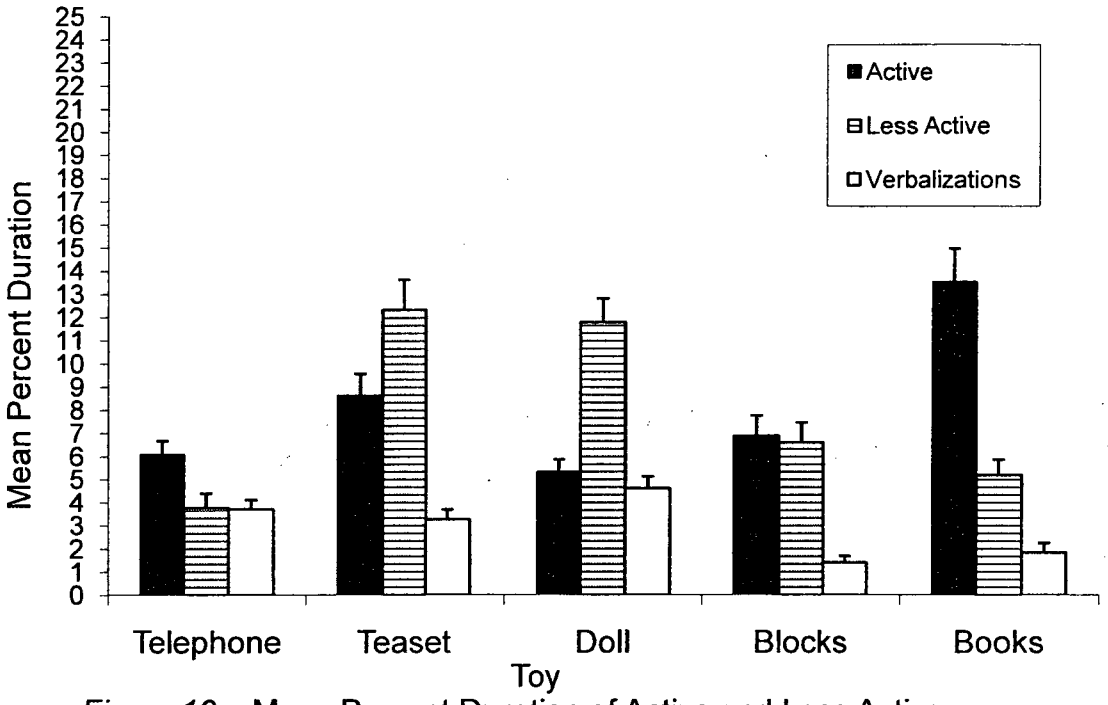

Figure 10a. Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Verbalizations at 12 Months

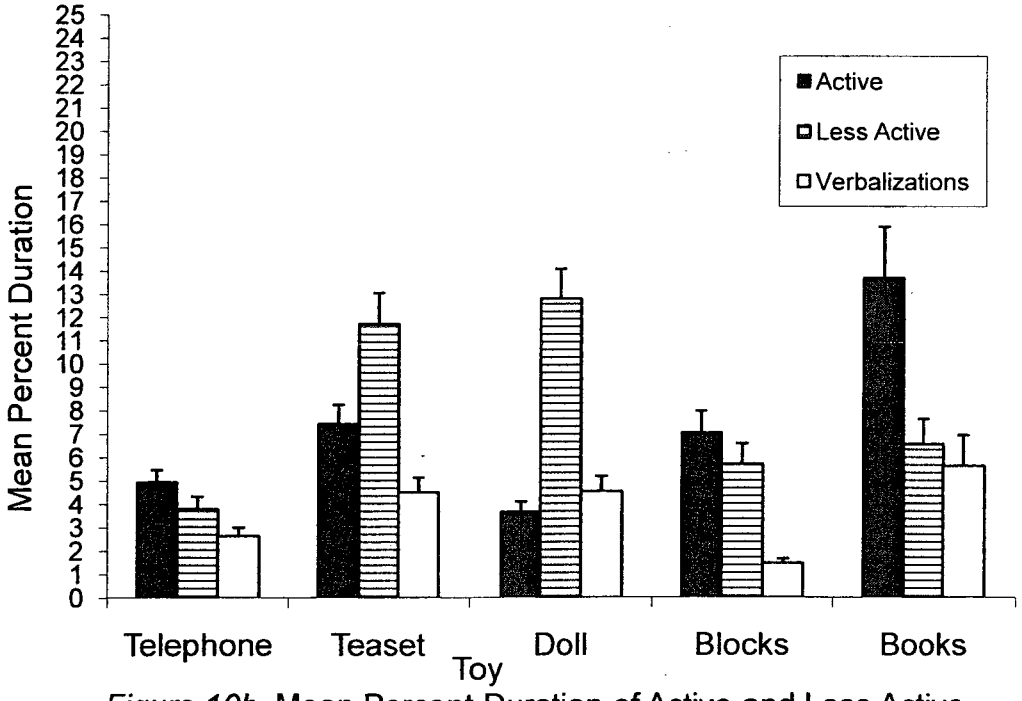

Figure 10b. Mean Percent Duration of Active and Less Active Maternal Nonverbal Behaviours and Verbalizations at 18 Months

Chapter 3. General Discussion

The present three-part study was designed to examine maternal use of attention scaffolding efforts with their infants during toy-centered play and infant-object directed attention. Several objectives guided the development of this study, which were to assess: (1) micro-contextual influences of toy-types on maternal nonverbal and verbal attention structuring behaviours and infant attention; (2) developmental changes in maternal nonverbal and verbal behaviours and infant attention; and (3) differences in mothers' use of nonverbal and verbal behaviours and infant gaze as a function of infant birth status in PT-VLBW and FT-NBW mother-infant dyads. These objectives were designed in order to enhance and broaden our present knowledge of mother-infant communication during play and to identify the impact of the physical play environment on mother and infant behaviours. Given that play is central to the growth of infants and the caregiver-infant relationship, identifying in a detailed manner how caregivers communicate with their infants was critical. Moreover, delineating the different contexts of play to which infants are exposed was warranted (Beeghly & MacDonald, 1993; Malone, 1999; Tamis-LeMonda & Bornstein, 1993). The individual toys available within play present micro-environments or micro-contexts for mothers and their infants. As such, the micro-contextual influences of toy-type were included as a potential variable that influenced mother and infant behaviour during play.

The results from the present study indicated that: (a) mothers use a variety of attention scaffolding behaviours and adjust their nonverbal and verbal behaviours according to toy-type; (b) infant gaze direction is influenced by both maternal behaviour and toy-type; (c) developmental changes take place between the age of 12 and 18 months in maternal behaviour and infant gaze according to toy type; and (d) infant birth status (FT-NBW and PT-VLBW) is associated with differences in maternal behaviour.

The Interplay of Social and Physical Contextual Influences during Toy-Centered Play

The concept of *scaffolding* was first introduced to account for maternal support when infants are confronted with a problem to be solved such as a task that involves an object (Wood et al., 1976). Later, researchers extended the applicability of scaffolding to infant attention, suggesting that caregiver scaffolding of infants' attention represents an early form of scaffolding (e.g. Pêcheux et al., 1992). Although infants are capable of exploring their external environments from about 3 months of age, they have difficulty independently focusing and maintaining their attention for long enough to process all of the information contained therein. As a result, caregivers often implement strategies to assist their infants in focusing and maintaining their visual attention. Pêcheux et al. (1992) maintained that helping an infant attend to and overcome the problem of waning attention is scaffolding. The present research provides evidence in support of the important role that mothers play in scaffolding the attention of their infants and clearly demonstrates that an array of nonverbal and verbal behaviours is used to scaffold infant attention toward toys during play interactions. Interestingly, mothers were not given specific instructions regarding how to engage their infants nor how to include toys in play. Yet, mothers employed a variety of multimodal attention-scaffolding behaviours, ranging from *touching* toys with infants to *demonstrating* the functions of toys, as well as calling attention to toys by naming and describing how to use them. Thus, the complexity and diversity of mother-infant interactions around toys was evident across the three time points of 5½, 12 and 18 months.

