THE EXPLORATORY DYAD THAT PLAYS TOGETHER STAYS TOGETHER: PARENT PLAY, ATTACHMENT, AND NON-OBVIOUS OBJECT PROPERTIES

A Dissertation

by

TRACY REBECCA SMITH

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Psychology

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Approved by:

Chair of Committee,	Teresa G. Wilcox
Committee Members,	Gerianne Alexander-Packard
	Carl Gabbard
	Jeffrey Liew
Head of Department,	Les Morey

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ABSTRACT

The Exploratory Dyad That Plays Together Stays Together:

Parent Play, Attachment, and Non-obvious Object Properties. (May 2010)

Tracy Rebecca Smith, B.S.; M.S., Texas A&M University

Chair of Advisory Committee: Dr. Teresa G. Wilcox

Many developmental changes occur across the first year of life, including areas of cognitive, social, emotional, and physical growth. One challenge of developmental research is to understand the complex set of factors that influence behavior within and across these domains of functioning and change. The present research attempts to illuminate the effects that parent relationships and interactions have on infants' ability to explore non-obvious object properties during free play. In our findings, the role of attachment, parents' actions on objects, parental sensitivity during play, and synchronous interaction all related to an increase in infants' object exploration when playing alone versus playing with a parent. These parent relationship and interaction factors affected infants' exploration differently at 6 months than 12 months. Overall, relational factors appeared of greater important for infants' more thorough object exploration than simply parents' actions on objects. The social context was important for the cognitive outcome of infants' object exploration.

DEDICATION

This labor of blood, sweat, tears, as well as mental stress and exhaustion is dedicated to all the little souls that inspire me to keep striving to understand children's early experiences. Without the love, laughter, and surprises that they continually bring to me, I would not have the will to keep going when the going gets tough in the world of developmental research. They are the reason I do this work. Jesus said in Matthew 19:14, "Let the little children come to me, and do not hinder them, for the kingdom of heaven belongs to such as these." Some of my current inspirations include baby Aaliyah, big guy Grayson and baby Ry, Audrey and Paxton, Ellis and Will, my precious and always entertaining four-year-old Sunday school classes, and the sweet babies and their older siblings who always make me smile when they come to play at the Infant Cognition Lab.

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Much appreciation belongs to all the delightful babies and parents who generously participated at the Infant Cognition Lab.

Finally, thanks to God, "who takes hold of [my] right hand, and says to [me], 'Do not fear; I will help you'" (Isaiah 41:13), without whom nothing would be possible. Thanks to the invaluable friends who encouraged and served as partners in the crime of spending too many hours on a computer: Jasmine Gonzalez, Magan Porter, Jessie Taylor and Winona Murphy, Adriana Martinez, Hannah Smith, and Blue Baker. I am most thankful for my beloved, David Brower. To conclude, I offer indescribable gratitude to my fun parents, who gave me wisdom, encouragement, editing, and more love than any daughter could deserve. "Train up a child in the way [she] should go, and when [she] is old [she] will not depart from it" (Proverbs 22:6).

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1. INTRODUCTION: SOCIAL CONTEXT OF OBJECT EXPLORATION

John Donne insightfully and poetically stated, “no man is an island” (1999, p.102). In fact, the same is true of infants; their development occurs in the context of a larger stage involving caregivers, families, and society. Psychologists agree that “the individual does not exist independent of his or her relationships” (Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001, p. 3). The experiences that enable infants to learn about the world, and objects, occur amidst and often as a direct result of the people with whom they are connected. The nature of the relationship between parents and infants proves influential in how infants explore objects. Also, the types of behaviors in which parents and infants engage during play influence the information to which infants attend during interactions. In other words, the social environment created by the parent shapes the information to which infants have access and, consequently, use when exploring and learning about objects.

In a growing landscape of research that utilizes interdisciplinary approaches and integrates content areas, it has become increasingly clear that studying infants’ cognitive development from a social development point-of-view facilitates a fuller understanding of how infants are experiencing and learning about their world. For example, current research has demonstrated that more securely attached infants are more likely to explore their environment and the objects within their environment (e.g., Wentworth & Witryol,

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This dissertation follows the style of *Developmental Psychology.*

2003; Belsky, Garduque, & Hrncir, 1984; Ainsworth, Blehar, Waters, & Wall, 1978). In addition, when and how parents display object manipulation behaviors influences the ways in which infants explore and manipulate objects (e.g., Huang & Charman, 2005; Bono & Stifter, 2003). The caregiver's sensitivity to their infant's changing needs and abilities, and the degree to which parent-infant dyads engage in synchronous or synchronous play, also influences the likelihood that infants will play with and explore objects (e.g., Mills-Koonce, Gariépy, Propper, Sutton, Calkins, Moore, & Cox, 2007; Matas, Arend, & Stroufe, 1978). Finally, the kinds of experiences that infants have with objects influence what they learn about those objects (e.g., Wentworth & Witryol, 2003; Stoffregen, 2000; Baldwin, Markman, & Melartin, 1993). Knowing how the social setting impacts adult-infant interactions is critical to comprehensive and integrative models of object explorations. In addition, it is of benefit to parents, teachers, and other caregivers who are striving to provide infants with the most supportive and nurturing environment. Recognizing an infant as an individual whose social, emotional, cognitive, and physical needs are all intertwined and important for reaching his/her developmental potential is an imperative part of facilitating infant development.

The focus of the current research is the relation between attachment security, parent-infant interactions, and infants' object exploration. In order to understand the relation between these factors, a number of research areas will be reviewed. Included in this review are findings that illuminate the relation between (1) attachment security, parental sensitivity, and object exploration, (2) parents' actions on objects and infants'

object exploration, and (3) the nature of infant-parent interactions and object exploration. Finally, the importance of object exploration to early learning is examined.

Attachment Security, Parental Sensitivity, and Exploratory Behaviors

Attachment refers to an emotional tie with another person and can be generally classified as secure or insecure. Infants who use the caregiver as a secure base (i.e., seek closeness to the caregiver) in novel situations and display distress on separation are typically categorized as securely attached. Research indicates that securely attached infants are more likely to engage in exploratory and novelty-seeking behaviors (Wentworth & Witryol, 2003; Hazen & Durrett, 1982; Ainsworth, Blehar, Waters, & Wall, 1978; Ainsworth & Bell, 1974). For example, at 12 and 13 months infants who use their parent as a secure base are more likely to explore objects and pursue cognitively sophisticated play behaviors than those who do not use their parent as a secure base (Belsky, et al., 1984). Furthermore, at 18 months infants who are classified as securely attached engage are more adept at exploring in novel environments (Cassidy, 1986).

A primary assumption in attachment theory is that the more securely attached dyad displays a qualitatively different pattern of interaction over the first year of the infant's life than a less securely attached dyad (Ainsworth, et. al., 1978). What leads to these different patterns of interaction? Some researchers have argued that parental sensitivity is the major contributing factor to the formation of a secure attachment (Ainsworth, et. al., 1978; Isabella & Belsky, 1991). Parental sensitivity is defined as caregivers' awareness and appropriate response to infants' needs. First, a sensitive caregiver is aware of his/her infant's physical and emotional needs, as they continually

change. Second, a sensitive caregiver responds in a timely and appropriate manner to those needs, with the parent's responses closely contingent on the infant's behavior.