A clear pattern that emerged from the results of Parts I and II of this research is the adjustments that mothers made to the amount of time they used their nonverbal and verbal attention-scaffolding behaviours according to infant age and toy-type. For example, from 12 to 18 months, mothers reduced the amount of time they spent *physically assisting* infants with toys and *demonstrating* toys, however, they increased

the amount of time they spent using *point* to direct attention towards toys. Likewise, while mothers increased the amount of time they used function verbalizations from 12 to 18 months, they maintained the amount of time they used the other types of verbalizations. These results are somewhat discrepant from previous research which has found that caregiver scaffolding lessens as infants grow (e.g. Barnard et al., 1984; Pêcheux et al. 1992). The difference between current findings and prior research may be explained by the fact that many previous studies did not investigate as many individual caregiver behaviours, and they typically combined nonverbal and verbal behaviours into one category. By examining an extensive array of nonverbal and verbal behaviours separately, results from the present research suggest that mothers do not necessarily reduce all their scaffolding behaviours as infants grow but rather they adjust the types and amount of time with which they use particular attention-scaffolding behaviours according to the age of their infants. Consequently, these findings underscore the need to consider the individual behaviours of mothers to gain an accurate understanding of how maternal scaffolding develops over time.

The examination of specific scaffolding behaviours revealed notable findings related to the nonverbal behaviours of *demonstrate* and to function verbalizations which can be considered the verbal complement of *demonstrate.* At 5½, 12 and 18 months, *demonstrate* was used for long durations with a variety of toys compared to many other maternal behaviours. In particular, mothers decreased the amount of time they used *demonstrate* from 12 to 18 months, however, they increased their use of function verbalizations over time. This finding may seem paradoxical because it might have been expected that mothers would verbalize less about the uses and functions of toys if they are demonstrating them less. However, demonstration of a toy's use or function serves not only the function of structuring infant attention but it also conveys a large amount of information about the function of the toy or how the toy should be used (McCune et al.,

1994). As such, mothers likely spent less time demonstrating as their infants grew because of the advancing skills of infants, and due to mothers' providing longer opportunities for infants to interact independently with the toys. However, as infants were actively involved in playing with the toys, mothers continued to verbally guide their infants on how to use and play with the toys appropriately. These results clearly illustrate the fine tuning of maternal nonverbal and verbal communication according to the developmental level of their infants. In addition to infant age, mothers adjusted their behaviour according to toys, important contextual elements within the play environment.

A unique contribution of this research is the inclusion of toy-type as a variable for empirical investigation. Given that previous research has illustrated the importance of other contextual factors during play, such as play partner, in promoting differing mother and infant responses (e.g. Adamson & Bakeman, 1985; Dickson et al., 1997; Garner & Landry, 1992), it follows that type of toy is one such contextual factor that required systematic investigation The importance of using different play contexts created by the inclusion of different toy-types is that a variety of toys provides infants with different learning opportunities, and exposes dyads to greater ludic, learning and didactic experiences (Malone, 1999; McCollum et al., 1988). Furthermore, the unfolding of communication between caregivers and infants during playful interchanges is promoted to varying degrees relative to the toy used. As expected, toy-type affected both maternal and infant behaviour from 5½ to 18 months, supporting the contention that toy-type is an important variable to take into account when investigating the development of communicative interchanges between maternal-infant dyads during play.

Closer examination of the association between maternal nonverbal and verbal behaviours and toy-types revealed important patterns in the way that mothers integrate toys into play with their infants and adjust their behaviours according to toys. At 5½ months, mothers' sensitivity to their infants' developmental level clearly emerged by their

use of many nonverbal and verbal scaffolding behaviours with the rattle and rings, toys that have functional properties. Toys with such properties more closely complement the interests and abilities of younger infants because they elicit play around the toys themselves, and infants at this stage tend to explore their physical environment by shaking, turning, and manipulating toys and objects (Belsky & Most, 1981; Ruff & Lawon, 1990; Ruff & Rothbart 1996). However, at 12 and 18 months, mothers focused their use of many nonverbal and verbal behaviours on the teaset and doll, more socially-oriented toys. Similar to the findings at 5½ months, mothers' nonverbal and verbal scaffolding efforts with socially-oriented toys at 12 and 18 months highlights their attunement to their infants' changing abilities. Mothers focused their scaffolding efforts on toys that fit the cognitive, motoric and social level of their infants because by the first year of life, infants are increasingly mobile, more active social partners and they demonstrate increased interest in toys with social properties (Chase, 1994).

The present research also provided valuable information about maternal behaviour with books. Picture book reading has been discussed as an important activity to promote language and literacy skills of children (e.g. Adams, 1990; Bus et al., 1995; DeBaryshe, 1993; DeTemple & Snow, 2003; Fletcher et al., 2008; Ninio, 1983; Raikes et al., 2006; Senechal & LeFevre, 2002; Senechal, LeFevre, Hudson, & Lawson, 1996; Snow & Goldfield, 1983). Yet, little research has studied picture book reading experiences between caregivers and infants in children under the age of 3 (Fletcher & Reese, 2005; Fletcher et al., 2008). The examination of nonverbal and verbal behaviours with books at 5½, 12 and 18 months revealed noteworthy findings and is consistent with previous research which has shown that picture book reading is an activity between an adult and infant that involves joint attention and assists infants in sustaining attention (e.g. DeLoache & DeMendoza, 1987; Moerk, 1985; Snow & Goldfield, 1983). At all three time points, *demonstration* of books by mothers was substantially longer compared to

the *demonstration* of other toys. Mothers also scaffolded their infants by using *touch-with* and *point* for longer with books. The greater use of these behaviours with books is understandable given that young infants are not capable of independent reading and require assistance in the practice of holding a book appropriately, turning pages and systematically looking through a book. Results in the verbal domain paralleled those found in the nonverbal domain. At 5½ months, function verbalizations were used for significantly longer with the book compared to other toys, and mothers increased their use of these verbalizations as their infants grew from 12 to 18 months. Function verbalizations with books included labeling pictures, and commenting and asking questions about pictures. Other research has also shown that parents frequently engage in these verbal behaviours when reading with young children (Bus, et al., 1997; Bus & van IJzendoorn, 1988; Ninio & Bruner, 1978; Senechal et al., 1995). Mothers' increased use of the pointing gestures with books complements the verbal findings, in that *point* was likely used independently to highlight features of books and pictures in the books as well as to complement mothers' verbalizations around the books. It is important to note that pictures, as those found in the picture books included in the current study, are symbols that may represent objects, people and events. For young infants, particularly those in the first year of life, pictures are treated as objects while their symbolic representations are not yet understood (DeLoache & Burns, 1994; DeLoache, Pierroutsakos, Uttal, Rosengren, & Gottlieb, 1998; Perner, 1991; Troseth & DeLoache, 1998). The present results extend previous findings by illustrating that mothers' routines around books actively include both nonverbal and verbal behaviours. Such routines involve conversations, labeling pictures and reading text as well as demonstrations on how to use a book, including holding a book appropriately, turning pages and looking through a book from start to finish. Furthermore, mothers employ these behaviours from as early as 5½ months, a finding which extends our knowledge about early behaviours

of mothers around book reading. Future research is warranted to study the multimodal communication that occurs during reading interactions between caregivers and their infants, how such communication changes as infants grow, and how it varies depending on book type.

Taken together, the present findings underscore that both maternal nonverbal and verbal behaviours are powerful ways in which mothers communicate with their infants during play interactions. Mothers' attunement to their infants' changing needs was apparent by their adjustment of both the amount of time and types of behaviours they employed according to the age of their infants. Mothers' sensitivity was also demonstrated by their use of specific scaffolding behaviours with particular toys, behaviour-toy combinations which were complementary to infants' cognitive, motor, and social developmental level. The contextual influences of toy-type found in the present study have wide-ranging implications in light of previous research that has included a broad array of toys when examining both maternal and infant behaviour during play. When results are reported across toy play in general (e.g. Adamson & Bakeman, 1985), results may not be fully accurate and developmental changes may be masked compared to reporting results based on the type of toy used. As such, more research including toy-type is warranted to achieve a greater understanding of how this environmental component interacts with other factors to influence the development of maternal and infant behaviour during play. Understanding how such microcontextual factors influence infant attention is of particular importance since this is a cognitive skill which has been linked to many important developments in infancy and childhood (e.g. Flom et al., 2007; Morales et al., 1998; Nelson, 1979).

Infant Gaze: A Window into Infant Attention

Visual attention is a critical measure of cognitive processing during infancy and the direction of infant eye gaze has been shown to be an important means in which to

evaluate infant attention (Flom & Pick, 2007; Morrow, 1993; Van De Weijer-Bergsma, 2008). Eye gaze is a salient medium through which infants communicate with their interactive partners and acquire information about their surroundings (e.g. Stern, 1977; Webbink, 1986). The present research examined infant gaze in relation to maternal nonverbal behaviours and toy-type and found that at 5½ months, infants gazed at rattle and rings, toys that had functional properties for longest compared to other toys when mothers were not interacting with them in some way. This outcome is likely because functional toys tend to be multimodal, and colourful and perhaps more attractive to infants. In addition, as discussed earlier, functional toys are more in line with infants' capabilities at this age and thus infants may be more likely to attend to such toys. Another possibility is that mothers engaged with these toys for longer, including giving functional toys to their infants to explore independently. As such, it may be that more opportunities were created by mothers for infants to attend to and play with these toys. Interestingly, infants gazed longer at the bear and book at 5½ months when mothers were in contact with the toy compared to when they were not. This is understandable given that both these toys are less complementary to infants' attentional and exploratory abilities at this age, thus making them more likely to attend to these toys with the assistance of their mothers. For example, at 6 months, infants usually visually attend toys that they can explore through mouthing and handling their surfaces. However, the social toy was a plush bear made of terry cloth material which likely was a texture that infants would not want to mouth and therefore might spend less time visually attending.

At 12 and 18 months, infants gazed at the teaset for longer when mothers were not interacting with it. This result may be partially explained by the fact that the teaset was a popular toy at 12 and 18 months which infants independently played with for long periods. When infants are actively engaged with a particular toy it is common that they are engaged with both their hands and visual attention. Another possibility is that

mothers' attention structuring behaviours were successful in directing infant attention. As previously discussed, many maternal attention behaviours were employed for longer with social toys at these age points, perhaps facilitating infants' visual interest in them.

Additional findings revealed that across time, infants gazed at books for longer when mothers were interacting with books compared to when they were not. Although infants' proficiency with books develops over time, between the ages of 5½ and 18 months, they require aid from their mothers to initiate and approach books appropriately. This is consistent with research which has shown that mothers frequently show infants how to appropriately interact with books, that is holding and turning pages of books (Fletcher & Reese, 2005). Infants were likely to gaze at books for longer when mothers were in contact with them because mothers' behaviours around books provided a stimulating experience for infants and thus increased their visual attention to the books. The present findings provide new information about mother-infant interactions around books in infants as young as 5½ months. Available studies have not typically addressed infant and maternal behaviours around books beginning at such a young age (e.g. Senechal et al., 1995; van Kleek, 2003). Gaining an understanding of maternal and infant behaviours in relation to books from such an early age is important since reading is a critical skill for children, and caregiver behaviours around books have been linked to later developments in child literacy and language development (Fletcher & Reese, 2005; Stadler & McEvoy, 2003; Wheeler, 1983).

Interestingly, infants did not necessarily gaze at all toys for longer when mothers' hands were in contact with them, which may have been expected, particularly at 5½ months. This may be because even though mothers spent a large portion of the available play time playing and engaging infant attention towards toys, they also allowed infants time to attend and play with toys independently. Furthermore, as infants grow, they become better able to independently control their gaze direction (Rothbart et al.,

1990) and thus may not be as impacted by maternal scaffolding behaviours. By 12 months, infants display better control over their attentional responses and although mothers may be attempting to direct their attention in some way, if infants are already attending and engaged with a toy, they can more easily choose to maintain their attention on the toy they are engaged with rather than shifting attention to a toy their mother is bringing forward. These findings are consistent with research which has found that as infants' attentional skills mature they become increasingly interested in their nonsocial surroundings compared to their mothers, and they actively use their skills to guide the flow of play with their interactive partner (e.g. Stern, 1977; McCune et al., 1994).

Together the findings illustrate that infant gaze direction is a powerful measure of infant attention. In addition, important information about the influences of social and physical contextual influences was revealed by changes in infant gaze direction. The present research focused on measuring infant gaze in relation to toy-types and maternal nonverbal behaviours and as such is was difficult to assess how maternal verbal scaffolding impacted infant gaze direction. While the current findings reveal important information about how infant attention is impacted when mothers use nonverbal behaviours with a variety of toys, it would be important for future research to study how verbal scaffolding as well as nonverbal and verbal scaffolding together influence infant attention. Important age-related changes in infant attention also emerged and demonstrate the need to more closely investigate the influence of other important infant developmental factors such as birth status on infant attention and caregiver behavior. Prematurity is known to affect infant attentional development and caregiver-infant play. The influence of infant preterm birth status was a central factor which was investigated in the present research. Studying the impact of birth status is particularly important since preterm infants have been shown to have difficulties with joint attention interactions and

object play, and to be at risk for later developmental problems (e.g. Doctoroff, 1996; Landry, 1986; 1995; Landry & Chapieski, 1988; Landry, Schmidt & Richardson, 1989; Smith & Ulvund, 2003; Van De Weijer-Bergsma et al., 2008).

Birth Status Influences on Maternal Scaffolding

Parts I and II of this study highlighted that in addition to infant age, infant preterm and fullterm birth status influenced maternal nonverbal and verbal communication during play. Findings showed that mothers adjusted some of their nonverbal and verbal behaviours according to infant birth status, however, frequently not in the direction expected. In the nonverbal domain, group differences emerged more prominently at 5½ and 12 months compared to 18 months. At 5½ months, mothers of preterm infants used several nonverbal scaffolding behaviours including, *shake*, *point* and *touch* for longer compared to mothers of fullterm infants. At 12 months, mothers of preterm infants used *point* and *show* for longer with toys whereas mothers of fullterm infants touched toys for longer. By 18 months, mothers of fullterm infants were using *tap* and *show* with toys for longer compared to mothers of preterm infants. Few toy-type related differences were found in relation to infant birth status at 5½, 12 and 18 months. The results in the verbal domain revealed that mothers of fullterm infants used verbal stimulation for similar amounts of time or for longer than mothers of preterm infants. For example, at 5½ months, mothers of fullterm infants used labeling for longer than mothers of preterm infants while all mothers used attention, characteristic and function verbalizations for similar lengths of time. At 12 months, mothers of fullterm infants used function and attention verbalizations for longer and by 18 months, no group differences were found.