There are a number of studies that support the hypothesis that parental sensitivity is closely linked to security of attachment (Matas, Arend, & Stroufe, 1978; Isabella & Belsky, 1991; De Wolff & van IJzendoorn, 1997; Mills-Koonce, et al., 2007; McElwain & Booth-LaForce, 2006). For example, Matas et al., (1978) assessed attachment security and maternal behaviors during a problem-solving task with 18 and 24-month-olds. They reported that the mothers of securely attached dyads showed significantly more sensitive and supportive behaviors (i.e., provided comfort when requested, gave minimal yet appropriate assistance when necessary, attended to the infant and task) than the mothers of the insecurely attached dyads. This outcome, along with the outcome of a number of other studies (Ainsworth & Bell, 1974; Ainsworth, et al., 1978; Isabella & Belsky, 1991; De Wolff & van IJzendoorn, 1997; Mills-Koonce, et al., 2007) suggests that infants perceive caretakers who are sensitive to their needs as a secure base (i.e., a source of comfort and support in novel or uncertain situations) and having a secure base allows infants to explore more freely.

Other researchers have argued that infant temperament is the critical contributing factor in the development of attachment relationships (Teti & McGourty, 1996; Vaughn, 1992; Teti, Nakagawa, Das, & Wirth, 1991; Goldsmith & Alansky, 1987; Kagan, 1982). Although there is some evidence that infant temperament is important to attachment relationships (Vaughn, 1992), there is also evidence pointing to the limited contribution of temperament. For example, security of attachment can vary by caregiver and by

changes in pattern of care (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2008; Waters & Deane, 1985) making it unlikely that temperament (which is considered a stable individual characteristic) can fully account for security of attachment. In addition, maternal social behavior is more strongly related to attachment security than to experimenter-rated or mother-reported infant temperament (Higley & Dozier, 2009; Kochanska, 1998; Wachs & Desai, 1993; Vaughn, Lefever, Seifer, & Barglow, 1989). Given evidence that both infant and parental characteristics contribute to the developing infant-parent relationship, many researchers have proposed that the formation of attachment security involves an interaction between infant and parent behaviors (Mangelsdorf, McHale, Diener, Goldstein, & Lehn, 2000; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Seifer, Schiller, Sameroff, Resnick, & Riordan, 1996; Chess, Thomas, Strelau, & Angleitner, 1991; Thomas & Chess, 1977; Thomas, Chess, Birch, Hertzig, & Korn, 1963). Hence, most integrative attachment research now includes measures of parental sensitivity and infant temperament. One component of temperament is sociability (Janson& Mathieson, 2008; Roberts & DelVecchio, 2000; Rubin, Hymel, & Mills, 1989; Thomas & Chess, 1977). Many researchers use sociability to measure individual differences in responses to social stimuli or situations.

Parental Influence on Infant Object Exploration

The opportunities that parents provide for object exploration and manipulation play an important part in the degree to which infants' engage in object exploration (Bruner, 1972; Dolhinow & Bishop, 1970; Vygotsky, 1967). Potentially, infants can learn new ways of exploring and manipulating objects by watching a caregiver or other

adult interact with objects. Indeed, there is a large body of research demonstrating that infants are sensitive to, and imitate, adults' actions on objects (Meltzoff & Moore, 2002; Stoffregen, 2000; Gibson, 1986). These experiences facilitate object exploration and learning about objects: infants are more likely to explore the objects, learn about the dynamic properties and structural features of objects, and detect non-obvious object properties (Huang & Charman, 2005; Stoffregen, 2000; Gibson, 1986; Ruff, 1982; Bruner, 1972; Dolhinow & Bishop, 1970). For example, in one study (Huang & Charman, 2005) adults acted on novel objects to produce target displays, giving infants' varying amounts of visual information. Infants were presented with one of four demonstrations: full demonstration, only experimenter's body-positions, only object-movement information, or no demonstration at all. Following the demonstrations, infants were given the chance to reproduce the sequence of actions, given the initial state of the objects. Whether the infants saw a full demonstration, only experimenter's body-position, or only object-movement information, infants always performed more target actions and more successfully than when shown no demonstration (a stationary set of objects and experimenter). In fact, even when the experimenter demonstrated a failed attempt at manipulating the objects in the right way to achieve the target positions, infants produced more target actions than in the baseline, or no demonstration, condition. These results are consistent with other reports (Bono & Stifter, 2003; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001) that even though some types of maternal demonstrations are more effective than others, maternal demonstration in and of itself (regardless of type) can encourage infants' ability to attend to objects, fostering infants'

curiosity and motivation to explore the objects themselves. This finding is particularly relevant to the current research, which utilizes a free-play situation where parents are not instructed to demonstrate object properties.

The question critical to the present research is whether the nature of the parent-infant relationship influences the extent to which infants are influenced by their parents' actions. Recall that infants who are part of a securely attached dyad are more likely to engage in exploratory behaviors than those who are part of a dyad that is less securely attached (Wentworth & Witryol, 2003; Belsky, et al., 1984; Hazen & Durrett, 1982; Ainsworth, Blehar, Waters, & Wall, 1978; Ainsworth & Bell, 1974). There is also evidence that parental sensitivity facilitates greater exploration of novel environments, including objects within those environments (Mills-Koonce, et al., 2007; McElwain & Booth-LaForce, 2006). For example, Bornstein and Tamis-LeMonda (1997) assessed maternal responsiveness and infants' interactions with objects during a free-play situation in 5- and 13-month-old infants. They found that mother's responsiveness to her infant at 5 months predicted greater exploration and more sophisticated interactions with objects, as well as greater attention to and more symbolic play with objects at 13 months. The way in which parents respond to their infants in the context of object play is critical to the kinds of exploratory experiences infants have in those situations.

In summary, what infants do with objects is influenced by what their parents do with objects. In addition, infants are more likely to engage in object exploration in the presence of their parent if they have a secure attachment with the parent and if their parent responds to them in a sensitive manner. What we do not know is the extent to

which each (parents' actions on objects, attachment security, and parental sensitivity) explains infants' exploratory behaviors comprehensively. On the basis of the preceding evidence, we predict that infants are more likely to benefit from watching their parent manipulate objects (i.e., show greater object manipulation themselves) if the infant has a secure attachment with the parent and if the parent responds sensitivity to the infant during the interaction.

How is parental sensitivity measured? One approach is to examine the way in which caregivers monitor and direct their infants' attention. Bono & Stifter (2003) classified maternal behaviors as (1) sensitive, maintaining infants' attention versus (2) insensitive, redirecting infants' attention. Sensitive attention directing, or "maintaining," is defined as asking questions, describing object qualities, naming the object, pointing, demonstrating unique characteristics of the *object in which the infant is already engaged*, et cetera. With *maintaining* as a means of an appropriate response to infants' needs, Bono and Stifter (2003) hypothesized that maternal behaviors aimed at maintaining infant attention would increase infants' success at focused attention and facilitate problem-solving actions on objects, allowing for more complete object exploration. In turn, this should increase the likelihood of infants' discovering non-obvious object properties (Baldwin, Markman, & Melartin, 1993). Insensitive attention directing, or "redirecting," is defined as maternal behaviors that attempt to redirect the infants' attention *away from something with which the infant is already engaged*. Bono and Stifter (2003) measured mother and infant behaviors at 10 and 18 months. Results

showed that more maternal *redirecting* was related to less focused attention in the 18-month-olds, leading to less successful object exploration.

Another approach is to measure the amount of time parents focus attention on their infant during a free play situation. Some researchers have suggested that attention directed towards the infant during a play situation allows the parent to monitor the emotional and psychological state of the infant (Striano & Stahl, 2005; Wentworth & Witryol, 2003). Parents use this information to provide an optimal play environment. In turn, infants respond more positively, with shared attention toward external objects and greater exploration of objects and their non-obvious properties. In addition, infants use parent attention to know when they should focus on objects within a social play situation (Striano & Stahl, 2005; D'Entremont, Hains, & Muir, 1997). Parents who attend to their infant in a consistent way can more fluidly direct their infants' attention to objects for exploration. If parent attention plays these roles for infant help and direction, then one would expect attention directed towards the infant to be a predictor of more sophisticated object exploration and play.