The present findings are somewhat counter to previous research which has shown that caregivers of preterm infants provide either more stimulation to their infants or similar amounts as mothers of fullterm infants. The fact that mothers of fullterm infants were found to use some forms of scaffolding for longer is noteworthy. The pattern in the

current results may be related to how scaffolding efforts were measured and the sample of preterm infants included in this study. While the present study included a large array of nonverbal and verbal communicative behaviours, other aspects of caregiver scaffolding efforts such as global measures of sensitivity and responsiveness may have revealed differences between the groups that the indices in the present study were unable to detect. Investigations involving a greater number of measures of caregiver scaffolding, including both micro and macro analytical indices would need to be undertaken to further elucidate the impact of birth status on caregiver scaffolding during toy-centered play.

It is also important to consider the sample of preterm infants studied in the current research. Preterm infants represent a heterogenous group, in terms of gestational age, birth weight and perinatal medical complications. Studies examining caregiver-infant interactions with preterm infants have not consistently attempted to isolate the contributions of prematurity from those of birth weight and in particular, medical illness. The present study sought to accomplish this goal through the use of stringent selection criteria excluding infants suffering from serious medical complications that might have confounded the impact of gestational age and birth weight. The methodological rigour in selection of the present sample of infants is particularly essential given that an increasingly prevalent assumption in the literature is that, it is the medical complications, rather than the degree of prematurity and lower birth weight per se that influences developmental outcomes and differences between such infants and fullterm infants (e.g. Creasy et al., 1993; Miceli et al., 2000).

The pattern of results found between groups may in part, be accounted for by the exclusion of PT-VLBW infants with medical complications which resulted in a more homogenous group of infants, at a lower degree of perinatal risk that more closely approximated the FT-NBW sample. As such, results from this study highlight the

importance of devising studies that isolate the contribution of prematurity from those of medical illness. The rigorous selection and matching criteria employed in the present study indicate that the present findings may not be reflective of the entire population of PT-VLBW infants. As this study was limited to healthy PT-VLBW infants, the results likely generalize to that particular subsample of the PT-VLBW population. It is also possible that the healthy medical status of the infants influenced mothers' perceptions of their infants and thus their behaviours with their infants. Although the present study did not directly assess maternal stress or their perceptions around infants' preterm births, it is possible that although infants were born early and small, because they experienced few health issues this allowed mothers to experience more typical interactions with their infants from birth. In contrast, early experiences and interactions between mother-infant dyads where infants are born preterm and with health difficulties may be more disrupted, in part because preterm infants with health problems are less likely to give clear communicative signals (Browm & Ruder, 1995; Divitto & Goldberg, 1979; Eckerman et al.1995; 1999; Fiese, Poehlmann, Irwin, Gordon & Curry-Bleggi, 2001; Goldberg, Brachfeld & Divitto, 1980; Landry, 1995; McGehee & Eckerman, 1983; van Beek & Samson, 1994).

The impact of VLBW birth status may have diminished by 5½ months, thereby explaining the limited differences found in the groups. This explanation is supported by the results of Leroux, Malcuit and Pormerleau (1999) who found differences of maternal sensitivity and contingency between preterm and fullterm dyads at 2 months that were no longer present when dyads were studied at 4 and 6 months. Although the exact reason for the lack of differences at the later time points is unclear, the authors suggest that the finding may be related to mothers' decreasing anxiety regarding their infants' development and their ability to care for their infants. Although lessened maternal stress may be a contributing factor, it is also plausible that sufficient time as well as experience

and growth permitted these infants to "catch up" to their fullterm counterparts. Furthermore, in the present sample, the correction for prematurity in the PT-VLBW group may have reduced or eliminated the developmental lag in core perceptual, cognitive and social abilities known to be associated with preterm birth (e.g. Als et al., 1982; Divitto & Goldberg, 1979; Field, 1982; Landry, 1986; Landry et al., 1997). Consequently, the literature would benefit from future studies that would seek to examine caregiver scaffolding efforts at younger ages when differences in caregiver behaviours among preterm and fullterm groups may be more prominent. Furthermore, it would be important for such studies to closely investigate differences in caregiver and infant behaviours while accounting for differences in the extent of prematurity, birthweight and level of medical risk status.

Implications and Future Directions

The present study provided a preliminary understanding of the multimodal nature of maternal scaffolding in the first 18 months of life. This period in infant development is critical because of the rapid and changing growth that occurs within infants and between caregivers and their infants. Infants' experiences within play have been shown to be important for later development (Bruner, 1983). For example, research has shown that infants' attentional skills, exploratory behaviours, and language are better developed when they had mothers who scaffolded their play at younger ages (Baldwin, 1991; Findji et al., 1993; Lawson et al., 1992). The present findings are valuable because they provide a more comprehensive account of the specific behaviours that caregivers employ to scaffold their infants' play at an early age, and capture the interplay between social and physical influences in play. The social scaffold that caregivers provide while utilizing elements in the physical environment is fundamental because it introduces new experiences and meaning for infants.

Early theories of development focused primarily on the individual contributions of the mother or the infant on development. More current theoretical views such as dynamic systems theory (Fogel & Thelen, 1987; Fogel et al., 2006; Fogel, King & Shanker, 2008), however, have considered the role of both caregivers and infants and their mutual influence as interactive partners over time. The present findings are consistent with more current views because they illustrated that both mothers and infants are attuned to one another. Interestingly, systems theories also maintain that infant development is influenced by multiple and interacting sources. Results from the present study illustrated the interconnection between multiple systems, including the infant, mother and physical environment. Furthermore, the development of mother and infant behaviours over time and the joint influence of these systems on mother-infant toy play were also examined.

The findings of the present study also highlighted Bruner's concept of scaffolding which holds that adults provide support to children to help them successfully participate in activities (Wood et al., 1976). The present results also call attention to the views of Vygotsky which regarded a child's physical environment, namely toys and objects as significant to their development. Mothers appeared not only to provide scaffolding that was sensitive to their infants' level and abilities but they were also keenly attuned to their nonsocial surroundings. Mothers adjusted their behaviours according to the toy-types that were present during play in order to create learning experiences and opportunities that were appropriate to the age and developmental level of their infants. Mothers employed both nonverbal and verbal means to demonstrate and discuss the function of toys, as well as support their attention and exploration of toys both independently and with maternal involvement. Maternal scaffolding was important because their actions and statements highlighted different facets of toys and play, and allowed infants to

experience toys and their functions in ways they may not have otherwise without the presence of a more competent play partner.

Overall, the present study made important contributions to understanding the development of maternal-infant toy-centered play, however, a few limitations were also present. It is important to note that many of the limitations can be addressed in future research. One main contribution of the present research is the valuable information revealed about the nonverbal and verbal behaviours that mothers utilize to scaffold infant attention. Nevertheless, limited statements regarding the association between maternal nonverbal and verbal behaviors could be made. In order to have a more in-depth understanding of the relationship between multimodal maternal scaffolding behaviors, it would be important for future research to investigate in more depth the role of temporal synchrony and desynchrony between maternal nonverbal and verbal behaviours. Such investigations can evaluate important issues such as whether mothers are more successful at directing infant attention when they use nonverbal and verbal behaviours together or when they use each behaviour alone. Likewise, questions related to whether nonverbal and verbal behaviours are equally effective at structuring infant attention, or whether one is more effective than the other, and whether these multimodal behaviours provide redundant information or unique information can be addressed.

Future research may also seek to analyze data using co-occurrence and sequential analyses. Co-occurrence analyses can reveal the duration of overlap between behaviours of interest during an interaction such as specific nonverbal and verbal maternal scaffolding behaviours (e.g. *demonstrate* and function verbalizations). In addition, sequential analysis has been argued to be a statistical technique which is beneficial in establishing directionality in patterns of ongoing interactions and can likely reveal important information about maternal multimodal scaffolding behaviours (e.g. Bakeman & Gottman, 1997).

Another important contribution of the present research is the demonstration of the significant role of toy-type on mother and infant behavior during play. The toys used in the present study were age appropriate, including both social and functional properties and books at varying levels which were selected to elicit age appropriate play between mothers and infants. More specifically, at 5½ months, four toys were available whereas at 12 and 18 months, five toys were available. Although toys with social and functional properties, as well as books were available at all three time points, the specific toy which fell into each category was different so as to be appropriate to the developmental level of the infants. Furthermore, one additional toy was available at 12 and 18 months compared to 5½ months because at these ages infants show greater interest in their nonsocial surroundings and providing a greater variety of toys was more suitable to meet their growing interests and skills. Given the different number of toys that were available at 5½ compared to 12 and 18 months, direct longitudinal comparisons could not be made across the three time points. However, comparisons were made from 12 to 18 months, and patterns in the findings were identified across the three time points. Some of the current results may have been influenced by the unequal number of toys with functional and social properties that were available at 5½, as well as 12 and 18 months. At 5½ months, two of the four toy-types available had functional properties while one was more socially-oriented whereas at 12 and 18 months, there was one toy with solely functional properties and two which were more socially-oriented. Despite the unequal number of toys with functional and social properties available within each age group, many maternal nonverbal and verbal behaviours were used for longer with particular toys that were not overrepresented in terms of their functional and social properties. This suggests that other factors, such as maternal attunement and sensitivity to their infants played an important role in influencing the types of behaviours mothers employed with particular toy-types. Although difficult, it would be beneficial for future research to select

toys that could fit the interests and abilities of infants at various age ranges and elicit appropriate caregiver-infant play. The inclusion of such toys would allow for longitudinal comparisons to be made across longer developmental time.

In addition to toy-type, it is possible that other toy characteristics such as the novelty of the toy and toy difficulty may have influenced both mother and infant behaviour. Some research has shown that maternal scaffolding varies according to toy difficulty (Stevens et al., 1998). Stevens et al. (1998) found that mothers' scaffolding of play with a toy train decreased from 9 to 15 months while their scaffolding with play of a shape toy (which was considered more difficult) increased over time. It is also plausible that toy novelty or previous experience playing with particular toys could influence caregiver and infant behaviour. For example, mothers may spend less time demonstrating and labeling a toy that is not novel. Likewise, infants may be less likely to direct their gaze towards a toy that they are familiar with compared to a novel toy. Thus, findings from the present study demonstrate important influences of toy-type on caregiver nonverbal and verbal behaviour and infant gaze, however, the results are bound to the specific toys included in this study and might vary with changes to other factors related to toys and the play context. As such, it would be important for future research to consider various factors associated with toys as these factors can potentially influence study results and expand our knowledge about the impact of elements within physical play environments on the progression of toy play.

One means of further assessing toy-centered play would be to examine aspects such as tempo and timing of play behaviours. Timing of actions is part of the communicative process (Nwokah, Hsu, Dobrowolska & Fogel, 1994; Trevarthan, 1977), and it would be of interest for future research to determine how the timing and tempo of mothers' scaffolding behaviours influence infant gaze and how such factors change with infant age. For example, mothers' demonstrations of toys would be tracked by

measuring the length of pauses between mothers demonstrating parts of a toy. Perhaps at 5½ months, mothers introduced toys by initially spending a long bout showing their infants the different parts of toys. In contrast, at 12 and 18 months, perhaps mothers may have offered demonstrations and assistance in shorter bursts. Investigations of mother-infant face-to-face play have revealed that altering the tempo of play has an effect on the amount of gaze towards the parent and positive facial expressiveness (Arco & McCluskey, 1981). Investigating the tempo of toy-centered play may also have implications for infants' communicative behaviours and thus, is an important avenue for future research.

The consideration of other measures could also add to our understanding of scaffolding in play interactions. The present study highlighted the importance of using microanalytical measures which target specific caregiver behaviours to gain an understanding of scaffolding in early toy play interactions. However, the inclusion of other more qualitative measures, such as caregiver level of sensitivity and responsiveness could complement microanalytical measures and provide a more comprehensive understanding of caregiver scaffolding during play. Furthermore, including measures that more closely assess the bidirectionality of mother-infant interactions would also be important for subsequent research to consider.

Finally, the present results revealed important findings related to infant birth status. However, additional research is needed to investigate the different groups of VLBW and preterm infants, that is, how caregiver and infant behaviours may vary between healthy PT-VLBW infants and those suffering from different degrees of postnatal medical complications and illness. Such research could further elucidate the role of social-interactive and biological influences on infant development.

Conclusions

The present study provides important findings on the development of toy-centered play in the first 18 months of life and demonstrates that mothers take an active scaffolding role, organizing play time into interactions that help to structure the attention of their infants and into transactions that are opportunities for learning. The beneficial effects of toy play on the development of infant skills, including language, attention, motor and explorotary would not be possible without the presence of a caregiver. The present study underscores that mothers were not only present but engaged in a breadth and diversity of multimodal scaffolding efforts which have not been previously documented. In addition, infants also appear to be highly attuned to their environment and possess the cognitive capacity and awareness to detect sources of information that may assist them in negotiating their surroundings.

The results of the present study also significantly contributed to our understanding of the micro-contextual play influences of toy-types on mother and infant behaviour. The consideration of toys as a variable for investigation clearly indicated that mothers and infants shift the ways in which they communicate as a function of the available toys. The findings highlighted the value of closely investigating toys as an important variable within play and provided much needed information on the interplay between physical and social environmental influences and their impact on mother-infant play during the first 18 months of life. Lastly, the findings permitted comparisons of physical and social environmental influences with PT-VLBW and FT-NBW infants. Together, the results illustrate the emergence of multiple components of play, including the cognitive, social and physical 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.

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Appendix A:

Toy Categories

Toy Categories

Different toys were used in the design at 5½ compared to 12 and 18 months in order to ensure the overall developmental suitability of the play context and to provide materials that would facilitate and elicit age appropriate play between mothers and their infants. As a result, separate analyses were conducted at 5½ compared to 12 and 18 months to examine the contextual influence of different toy types on maternal nonverbal behaviours and infant attention.

In order to determine the classification of toys in the present study, twenty female participants, ranging in ages from 22 to 34 years (M = 26.30, SD = 2.20) completed a questionnaire (provided below) in which they were provided the definitions of a social and functional toy, and the names of the seven individual toys that were included in the study. A social toy was defined as primarily eliciting social activity between play partners with less focus on the toy itself. A functional toy was defined as primarily eliciting play around the toy itself. The toys included a plush bear, rattle, Rock-a-Stack, tea set, doll, Lego blocks, and plastic telephone. Participants were then asked to select whether they believed each toy to be primarily social or functional within a play context based on the definitions they were provided. The results revealed that bear, teaset and doll were categorized as social by 95% of participants. The rattle, Rock-a-Stack and Lego blocks were categorized as functional by 95% of participants. The telephone received equal social and functional categorizations, that is, 50% of participants categorized this toy as social, and 50% categorized it as functional.

Toy Survey

Toy Definitions:

Social Toy:

- A social toy primarily elicits social activity between play partners with less focus on the toy itself.

Functional Toy:

- A functional toy primarily elicits play around the toy itself.

Based on these definitions and considering a ***play context***, please choose whether you believe the toy to be primarily social or functional.

Rattle	Social _____	Functional _____
Doll	Social _____	Functional _____
Lego Blocks	Social _____	Functional _____
Tea Set	Social _____	Functional _____
Plush Bear	Social _____	Functional _____
Telephone	Social _____	Functional _____
Rock-a-Stack (rings)	Social _____	Functional _____

Appendix B:

Consent Forms

HÔPITAL GÉNÉRAL JUIF
SIR MORTIMER B. DAVIS
JEWISH GENERAL HOSPITAL

Department of Neonatology
Département de Néonatologie

UNIVERSITÉ
Concordia

Centre for Research in Human Development
Centre de recherche en développement humain

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 exchange.