The Importance of Synchronous Interaction

Attachment security refers to the current nature of an ongoing infant-parent relationship and parental sensitivity refers to an on-line evaluation of how a parent responds to their infant in that specific situation. Another component that has been identified as important to early social relationships is dyadic synchrony. Dyadic synchrony refers to both parent and infant behaviors together: interactions that are well-timed, reciprocal and mutually rewarding are considered synchronous; those that are not

reciprocal, are one-sided or intrusive and not mutually rewarding are asynchronous. Some researchers have suggested that synchronous interactions are critical to infant's formation of a representation of the parent as available, responsive, and trustworthy (Ainsworth et al., 1978; Isabella, Belsky, & von Eye, 1989). Although dyadic synchrony has many names in the literature, including mutual responsiveness, contingent responsivity, mutual contingency, reciprocal matching behaviors, and behavioral harmony (e.g., Harrist & Waugh, 2002; Isabella, Belsky, & von Eye, 1989), most researchers agree that this phenomenon is important to the development of significant relationships and facilitates social, emotional, and cognitive growth in the infant. Dyadic synchrony includes three primary components: (a) maintained, shared focus of attention, (b) temporal coordination, and (c) contingency (Harrist & Waugh, 2002). Synchronous interactions are tied to the quality of parent-infant interactions that foster a more secure attachment. To re-iterate, parental sensitivity promotes the occurrence of synchronous interactions, but synchronous interaction only occurs when the infant responds in a certain way, in a way that is appropriate and contingent to parental behavior. Thus, a relational history of positive and mutually responsive interactions would seem to lead to more synchronous interactions as well as a more secure attachment.

Most important to the present research is that dyadic synchrony predicts quality of attachment (Mills-Koonce et al., 2007; Schölmerich, Lamb, Leyendecker, & Fracasso, 1997; Isabella, Belsky, & von Eye, 1989), although there are some developmental changes in the nature of this relation. For example, there is evidence that dyadic synchrony measured at 1, 3, 4, 6, 8, and 12 months predicts security of attachment

measured at the end of the first year (12 months). Those dyads that interacted in a synchronous fashion during the first half of the first year were more likely to have secure attachments at one year and after; conversely, those dyads that interacted in a disproportionately asynchronous manner were those that more likely to display insecure attachments at 12 months (Mills-Koonce et al., 2007; Schölmerich et al, 1997; Isabella, Belsky, & von Eye, 1989). However, research has also found that dyadic synchrony measured at 9 months does not predict attachment security measured at the end of the first year (12 months) (Isabella, Belsky, & von Eye, 1989). These findings are intriguing given the fact that parental sensitivity is significantly correlated with attachment security during the first two years of life (Mills-Koonce, et al., 2007; McElwain & Booth-LaForce, 2006; De Wolff & van IJzendoorn, 1997; Isabella & Belsky, 1991; Matas, Arend, & Stroufe, 1978). These data suggest that synchronous interactions are important for the development of secure attachments during the early months of life but that later in the first year, and into the second year, other factors (such as parental sensitivity) become more important.

The advantage of measuring synchronous interactions is that it is an "on-line" assessment of the nature of the parents' and infants' way of relating to one another, embedded within the play or task environment. The extent to which infant-parent dyads demonstrate synchronous interactions can illuminate whether or not a good fit exists between the parent (e.g. parental sensitivity) and the infant temperament (e.g. infant sociability). Furthermore, this aspect of social development, which is important for parent-infant communicative success and quality of interactions, holds implications for

the quality of object exploration that occurs within that context. For example, synchronous interactions during object play (e.g., parent directs attention to objects and parent/infant attend to objects simultaneously) fosters object exploration and more in-depth processing of the object (Bakeman & Adamson, 1984; Kaye & Fogel, 1980). Skilled adults, mothers in particular, can "socialize" object attention and exploration by introducing objects into the interpersonal environment, allowing infants to explore objects in ways that they would not have done if they were alone (Bakeman & Adamson, 1984). Thus, social interactions provide the opportunity for object exploration, manipulation, and processing.

However, as was observed in the relation between synchronous interactions and attachment security, there appears to be an age-related change in the relation between synchronous interactions and object exploration (Strid, Tjus, Smith, Meltzoff, & Heimann, 2006). For example, Van den Boom (1997) found that early in the first year parental sensitivity and synchronous interaction predicted high levels of infant competence in object processing and manipulation tasks, but that later in the first year this relation was not evident. One possible explanation for this findings is that maternal behaviors that were supportive early in the first year later become intrusive or over stimulating, making the mother-infant interactions asynchronous and non-adaptive. Perhaps as infants become more mobile and independent they require less direction and interpret repeated attempts at guidance in object play as interference.

Exploration's Consequences/Benefits

Why is it important to examine the impact of attachment security, parents' actions on objects, parental sensitivity, and synchronous interactions on infants' object exploration? Object exploration is vital for infants' learning about their physical world. Social contexts that support object exploration, including novelty seeking behaviors, also support learning (Wentworth & Witryol, 2003; Claussen, Mundy, Mallik, & Willoughby, 2002; Tomasello & Akhtar, 1995; Bruner,1972).

One way of examining infants' success at object exploration is by assessing their discovery of non-obvious object properties (Baldwin, Markman, & Melartin, 1993). Non-obvious object properties are those properties that are not immediately evident to infants. These object properties are such that infants do not spontaneously recognize but uncover through more in-depth exploration of the object or learn by watching someone else, typically an adult, interact with the object. Non-obvious properties might be a hidden compartment or novel movement of an object, such as removable parts, which can be revealed by more comprehensive exploration of an object (Baldwin, Markman, & Melartin, 1993). Within the auditory domain, sounds can be categorized as obvious or non-obvious. Obvious sounds are defined as those sounds produced by the physical interaction of the object and other surfaces or by the interaction of the objects' parts, in a way that was visibly obvious. These sounds include contact sounds (e.g., hitting, rubbing, scratching) and sound produced by parts of the object interacting (e.g. contact sounds produced by two rigid objects). Previous research indicates that infants produce a higher proportion of obvious sounds when playing alone, without the influence of

parents (Smith & Wilcox, 2009). In addition, infants and adults more readily link obvious sounds to objects and use these sounds for object individuation and identification (Coward & Stevens, 2004; Wilcox & Smith, 2009; Wilcox, Woods, Tuggy, Napoli, 2006). Non-obvious sounds are defined as sounds that are not directly or obviously related to the physical structure of the object (e.g., the ring tone of a cell phone or the sound an electronic toy makes when a button is pushed). Infants produce a higher proportion of non-obvious sounds when playing with a parent than when playing alone (Smith & Wilcox, 2009) and have difficulty using non-obvious sounds to track the identity of objects (Wilcox & Smith, 2009). In addition, children and adults require training before linking non-obvious sounds to individual objects (Coward & Stevens, 2004; Jacko & Rosenthal, 1997) Given that non-obvious sounds require more in-depth exploration of objects and that object exploration is influenced by the nature of the parent-infant relationship, the current research focused on the relation between infants' production of non-obvious object sounds and components of this relationship.

Current Research

Despite the growing body of research examining the relation between object exploration and each of the following: attachment security, parental behaviors, and synchronous interactions; many questions remain to be answered. For example, the research reviewed indicated that more securely attached infants are more adept explorers of their environment. Separate studies revealed that watching parents act on objects fosters infant's object exploration. In addition, synchronous interaction facilitates exploratory behaviors in infants (Harrist & Waugh, 2002; Bakeman & Adamson, 1984;

Kaye & Fogel, 1980). However, it is not clear how attachment security, parental behaviors, interactional synchrony, and object exploration are related. Furthermore, the impact of parental sensitivity on object exploration in infants younger than 10 months has yet to be investigated.

The goal of the current research was to examine the relation between these factors and how that relation may change across the first year of life. Two research questions were assessed. The first research question asked what relation exists between attachment security, parent behaviors, and infants' object exploration. We expect that the degree to which infants score as securely attached, the degree with which parents display behaviors meant to facilitate infants' object exploration (e.g., parents' demonstrations of object manipulation and parental sensitivity), and the degree to which infant-parent dyads demonstrate synchronous interactions, will be positively correlated with object exploration as measured by the production of non-obvious sounds. Although attachment security and parent behaviors are expected to be related, they are predicted to make independent contributions toward infants' object exploration behaviors. In addition, we expected to find an age-related change in the extent to which parents' object manipulation predicts infants' object exploration. Specifically we predict that 6-month-olds will be more influenced by their parents' attention and object play than 12-month-olds. The second research question asks whether the degree to which parents and infants engage in synchronous interaction can help explain individual differences in attachment security and parent behaviors and infants' object exploration. Previous research indicates that synchronous interactions facilitate infants' learning about objects. Parents who

engage in synchronous interactions are more likely to work at maintaining rather than redirecting their infant's attention, which facilitates more adept object exploration and learning. The prediction is that synchronous interactions will also be positively related to attachment security, across age groups. However, synchronous interactions will be a better predictor of infants' object exploration than parental sensitivity and attachment security, at least in the younger age group.

2. METHOD

Participants

Two groups of infants were tested: 6-month-olds and 12-month-olds. The 6-month-old group consisted of 30 infants with 17 males, *M* age 6 months, 14 days, ranging from 5, 11, to 7, 14. The 12-month-old group consisted of 30 infants with 12 males, *M* age 12 months, 15 days, ranging from 12, 1, to 13, 28. Ethnicity of participants as reported by parents was 47 Caucasian, 10 Hispanic, and 3 African-American. A power analysis revealed that n = 30 is sufficient o obtain statistical significance with effect sizes as small as r = .14, which is adequate power for research involving the attachment and sociability measures and the behavioral measures used in this study (van Ijzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). For all but 3 infants, the participating parent was the mother. Hence, the parent will be referred to as a female.

Apparatus

The apparatus included a table 122 x 94 cm with a 13 x 18 cm rectangular section removed from one side of the table (Figure 1). The infant sat on his or her parent's lap in the rectangular opening within easy reach of where the toys were placed; the experimenter sat directly across the table from the infant. The top of the table fell midway between the infant's shoulder and their seat-bottom. When necessary, an adjustable riser measuring the appropriate height was placed underneath the parent's feet to raise the height of her lap, and subsequently, the height of infant's seat-bottom, to the

appropriate place (Choi & Mark, 2004). At the start of each phase of the test session, the experimenter placed the toys in a semi-circle around the infant, each toy approximately 12 inches from the infant and equidistance from each other. A second experimenter observed the infant's session on-line via a computer monitor and if a toy moved beyond the infant's outstretched hand, the first experimenter was cued to return the toy to its original position.

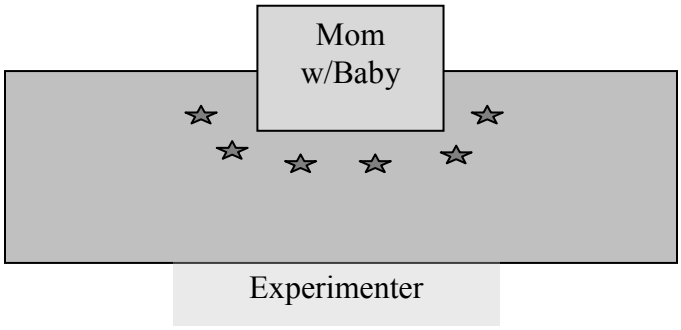

Figure 1. *Table with seating for mom, infant, and experimenter. Stars represent the position of the six toys laid out in random order.*

Six colorful, age-appropriate toys were used and each toy could produce obvious and non-obvious sounds. The toys, which have been used in a previous study of infant play and sound production (Smith & Wilcox, 2009), included a butterfly, a musical roller, an oversized block, a set of keys, a hammer, and a twister-toy (see Figure 2). The butterfly had wings that bent to produce non-obvious sounds: a variety of electronic "boink," "whirl," and laughing-type sounds; it also contained small beads that rattled when shaken, producing obvious sounds. When the squishy head of the hammer was hit against a solid surface it produced a non-obvious sound of "boing" or "spring" or "whoop-whoop." When the opposite end of the hammer was hit on the table, it produced

the obvious banging sound of hard, solid surface making contact with another hard, solid surface. The set of keys could make non-obvious sounds of beeping and "vroom-vroom" by pushing buttons, or the keys could be shaken or hit against the table to produce obvious contact sounds. The musical roller contained beads that rattled when shaken, producing obvious sounds, and when rolled like a paint roller, it produced an unrecognizable melodic tune, a non-obvious sound. The oversized block had a cloth "pull" that caused the block to make a grinding, vibration sound, classified as non-obvious. It could produce obvious sounds when bounced or hit against the table. Lastly, the twister-toy could be twisted to produce a popping, non-obvious sound or shaken to rattle the small beads held within the "arms" of the toy, producing obvious sounds. Research conducted with 6.5- and 12.5-month-olds using these six toys reported that parents, when playing with their infant, produce a large proportion of nonobvious sounds with the toys and that infants produce a higher proportion of nonobvious sounds when playing with the parent than when playing alone (Smith & Wilcox, 2009). In the present study, we were interested only in nonobvious sound production.

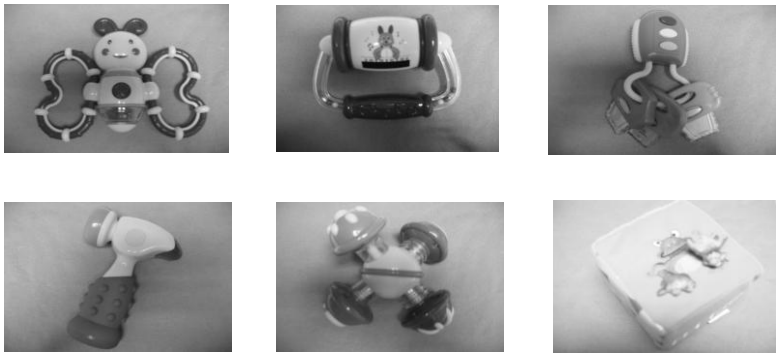

Figure 2. *Toys used in Phase 1 and 2: Each toy can make both non-obvious and obvious sounds.*

Procedure

Prior to the play phases of the test session, parents were asked to fill out a demographic questionnaire that included questions about the infants' race, ethnicity, parent education level, and number of siblings. In addition, attachment security was assessed using Waters' Attachment Q-set version 3.0, using mothers as observers (Waters, 1987). Mothers were given a stack of the q-sort items, with one item on each note card, and asked to rate each item on a scale of 1 to 9. They were asked to give high scores to items that are usually characteristic of the child, with a score of 9 representing an item that always describes the child. They were asked to give low scores to items that rarely characterize the child, with a score of 1 meaning the item never describes the child. For the convenience of the mothers, a cloth strip of pockets labeled "1" through "9" was provided to put the cards into the appropriate pocket, according to its rating. We correlated each infant's 90-items with the criterion sort of the "most securely attached infant" (Waters, 1987; Waters & Deane, 1985). Thus, a higher correlation signifies a more securely attached infant. Negative or very low correlation scores would indicate a much less securely attached infant.