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 (848-2424, ext.7565), Dr. Lisa Serbin (848-2424, ext.2255) or Dr. Alex Schwartzman (848-2424 ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Mrs. Laurie Berlin (340-8222, ext.5833). 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 child: _____ Date: _____
Parent's signature: _____ Date: _____
Witness: _____ Date: _____

RESEARCH ETHICS
05 DEC 2003
APPROVAL

HÔPITAL GÉNÉRAL JUIF
SIR MORTIMER B. DAVIS
JEWISH GENERAL HOSPITAL

Department of Neonatology
Département de Néonatologie

UNIVERSITÉ
Concordia

Centre for Research in Human Development
Centre de recherche en développement humain

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 exchange.

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 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 outside without my permission.

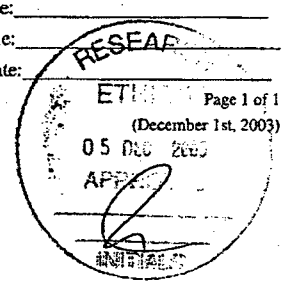
I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my 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 (848-2424, ext.7565), Dr. Lisa Serbin (848-2424, ext.2255) or Dr. Alex Schwartzman (848-2424 ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Mrs. Laurie Berlin (340-8222, ext. 5833). 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 child: _____ Date: _____
Parent's signature: _____ Date: _____
Witness: _____ Date: _____



Appendix C:

Detailed Coding Criteria

Mother-Infant Toy-centered Play Interactions

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 mothers. 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 mother-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 nonverbal and verbal coding schemes were developed to describe and evaluate the attention scaffolding behaviours which mothers use with their 5½ -, 12-and 18-month old infants in a toy-centered free play situation. The goals of the present coding schemes were to capture the specific nonverbal or physical/gestural behaviours and verbal stimulation which mothers employ to structure their infant's attention towards a variety of toy-types while playing with them. To obtain a detailed account of the behaviours which mothers use with their infants, each play interaction (5½, 12 and 18 months) was coded by one-second intervals. Play interactions were viewed on two separate occasions, to first record nonverbal behaviours and then to record verbal behaviours. Segmenting play into discrete units allowed for comparisons to be made at each age group and also allowed for comparisons to be made across developmental time.

The nonverbal coding system consisted of nine main categories of strategies which mothers used to scaffold the attention of their infants towards different toy types during play. The nine behaviours were classified into active and less active categories.

The active category included: shaking or waving a toy(s), pointing towards a toy(s), tapping a toy(s), giving or offering a toy(s) and demonstrating the use or function of a toy(s). The less active category included: touching a toy(s), touching a toy with the infant, showing a toy(s), and physically assisting the infant with a toy(s). Similar categories for maternal nonverbal behaviours have been used in previous research (Landry, Chapieski & Schmidt, 1986; Leiba, 2000).

The coding system also consisted of attention-structuring verbalizations mothers used with their 5½ - , 12- and 18-month-old infants in free play with different types of toys. Four different categories of maternal verbal scaffolding behaviours were recorded. The first category, *labeling verbalization* included labeling or naming a whole toy (e.g. *What a nice book!*). The second, characteristic verbalization was naming a part, feature or characteristic of a toy such as its colour, shape or size (e.g. *The rings are blue, red and yellow*). The third, function verbalization included labeling or naming the function of a toy or the action that is completed with a toy (e.g. *Shake the rattle*). The final category was attention verbalizations which included general attention-directing utterances and/or verbs (e.g. *Look, look at that!*).

Maternal nonverbal behaviours that were not within the field of vision of the infant or within the view of the camera were not coded. When obtaining start and stop times of all the measures, the coder obtained times that accurately represented maternal nonverbal and verbal behaviours while leaving the minimum number of seconds unaccounted for. 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. Minutes and seconds were recorded when indicating start and stop frames, but frames were not recorded. Frames were taken into account because they were crucial for rounding purposes and to obtain an accurate measurement of the duration of behaviours. The fifteenth frame was used as the midpoint. Start and stop times of

behaviours were coded as the following: behaviours that start or stop between 1 and 14 frames were 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 were rounded up to the nearest second (for example, 00:06: 20 ~ 00:07; 00:06:15 ~00:07). The purpose of this scheme was to record distinct maternal nonverbal and verbal behaviours by second. However, the present coding schemes accounted for breaks and pauses that occur in the natural flow of play. Accordingly, brief pauses of one or less than one-second *between* behaviours were not coded. For example, shake - pause - shake. If the pause between behaviours was equal to or less than one second then a code of shake is continued through this one second interval. If the break was greater than one second then the appropriate code is recorded. The same criteria applied to the verbal coding scheme.

All play interactions when coded for maternal nonverbal behaviours were coded with no sound. Upon completion of the nonverbal coding scheme, play interactions were viewed with sound in order to record maternal verbal behaviours. It is important to note that some of the codes in the nonverbal scheme were not mutually exclusive and as a result could not be coded simultaneously. Show could not be coded with any of the following codes: shake/wave, tap or point. The latter are considered to be more defined attentional strategies, which describe more specifically what is done with a toy while the mother is *showing* it. In addition, show was not 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 was not 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 were also not 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 were not coded.

Appendix D:

Operational Definitions of Maternal Nonverbal Scaffolding Behaviours

Operational Definitions of Maternal Nonverbal Behaviours

(Adapted from Landry and Chapieski, 1989)

I. *Less Active Attention-Directing Behaviours:*

Touch:

- 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.
- Bringing numerous toys closer to the infant sequentially or simultaneously with no breaks is coded as a touch.
- This code is only used when the mother is **not** interacting with the toy to: show, wave/shake, tap, or point.
- 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.

Touch-with:

- 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.
- 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.
- 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).

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.

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.

II. *Active Attention-Directing Behaviours:*

Shake/Wave:

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

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.

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.

***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.

Demonstrate:

- Illustrating the appropriate use or function of an object:
- Examples at 5 months, include:
    - Bear: Hug, Kiss or Caress
    - *Rattle:* Roll ball on rattle and shake rattle
    - *Rings:* Take rings off stand; Put rings back on stand; Rocking the Rack-a-stack back and forth; Stack rings on the ground
    - *Book:* Open/Close book; Turn pages of book; Hold book open; Squeeze book (noise/ no noise)
- Examples at 12 and 18 months, include:
    - *Telephone:* Hold phone to own or infants ear; Talk on phone; Hang up phone; Press buttons on phone
    - *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
    - *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
    - *Blocks:* Place block pieces together; Pull block pieces apart
    - *Books:* Open/Close book; Hold book open; Turn pages of book

Appendix E:

Operational Definitions of Infant Gaze

Operational Definitions of Infant Gaze

1. *Toy:* Infant is looking at a toy. At each time point, the direction of infant gaze is recorded per toy.
2. *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 infant's gaze shifts to two or more toys within a one second interval.
3. *Hand/Toy:* Infant is looking at a toy while mother's hand(s) are in contact with the toy.
4. *Hand/Toy Combination:* Infant is looking at a toy while mother's hand(s) are in contact with two or more toys and it cannot be distinguished which toy the infant is looking at.
5. *Away:* Infant is looking at the mother's face and surrounding facial area or at something off camera view or a toy that is not part of the experimental set-up.
6. *No Code:* Infant gaze cannot be coded because infants' eyes are not visible

Appendix F:

Operational Definitions of Maternal Verbal Scaffolding Behaviours

Operational Definitions of Maternal Attention-Structuring Verbal Behaviours

Attention-structuring verbalizations include attention-directing utterances and verbs e.g. "*Look, watch what mommy is doing*". Verbalizations may also include imperatives which frequently include giving a command, making a request or giving a verbal directive to do an activity e.g. come, show, throw, give, put. Other examples include, "*Please bring me that spoon*"; "*Shake the rattle!*"

- The verbalizations include four main categories:
    1. *Attention:* saying child's name, come here, look here, look at /watch Mommy
    2. *Labeling:* attaching a label or naming a whole toy with or without an attention label. For example, "This is a *bear*"; "*Look at the rattle!*"
    3. *Characteristic labeling:* Attaching a label or naming part of a toy such as its colour, shape, size with or without an attention label. For example, "The baby has a smooth head"; "Look at the red buttons on the telephone".
    4. *Function labeling*: attaching a label or naming the function of a toy or the action that is completed with a toy with or without an attention label. For example, reading from the book and talking on the phone. A further example includes, "Mommy is pouring tea into the cups"; Put the rings on the peg"; "This is how you put the blocks together".
- *Coding of verbalizations with toys:*
    - A verbalization is coded according to each specific toy.