This method was chosen for a number of reasons. First, there is evidence that the q-sort is a valid alternative to the Strange Situation and is especially useful for collecting attachment classification in a non-stressful way that will not interfere with a free play period (Tarabulsy, Provost, Larose, Moss, Lemelin, Moran, Forbes, & Pederson, 2008; van Ijzendoorn, et al., 2004; Tarabulsy, Avgoustis, Phillips, Pederson, & Moran, 1997; Teti & McGourty, 1996). Furthermore, using the Q-sort allowed us to collect attachment

data at both 6 and 12 months using the same measure (Ijzendoorn et al, 2004). Finally, attachment classification measured using the q-sort has been shown to significantly correlate with attachment classification using observers' sorts as well as with the Strange Situation, though mothers sometimes tend to place additional emphasis on infant fussiness-related items when using the q-sort (Tarabulsy, et al., 2008; van Ijzendoorn, et al., 2004; Tarabulsy, Avgoustis, Phillips, Pederson, & Moran, 1997; Teti & McGourty, 1996).

The q-sort was also used to assess infants' sociability, an aspect of temperament that may be related to infants' play behavior and/or attachment security (Waters, 1987; Waters & Deane, 1985). In order to use the sociability criterion sort developed by Waters and colleagues (1985) for the 100-item sort, we cross-referenced the items from the original set to map onto the 90-item sort that was used in the current study. In other words, we adapted the sociability criterion sort for the 100-item version to match the 90-item version of the q-set. We correlated each infant's 90-items with the criterion sort of the "most sociable infant" (Waters, 1987; Waters & Deane, 1985). Thus, a higher correlation signifies an infant with higher rating of sociability. Negative or very low correlation scores would indicate a much less sociable infant.

Following this interview period, the play phases of the test session was conducted in a separate room. There were two phases of play: (1) Infant Alone and (2) Infant with Parent. In Phase 1, the experimenter instructed the parent to refrain from interacting with her infant in any way and to direct her gaze to a neutral location (the participating parent was typically the mother). Then the experimenter withdrew the toys

one at a time from a basket (which was previously out of the infant's view) and placed them at one of six pre-determined locations on the table, each 12 inches from the infant, within reach of the infant's outstretched arm. The order in which the toys were retrieved from the basked and their location of placement was determined by a computer-generated randomization plan (1 of 720 possibilities). Once all six toys were placed on the table, the infant was allowed to freely play with the toys for four minutes. At the end of the four minutes, the experimenter gathered the toys and returned them to the basket.

Phase 2 immediately followed Phase 1 and differed only in that the parent was instructed to play with her infant in any way she felt comfortable, as they would at home. This procedure allowed us to assess how infants play and explore differently when alone than when playing with a parent and to observe individual differences in parent and infant play and interactions. We were also able to assess the types of behaviors in which parents spontaneously engage when playing with their infants and how these might be related to infants' sound production and attachment security.

Coding of Behavior

Phase 1 and Phase 2 of the test session were videotaped and later coded using Noldus ObserverPro 16. The following behaviors were coded.

Phase 1: Infants' Sound Production. The amount of time that infants spent producing non-obvious sounds was coded. Recall that non-obvious sounds are those sounds that are not directly or obviously related to the physical structure of the object. This included the electronic sounds produced by the butterfly, the "boing" , "spring", and "whoop-whoop" sound made by the hammer, the beeping and "vroom-vroom" made

by the keys, the musical sound produced by the roller, the grinding sound made by the green block, and electronic popping sounds produced by the twister-toy. For purposes of data analysis, duration scores (i.e., the total amount of time in s that infants spent producing non-obvious sounds during the 4 minutes) were converted to proportion duration scores (duration of non-obvious sound production/240 s). Proportion of time scores are commonly used in infant studies of object play and exploration (e.g. Courage, Reynolds, & Richards, 2006; Gulsrud, Kasari, Freeman, & Paparella, 2007; Mayes, Carter, & Stubbe, 1993; Howes & Matheson, 1992). In addition, a previous study using a similar free-play method utilized proportion of time scores (Smith & Wilcox, 2009).

Phase 2: Infants' Sound Production. The coding system used in Phase 1 for assessing infants' non-obvious sound production was used in Phase 2. Infant sound production during Phase 1 and 2 was coded by an experienced observer who was naïve to the experimental hypothesis. Fifty percent of the sessions were coded independently by a secondary observer (Hines, Pasterski, Geffner, Brain, Hindmarsh, & Brook, 2005; Colman & Thompson, 2002; Tarabulsy, Tessier, Gagnon, & Piché, 1996; Isabella, Belsky, & von Eye, 1989). Reliability averaged 97.2% agreement across phases, with a range of 88.9% to 99.9%.

To determine the extent to which infants' sound-producing behavior during free play alone differed from that during free play with parent, a difference score was created by subtracting the percentage of non-obvious sounds produced when alone from the percentage produced with the parent. This was the change in the percent duration of non-

obvious sounds the infant produced when playing with the parent (Phase 2) than when playing alone (Phase 1).

Phase 2: Parents' Action on Objects and Parental Sensitivity. The amount of time parents acted on the objects was coded. Any physical contact that the parent made with a toy using her hands was coded as acting on that toy. Duration of action (in s) was converted to proportion of action (duration of action on toys/240 s) for data analysis.

Parental sensitivity was assessed in two ways. First, the degree to which the parent focused attention on her infant in the free-play situation was measured by coding the number and duration of looks to the infant's face and body (arms, hands, torso, top of head), separately. Although it is common to use looking at the face as an indicator of person-directed attention in social situations, we hypothesized that in this circumstance looking to the infant, more generally, also might be a sensitive measure of person-directed attention. This hypothesized was based on the fact that free play involves interaction with objects, and parents can be actively engaged in the task without looking directly at the infant's face (e.g., looking may be directed at the toy or the infant's hand). Mean duration of looks to the infants' face and the infants' body were calculated and used in data analysis. Mean duration of looks, rather than mean cumulative looking time, was used here because length of looks is considered a reliable and sensitive measure of focused attention (Fletcher, Perez, Hooper, & Claussen, 2005; Hood, Willen, & Driver, 1998; Hood, Murray, King, & Hooper, et al., 1996) and that parents' attention directed towards the infant can facilitate object exploration (Striano & Stahl, 2005; Bono & Stifter, 2003; Hunter, McCarthy, MacTurk, & Vietze, 1987; MacTurk, McCarthy,

Vietze, & Yarrow, 1987). Given this evidence, we coded whether the parents' gaze was directed towards the infant during Phase 2.

The second measure of parental sensitivity involved coding parents' attempts to direct their infants' attention. Parental behaviors were classified as maintaining, redirecting, or no attention-directing behaviors, based on Bono & Stifter's (2003) scheme for assessing maternal attention-directing strategies. *Maintaining* refers to mothers' verbal, nonverbal, or verbal and nonverbal attempt to maintain the infant's attention to an object with which the infant was already visually, physically, or visually and physically engaged. *Redirecting* refers to mothers' verbal, nonverbal, or verbal and nonverbal attempt to direct the infant's attention toward another object while the infant was already visually, physically, or visually and physically engaged with a different object. To clarify, maintaining and redirecting behaviors both refer to parents' actions directed towards the toys and/or infant and neither behavioral code equated with the parent being disengaged/looking away from the task. The parent could be engaged with the task while simultaneously attempting to maintain or redirect her infant's attention. Although all three behaviors were coded, preliminary analysis suggested that the use of one behavior, maintaining attention, was sufficiently predictive for our model. Hence, in data analysis the percent duration of time (in s) that the parent engaged in maintaining-attention behaviors during the 4 min play phase was used. The primary coder, who was more experienced, observed all the sessions and was naïve as to the experimental hypothesis. A secondary observer coded fifty percent of the sessions independently and reliability scores averaged 96.4% agreement and ranged from 83.4% to 100% .