- A mother must be holding the toy or it must be clear from the context that she is referring to the toy for her verbalization to be recorded as relating to that toy.
- The verbalization must make direct reference to the whole toy, part of the toy or to the function of the toy.
- A mother's verbalization is also coded when the infant is holding/playing with or exploring the toy visually (gaze) and it is clear from the context that mother is referring to that toy.
- There will be some instances where verbalizations will refer to two toys (their labels, characteristics and/or functions). When such instances arise, then the verbalization will be coded for according to both toys that are referred to. For example, "Feed the doll with the spoon". In this example, the mother is referring to the tea set and to a function of both the doll and spoon, so it is clear that the verbalization can be coded for under both toys.
- "Feed the baby"; "Fait manger a bebe": In this example, the verbalization includes direct reference to the doll and indirectly to the function of the tea set (from the context we can see that a spoon is being held by either mom or baby).
- *Coding of Verbalizations with no toys:*
  - If a mother's verbalization cannot be linked to any of the toys present then her verbalization will be coded under a "No Toy" category and can only include the Attention verbalization subcategory. For example, "Come here"; " Jake, come here".

Examples per verbalization category:

1. *Attention:*
    - Look, look at that!
    - Take, take this one
    - Can you pick this up?
    - Do you want to look at something else?
    - Do you want to take it?
    - Can you grab it?
    - Can you do that?
    - What's that? What's that one?
    - Come on!
    - Here!
    - What do you want?
2. *Labeling:*
    - It's your donut (ring)
    - It's a nice book
    - You like the book (??)
    - There's the teddy.
    - Does the book taste good?
    - The doll is pretty
    - Look at the book
    - Oh you have the bear, here
    - Gonna make mommmy some tea?
    - Labeling pictures from the book: "This is a tiger"; "This is a rabbit"

3. *Characteristic Labeling:*

   - That's a big donut
   - You want the blue ring
   - The teddy is soft
   - Oh, there are red, blue and green blocks
   - The plates are yellow and red
   - Let's look at the small book
   - Labeling pictures from the book: "This is a little dog"

4. *Function Labeling:*

   - Turn the page
   - Oh, the book squeaks
   - Feed the baby
   - It makes a funny noise, ay? (rattle)
   - We can build stuff
   - Do you want to put them back?
   - Do you want to shake it?
   - Say hello (phone); You want to talk?

Appendix G:

MANOVA and ANOVA Summary Tables for Maternal Nonverbal Behaviours (Part I) and Infant Gaze (Part I), Maternal Verbal Behaviours (Part II), and Maternal Nonverbal and Verbal Behaviours (Part III)

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Active Maternal Nonverbal Behaviours at 5 Months (Part I)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	5	67	4.45**
Toy	15	57	52.09**
Toy X Group	15	57	3.07**

Shake

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	11.23
Error	71	(1.17)
	Within subjects	
Toy	3	61.51**
Toy X Group	3	2.94
Toy (error)	213	(1.19)

Tap

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.60
Error	71	(.13)
	Within subjects	
Toy	3	21.36**
Toy X Group	3	.18
Toy (error)	213	(.17)

Give

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	7.31
Error	71	(.22)
	Within subjects	
Toy	3	31.07**
Toy X Group	3	3.13
Toy (error)	213	(.21)

Demonstrate

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.64
Error	71	(1.57)
	Within subjects	
Toy	3	68.24**
Toy X Group	3	1.42
Toy (error)	213	(1.56)

Point

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	2.50*
Error	71	(.38)
	Within subjects	
Toy	3	48.87**
Toy X Group	3	3.67*
Toy (error)	213	(.53)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Less Active Maternal Nonverbal Behaviours at 5 Months (Part I)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	4	26	2.29*
Toy	12	18	15.33*
Toy X Group	12	18	.79

Touch

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	5.34*
Error	29	(.32)
	Within subjects	
Toy	3	26.04**
Toy X Group	3	.17
Toy (error)	87	(.23)

Touch-with

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	2.74
Error	29	(.94)
	Within subjects	
Toy	3	2.23*

Toy X Group	3	1.60
Toy (error)	87	(1.08)

Show

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.27
Error	29	(1.41)
	Within subjects	
Toy	3	5.67**
Toy X Group	3	1.02*
Toy (error)	87	(1.46)

Physically Assist

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.1.58
Error	29	(.62)
	Within subjects	
Toy	3	4.89*
Toy X Group	3	2.04
Toy (error)	87	(.35)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Active Maternal Nonverbal Behaviours at 12 and 18 Months (Part I)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	5	53	1.84
Age	5	53	24.98**
Age X Group	5	53	3.15*
Toy	20	38	23.79**
Toy X Group	20	38	2.17
Age X Toy	20	38	8.99**
Age X Toy X Group	20	38	1.88

Shake

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.00
Error	57	(.40)
	Within subjects	
Age	1	108.75**
Age X Group	1	1.37
Age (error)	57	(.30)
Toy	4	133.42**
Toy X Group	4	1.92
Toy (error)	228	(.91)
Age X Toy	4	92.42**

Age X Toy X Group	4	.35
Age X Toy (error)	228	(.64)

Tap

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.31
Error	57	(.11)
	Within subjects	
Age	1	1.80
Age X Group	1	5.91*
Age (error)	57	(.14)
Toy	4	9.54**
Toy X Group	4	1.17
Toy (error)	228	(.20)
Age X Toy	4	2.04
Age X Toy X Group	4	.59
Age X Toy (error)	228	(.13)

Give

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.28
Error	57	(.15)
	Within subjects	
Age	1	1.76
Age X Group	1	.22
Age (error)	57	(.18)
Toy	4	16.83**
Toy X Group	4	2.05
Toy (error)	228	(.17)
Age X Toy	4	1.05
Age X Toy X Group	4	.27
Age X Toy (error)	228	(.14)

Demonstrate

Source	*Df*	*F*
ANOVA	Between subjects	
Group	1	5.05*
error	57	(11.40)
	Within subjects	
Age	1	23.26**
Age X Group	1	1.22

Age (error)	57	(9.72)
Toy	4	33.30**
Toy X Group	4	2.11
Toy (error)	228	(40.39)
Age X Toy	4	39.40**
Age X Toy X Group	4	2.49
Age X Toy (error)	228	(25.60)

Point

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	6.58*
Error	57	(.52)
	Within subjects	
Age	1	5.50*
Age X Group	1	8.18*
Age (error)	57	(.34)
Toy	4	30.51**
Toy X Group	4	3.84
Toy (error)	228	(1.01)
Age X Toy	4	.58
Age X Toy X Group	4	1.77
Age X Toy (error)	228	(.49)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Less Active Maternal Nonverbal Behaviours at 12 and 18 Months (Part I)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	4	54	1.56
Age	4	54	6.73**
Age X Group	4	54	6.02**
Toy	16	42	50.77**
Toy X Group	16	42	1.89
Age X Toy	16	42	4.61**
Age X Toy X Group	16	42	2.57