Phase 2: Interaction Characteristics. During Phase 2 of the test session, coders also assessed whether infant-parent interactions were synchronous or asynchronous in nature. They coded the amount of time (of the 4 minute interval) infants and parents engaged in synchronous or asynchronous behaviors (Isabella, Belsky, & von Eye, 1989; Isabella & Belsky, 1991). Synchronous play was defined as reciprocal and mutually rewarding exchanges in which the mother responds to the infant appropriately. For example, if the infant wanted a toy that was just out of reach, a synchronous interaction involved the mother responding to the baby's bid for help by bringing the toy within the infant's grasp. If baby became bored and unhappy, a mutually rewarding interaction meant that mom provided stimuli or support, according to the infant and the specific situation. Asynchronous interactions were defined as one-sided, unresponsive, or intrusive behaviors that appeared to fail at being mutually rewarding or reciprocal exchange.

In the free play situation, these types of interactions were characterized by an upset infant paired with an unresponsive parent or, perhaps, a parent playing with one toy while not paying attention to her infant who was playing with another toy on the other side of the table. If the infant displayed a bid for help or assistance but the parent was unresponsive, that type of interaction was categorized as asynchronous. Also, if the parent forced the infant to play with a certain toy despite causing the infant distress or discomfort, that type of interaction was coded as asynchronous. Subsequently, inter-observer reliabilities were calculated for this behavioral measure. If inter-observer reliability fell below 80%, the two coders watched the video together to reach agreement for at least 80% of the phase. Reliability averaged 93.4% agreement of the phase, with a range of 85.1% to 99.5%. Finally, because the time engaged in asynchronous behavior was dependent on the time engaged in synchronous behavior (behaviors were coded as one or the other) only the duration of synchronous interaction was included in data analysis.

3. RESULTS

Descriptive statistics were first conducted for the output variable (difference in percent time spent producing non-obvious sounds during Phase 2 as compared to Phase 1) and the seven input variables (Table 1).

Correlation analyses were then conducted separately for each age group to determine the relation among the output variable and the seven input variables (Tables 2 & 3). As expected, the three variables chosen for quantifying parental sensitivity (mean duration of looks to the infant's face, mean duration of looks to the infants' head and arms, and maintaining the infant's attention) were highly correlated. Hence, these three variables were standardized into z-scores and averaged to form a composite interaction variable, "parental sensitivity", to be used in the path analyses (Paunonen & Gardner, 1991). Once this composite score was formed there were five, rather than eight, input variables.

Next, a 2 x 2 analysis of variance (ANOVA) with age (6 or 12 months) and sex (male or female) as the between-subjects factors was performed on the output variable (difference in proportion of time spent producing non-obvious sounds between Phase 1 and Phase 2) and the five input variables. The main effects of age and sex on the difference in non-obvious sound production were not significant, $F(1, 57) = 1.99$, $p > .05$ and $F(1, 57) = 1.22$, $p > .05$, respectively, but the interaction between age and sex was significant, $F(1, 57) = 10.50$, $p < .01$, $\eta_p^2 = .16$. Post-hoc comparisons revealed that the percent of time the 6-month-olds spent producing non-obvious sounds differed

significantly by sex, with males showing a difference of 17.95% and females -7.56%, $t(28) = 2.82$, $p < .01$, Cohen's $d = 1.00$. In contrast, the 12-month-olds' percent difference score differed by sex in the opposite direction, though not significant, with males showing a difference of -9.41% and females 3.14%, $t(27) = -1.65$, $p = .12$, equal variances not assumed, Cohen's $d = -.64$. Finally, 6-month-old males showed a greater change in percent duration of non-obvious sound production than 12-month-old males, $t(27) = 3.59$, $p < .01$, Cohen's $d = 1.32$.

The five input variables were analyzed using a 2 x 2 analysis of variance (ANOVA) with age category (6 or 12 months) and sex (male or female) as the between-subjects factors. The main effects of infants' age and sex on parental sensitivity were not significant, $F(1, 57) = 3.70$, $p > .05$ and $F(1, 57) = 3.85$, $p > .05$, respectively, but the interaction between infants' age and sex was significant, $F(1, 57) = 4.22$, $p < .05$, $\eta_p^2 = .07$. Post-hoc comparisons revealed that parental sensitivity of the parents of 6-month-olds differed significantly by infants' sex with parents of males showing displaying a greater duration of parental sensitivity than parents of females, $t(27) = 2.57$, $p < .025$, Cohen's $d = 1.01$, though the parents' of the 12-month-olds parental sensitivity did not differ by infants' sex. Additionally, parents of the 6-month-old males showed more parental sensitivity than parents of the 12-month-old males, $t(27) = 2.34$, $p < .05$, Cohen's $d = .90$. Given the significant effect of sex in these analyses, sex was included as an input variable in the path models.The other input variables to be used in the models revealed no significant main effects of, or interactions involving age or sex.

Table 1. Descriptive statistics of differences in infants' non-obvious sound production as well as input variables by infants' age group and sex.

Mean (Standard Deviation)	**6 mos.**	6 mos. Males	6 mos. Females	**12 mos.**	12 mos. Males	12 mos. Females	**Both Ages**
1. Diff in Non-obvious Sound Production	**6.90 (27.35)**	17.95 (17.90)	-7.56 (31.31)	**-2.05 (19.38)**	-9.41 (23.17)	3.14 (14.81)	**2.50 (23.99)**
2. Parent Acts on Objects (% duration)	**41.39 (19.62)**	45.52 (20.06)	36.00 (18.38)	**39.05 (17.56)**	36.18 (18.01)	41.08 (17.48)	**40.24 (18.51)**
3a. Parental Sensitivity: Parent Maintaining Infant's Attention (% dur)	**49.16 (21.97)**	56.20 (21.48)	37.89 (18.53)	**46.23 (20.22)**	45.20 (19.43)	46.92 (21.25)	**47.59 (20.91)**
3b. Parental Sensitivity: Parent Looks to Infant's Body (mean duration)	**4.00 (1.91)**	4.66 (2.02)	3.16 (1.45)	**2.94 (1.65)**	2.96 (2.11)	2.92 (1.34)	**3.50 (1.85)**
3c. Parental Sensitivity: Parent Looks to Infant's Face (mean duration)	**4.37 (3.41)**	4.83 (4.32)	3.79 (1.70)	**2.62 (1.56)**	2.72 (1.13)	2.55 (1.84)	**3.55 (2.82)**
4. Attachment Security (criterion sort r-score)	**0.24 (0.10)**	0.25 (0.12)	0.22 (0.08)	**0.28 (0.13)**	0.29 (0.17)	0.28 (0.11)	**0.26 (0.12)**
5. Sociability (criterion sort r-score)	**0.30 (0.14)**	0.32 (0.11)	0.27 (0.17)	**0.36 (0.17)**	0.37 (0.21)	0.35 (0.15)	**0.33 (0.16)**
6. Synchronous Interaction (% duration)	**78.83 (13.68)**	79.04 (11.00)	78.56 (17.07)	**78.27 (14.36)**	73.77 (17.90)	81.64 (10.39)	**78.56 (13.90)**

Table 2. 6-month-olds' correlations between variables.

Pearson's R^2 (significance)	1.	2.	3a.	3b.	3c.	4.	5.	6.
1. Diff in Non-obvious Sound Production	-	.325 (p = .08)	.420 (p = .03)	.285 (p = .17)	.062 (p = .77)	.308 (p = .10)	.281 (p = .13)	.102 (p = .59)
2. Parent Acts on Objects (% duration)	-	-	.629 (p = .00)	-.139 (p = .51)	.210 (p = .31)	-.009 (p = .96)	-.016 (p = .93)	-.433 (p = .02)
3a. Parental Sensitivity: Parent Maintaining Infant's Attention (% dur)	-	-	-	.398 (p = .07)	.507 (p = .02)	.079 (p = .70)	.136 (p = .51)	.201 (p = .32)
3b. Parental Sensitivity: Parent Looks to Infant's Body (mean duration)	-	-	-	-	.491 (p = .01)	.361 (p = .08)	.100 (p = .63)	.437 (p = .03)
3c. Parental Sensitivity: Parent Looks to Infant's Face (mean duration)	-	-	-	-	-	.431 (p = .03)	.015 (p = .94)	.343 (p = .09)
4. Attachment Security (criterion sort r-score)	-	-	-	-	-	-	.339 (p = .07)	.085 (p = .65)
5. Sociability (criterion sort r-score)	-	-	-	-	-	-	-	.186 (p = .33)
6. Synchronous Interaction (% duration)	-	-	-	-	-	-	-	-

Table 3. 12-month-olds' correlations between variables.

Pearson's R^2 (significance)	1.	2.	3a.	3b.	3c.	4.	5.	6.
1. Diff in Non-obvious Sound Production	-	-.151 (p = .44)	.146 (p = .45)	.065 (p = .78)	-.412 (p = .06)	.044 (p = .82)	.165 (p = .39)	.242 (p = .22)
2. Parent Acts on Objects (% duration)	-	-	.136 (p = .48)	.028 (p = .91)	.123 (p = .60)	-.246 (p = .20)	-.052 (p = .79)	-.412 (p = .03)
3a. Parental Sensitivity: Parent Maintaining Infant's Attention (% dur)	-	-	-	-.059 (p = .79)	.029 (p = .90)	.025 (p = .90)	.226 (p = .23)	.460 (p = .01)
3b. Parental Sensitivity: Parent Looks to Infant's Body (mean duration)	-	-	-	-	.259 (p = .24)	.097 (p = .67)	.240 (p = .28)	.147 (p = .54)
3c. Parental Sensitivity: Parent Looks to Infant's Face (mean duration)	-	-	-	-	-	.128 (p = .57)	.059 (p = .80)	-.380 (p = .10)
4. Attachment Security (criterion sort r-score)	-	-	-	-	-	-	.636 (p = .00)	.358 (p = .06)
5. Sociability (criterion sort r-score)	-	-	-	-	-	-	-	.346 (p = .07)
6. Synchronous Interaction (% duration)	-	-	-	-	-	-	-	-

Research Question 1: Models 1A and 1B

Regression for path analysis was used, for each age separately, to test the hypothesis that attachment security, parents' actions on the objects, and parental sensitivity are positively related to the difference in percent of non-obvious sounds infants produce when playing with the parent (Phase 2) than when playing alone (Phase 1). This analysis also tested for the relation between attachment security and two other factors, parental sensitivity and sociability. Since preliminary analysis showed no relation between the change in infants' production of non-obvious sounds and parents' level of education (Est./S.E. = 0.94, $p > .05$) or the number of infants' siblings (Est./S.E. = 0.94, $p > .05$), the only demographic variable included in each analysis was sex. The paths were tested using maximum likelihood estimation with robust standard errors and a mean-adjusted Chi-square statistic test with a saturated model (MLR; Muthén & Muthén, 2004) (see Table 4).

Overall, for the 6-month-olds the model (Model 1A) significantly predicted the change in infants' production of non-obvious sound, $R^2 = .406$, S.E. = .14, $p < .01$; however, the model did not fit well for the 12-month-olds (Model 1B), $R^2 = .171$, S.E. = .13, $p > .05$.

First, the 6-month-old data will be examined (Model 1A). Given the sex differences that were observed in the ANOVAs, the path analysis for Model 1A was tested using sex distinction in a multiple group test to determine if the model fits more optimally with the males or females. The model fit did not differ by males (Est./S.E. = 0.88, $p = .38$) or females (Est./S.E. = 1.43, $p = .15$) in the 6-month-olds, as shown by

comparing the R^2 test. The initial ANOVA revealed a significant interaction by age and sex on the change across phases of infants' production of non-obvious sound. We also found a significant interaction of age and sex on parental sensitivity, going in the same direction as the interaction on infants' production of non-obvious sound. So, how infants are behaving differently (their change in non-obvious sound production) maps onto how parents are behaving differently (parental sensitivity), making the relation between the two, as assessed by our regression model, to represent the same path across sex. This explains why no sex difference was found in our path model. The relation between the variables does not differ by sex.

Sociability scores were not related to attachment security in the 6-month-old group. As expected, parental sensitivity predicted attachment security at 6 months (see Figure 3). In addition, the duration of time that parents spent acting on the objects predicted non-obvious sound production in the 6-month-olds.

Now, to examine the 12-month-old data (Model 1B), the fit did not differ by males (Est./S.E. = 0.91, $p = .36$) or females (Est./S.E. = 0.57, $p = .57$) in the 12-month-olds, as shown by comparing the R^2 test, showing the same results as Model 1A. Unlike the 6-month-old data, sociability scores were significantly related to attachment security scores, Est./S.E. = 2.93, $p < .01$, as well as parental sensitivity, Est./S.E. = 2.10, $p < .05$, with the 12-month-old group. This may reflect a developmental change in the role that infant sociability plays in attachment security or in the degree to which parents respond sensitively to their infant. As expected, parental sensitivity did not predict attachment security at 12 months, even though they were significantly related at 6 months (see Figure 4). In addition, the duration of time parents spent acting on the objects failed to predict infants' non-obvious sound production in the 12-month-olds, despite its predictive power with the 6-month-olds. This may be due to infants' increasing adeptness at grasping and manipulating objects without the help of an adult. Infants are able to more frequently assert their own independence in object play.

Table 4. Paths for Research Question 1: Models 1A and 1B.

	6 months		12 months	
	Standardized Coefficient	Standard Error	Standardized Coefficient	Standard Error
Diff in Non-obvious Sound Production -> Parent Acts on Objects (% duration)	2.193*	.967	-.401	.484
Diff in Non-obvious Sound Production -> Parental Sensitivity (Averaged Z-score)	2.921	5.209	-1.555	5.464
Diff in Non-obvious Sound Production -> Attachment Security (criterion sort r-score)	66.372	43.452	-20.369	32.267
Parent Acts on Objects (% duration) -> Attachment Security (criterion sort r-score)	-.090	.075	-.159	.140
Parental Sensitivity (Averaged Z-score) -> Attachment Security (criterion sort r-score)	3.474*	1.524	-.832	1.063
Parental Sensitivity (Averaged Z-score) -> Parent Acts on Objects (% duration)	.114	.591	-.463	.797
Parental Sensitivity (Averaged Z-score) -> Sociability (criterion sort r-score)	.46	1.15	1.69*	.81
Attachment Security (criterion sort r-score)-> Sociability (criterion sort r-score)	$.005^{+}$	.003	.014**	.005

**$p < .01$, *$p < .05$, $^{+}p \leq .10$

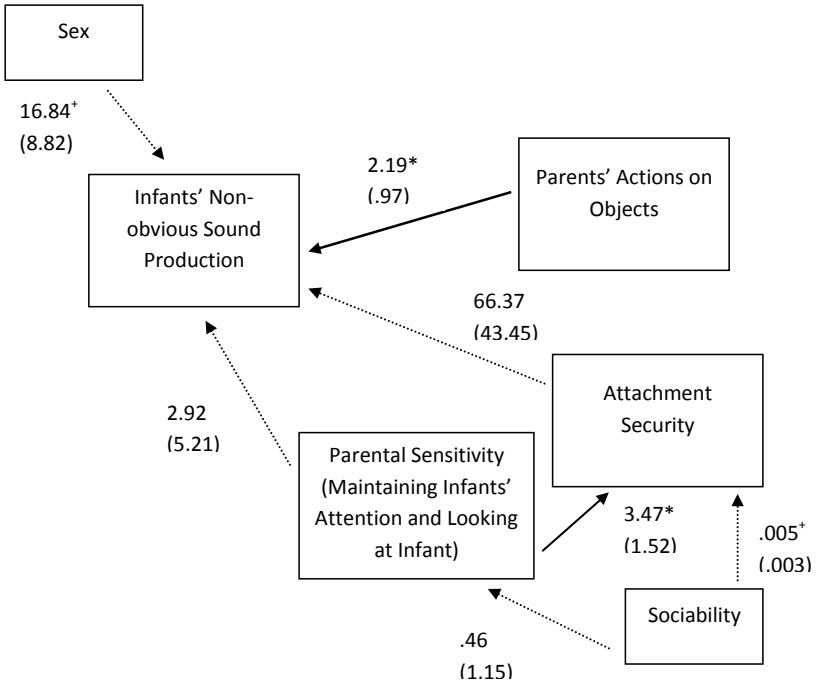

Figure 3. Model 1A: 6-month-olds' fit for Research Question 1.