Touch

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	6.06
error	57	(.37)
	Within subjects	
Age	1	22.92**
Age X Group	1	4.68*
Age (error)	57	(.30)
Toy	4	10.23**
Toy X Group	4	1.57
Toy (error)	228	(.16)
Age X Toy	4	2.07

Age X Toy X Group	4	5.26
Age X Toy (error)	228	(.18)

Touch-with

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.79
error	57	(.96)
	Within subjects	
Age	1	.17
Age X Group	1	1.38
Age (error)	57	(.63)
Toy	4	11.23**
Toy X Group	4	2.39
Toy (error)	228	(.87)
Age X Toy	4	1.32
Age X Toy X Group	4	1.26
Age X Toy (error)	228	(.81)

Show

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.13
Error	57	(19.87)
	Within subjects	
Age	1	1.27
Age X Group	1	19.66**
Age (error)	57	(16.86)
Toy	4	62.66**
Toy X Group	4	4.52*
Toy (error)	228	(33.30)
Age X Toy	4	4.63*
Age X Toy X Group	4	2.81
Age X Toy (error)	228	(.14)

Physically Assist

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.81
Error	57	(.16)
	Within subjects	
Age	1	8.08*
Age X Group	1	.41

Age (error)	57	(.11)
Toy	4	7.86**
Toy X Group	4	2.12
Toy (error)	228	(.12)
Age X Toy	4	2.34
Age X Toy X Group	4	1.08
Age X Toy (error)	228	(.11)

Note. Values enclosed in parentheses represent mean square errors.

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

Analysis of Variance for Percent Duration of Infant Gaze at 5 Months (Part I)

Source	*df*	*F*
	Between subjects	
Group	1	9.01*
Error	77	(14.86)
	Within subjects	
Gaze	12	67.31**
Gaze X Group	12	1.55
Gaze (error)	924	(82.46)

Analysis of Variance for Percent Duration of Infant Gaze at 12 and 18 Months (Part I)

Source	*df*	*F*
	Between subjects	
Group	1	2.96
Error	45	(24.48)
	Within subjects	
Age	1	11.76*
Age X Group	1	6.84
Age (error)	45	(13.78)
Gaze	14	74.48**
Gaze X Group	14	2.21
Gaze (error)	630	(309.03)
Age X Gaze	14	5.47**
Age X Gaze X Group	14	.97
Age X Gaze (error)	630	(160.10)

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Verbalizations at 5 Months (Part II)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	4	65	4.38**
Toy	12	57	16.19**
Toy X Group	12	57	1.036

Attention

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	2.00
Error	68	(.60)
	Within subjects	
Toy	3	28.56**
Toy X Group	3	3.73*
Toy (error)	204	(.36)

Labeling

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	16.70**
error	68	(.29)
	Within subjects	
Toy	3	15.00**
Toy X Group	3	1.26
Toy (error)	204	(.35)

Characteristic

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	3.72
error	68	(.49)
	Within subjects	
Toy	3	17.59**
Toy X Group	3	.66
Toy (error)	204	(.63)

Function

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.87
Error	68	(.99)
	Within subjects	
Toy	3	34.09**
Toy X Group	3	1.31
Toy (error)	204	(.95)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Verbalizations at 12 and 18 Months (Part II)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Group	4	64	4.11*
Age	4	64	4.87**
Age X Group	4	64	3.70*
Toy	16	52	14.79**
Toy X Group	16	52	4.81**
Age X Toy	16	52	4.36**
Age X Toy X Group	16	52	2.56*

Attention

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	13.52**
error	67	(.60)
	Within subjects	
Age	1	.52
Age X Group	1	6.13*
Age (error)	67	(.49)
Toy	4	25.49**
Toy X Group	4	6.98**
Toy (error)	268	(.21)
Age X Toy	4	2.24

Age X Toy X Group	4	1.63
Age X Toy (error)	268	(.22)

Labeling

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	11.89**
error	67	(.99)
	Within subjects	
Age	1	.03
Age X Group	1	.74
Age (error)	67	(.97)
Toy	4	40.94**
Toy X Group	4	10.36**
Toy (error)	268	(.65)
Age X Toy	4	7.08**
Age X Toy X Group	4	7.41**
Age X Toy (error)	268	(.49)

Characteristic

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	2.33
error	67	(.51)
	Within subjects	
Age	1	1.04
Age X Group	1	.39
Age (error)	67	(.44)
Toy	4	39.58**
Toy X Group	4	5.64**
Toy (error)	268	(.62)
Age X Toy	4	11.23**
Age X Toy X Group	4	6.13**
Age X Toy (error)	268	(.60)

Function

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	6.55*
error	67	(3.54)
	Within subjects	
Age	1	9.76**
Age X Group	1	5.75*

Age (error)	67	(2.19)
Toy	4	20.65**
Toy X Group	4	3.51*
Toy (error)	268	(1.90)
Age X Toy	4	6.43**
Age X Toy X Group	4	5.64**
Age X Toy (error)	268	(1.72)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Active Nonverbal Behaviours and Maternal Verbalizations at 5 Months (Part III)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Toy	7	59	21.54**
Toy X group	7	59	2.09

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.447
error	65	(5.29)
	Within subjects	
Toy	7	16.38**
Group X Toy	7	2.06
Toy (error)	455	(4.13)

Note. Values enclosed in parentheses represent mean square errors.

** $p < .01$.

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Less Active Nonverbal Behaviours and Maternal Verbalizations at 5½ Months (Part III)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Toy	7	21	19.73**
Toy X group	7	21	1.60

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.04
Error	27	(5.06)
	Within subjects	
Toy	7	16.38**
Group X Toy	7	2.06
Toy (error)	455	(4.13)

Note. Values enclosed in parentheses represent mean square errors.

** $p < .01$.

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Active Nonverbal Behaviours and Maternal Verbalizations at 12 and 18 Months (Part III)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Toy	9	43	33.20**
Toy X Group	9	43	8.02**
Age	1	51	7.66
Age X Group	1	51	.356
Toy X Age	9	43	10.43**
Toy X Age X Group	9	43	3.71

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	.41
Error	51	(15.01)
	Within subjects	
Toy	9	24.30**
Toy X Group	9	3.88*
Toy (error)	459	(10.50)
Age	1	7.66
Age X Group	1	.36
Age (error)	51	(9.14)
Toy X Age	9	16.30**

Toy X Age X Group	9	2.09
Toy X Age X Group (error)	459	(24.84)

Note. Values enclosed in parentheses represent mean square errors.

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

Multivariate Analysis of Variance and Univariate Follow-Up Tests for Percent Duration of Maternal Less Active Nonverbal Behaviours and Maternal Verbalizations at 12 and 18 Months (Part III)

Source	*df*	*df error*	*Pillai's Multivariate F*
MANOVA			
Toy	9	43	39.68**
Toy X Group	9	43	4.43**
Age	1	51	7.37
Age X Group	1	51	3.27
Toy X Age	9	43	26.47**
Toy X Age X Group	9	43	2.95

Source	*df*	*F*
ANOVA	Between subjects	
Group	1	12.59
Error	51	(10.01)
	Within subjects	
Toy	9	28.56**
Toy X Group	9	3.73*
Toy (error)	459	(35.46)
Age	1	7.37
Age X Group	1	3.27
Age (error)	51	(12.06)
Toy X Age	9	40.27**

Toy X Age X Group	9	2.30
Toy X Age X Group (error)	459	(32.60)

Note. Values enclosed in parentheses represent mean square errors.

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