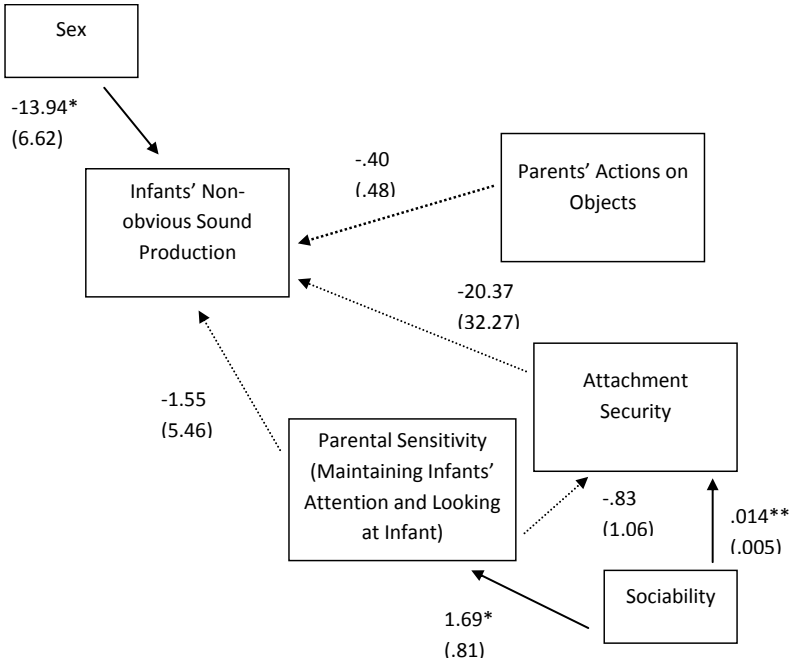

Figure 4. Model 1B: 12-month-olds' fit for Research Question 1.

Research Question 2: Models 2A and 2B

Previously mentioned, parents who engage in synchronous interactions are more likely to work at maintaining rather than redirecting their infant's attention, which facilitates more adept object exploration and learning. Thus, we hypothesized that synchronous interactions will be related to parental sensitivity and be a better predictor of infants' object exploration than the previous input variables alone (parents' actions on the objects, parental sensitivity, and attachment security), at least in the younger age group. We also predicted that synchronous interactions will be positively related to attachment security, across age groups. To assess whether percent duration of synchronous interaction adds explanatory power to the model, and to determine the relation between synchronous interactions and parental sensitivity, infant sociability, and attachment security, this input variable was added to the model.

Regression for path analysis was used to test the hypothesis that attachment security, parents' actions on the objects, parental sensitivity, and synchronous interaction are positively related to the change in percent duration of non-obvious sounds infants produced in Phase 1 as compared to Phase 2. This analysis also tested for the relation between these four contributing variables (i.e., attachment security, parents' actions on objects, parental sensitivity, sociability, and synchronous interaction). The paths were tested using maximum likelihood estimation with robust standard errors and a mean-adjusted Chi-square statistic test with a saturated model (MLR; Muthén & Muthén, 2004) (see Table 5).

For the 6-month-olds, the model including synchronous interaction (Model 2A) significantly predicted the change in infants' production of non-obvious sound, R^2 = .501, S.E. = .13, $p < .001$. Synchronous interaction provided a statistically significant input variable above and beyond the ability of the previously used input variables to predict the infants' object exploration, or change in infants' production of non-obvious sounds (Est./S.E. = 2.38, $p < .05$). Synchronous interaction was also significantly related to parental sensitivity for the 6-month-olds (Est./S.E. = 2.40, $p < .05$).

The model did not fit well for the 12-month-olds (Model 2B), R^2 = .137, S.E. = .12, $p > .05$. So, neither model 1 nor model 2 provided an optimum fit for the 12-month-olds in predicting the infants' object exploration, or change in production of non-obvious sounds (see Figures 4 & 6), unlike the 6-month-olds (see Figures 3 & 5). Nevertheless, synchronous interaction was significantly related to parental sensitivity (Est./S.E. = 2.12, $p < .05$), as with the 6-month-olds. Synchronous interaction was also significantly related to 12-month-olds' sociability scores (Est./S.E. = .83, $p < .05$), lessening a previously significant relationship (in Model 1B) between parental sensitivity and infants' sociability scores. Synchronous interaction was also significantly related to attachment security in the 12-month-olds (Est./S.E. = 2.10, $p < .05$), which was not the case with the 6-month-olds (Est./S.E. = .44, $p > .05$).

The path analysis was also tested using sex distinction in a multiple group test to determine if the model fits more optimally with the males or females. The model fit did not differ by males (Est./S.E. = 1.34, $p = .18$) or females (Est./S.E. = 1.27, $p = .20$), as shown by comparing the R^2 test.

Table 5. Paths for Research Question 2: Models 2A and 2B.

	6 months		12 months	
	Standardized Coefficient	Standard Error	Standardized Coefficient	Standard Error
Diff in Non-obvious Sound Production -> Parent Acts on Objects (% duration)	4.027**	1.167	-.322	.508
Diff in Non-obvious Sound Production -> Parental Sensitivity (Averaged Z-score)	-3.820	5.559	-2.424	5.836
Diff in Non-obvious Sound Production -> Attachment Security (criterion sort r-score)	103.771*	42.776	-.704	.482
Diff in Non-obvious Sound Production -> Synchronous Interaction (% duration)	.928*	.386	.129	.305
Synchronous Interaction (% duration) -> Attachment Security (criterion sort r-score)	.112	.246	.660*	.315
Parent Acts on Objects (% duration) -> Attachment Security (criterion sort r-score)	-.090	.075	-.160	.140
Parent Acts on Objects (% duration) -> Synchronous Interaction (% duration)	-32.277**	8.235	-26.988	18.094
Parental Sensitivity (Averaged Z-score) -> Attachment Security (criterion sort r-score)	3.398*	1.399	-1.246	1.010
Parental Sensitivity (Averaged Z-score) -> Synchronous Interaction (% duration)	.024*	.010	.017*	.008
Parental Sensitivity (Averaged Z-score) -> Parent Acts on Objects (% duration)	$.872^{+}$	.462	-.100	.718

**$p < .01$, *$p \leq .05$, $^{+}p \leq .10$

Table 5. Continued.

	6 months		12 months	
	Standardized Coefficient	Standard Error	Standardized Coefficient	Standard Error
Parental Sensitivity (Averaged Z-score) -> Sociability (criterion sort r-score)	-.367	1.034	1.43^{+}	.773
Attachment Security (criterion sort r-score)-> Sociability (criterion sort r-score)	$.005^{+}$	.003	.014**	.005
Sociability (criterion sort r-score)-> Synchronous Interaction (% duration)	.337	.276	.828*	.415

**$p < .01$, *$p \leq .05$, $^{+}p \leq .10$

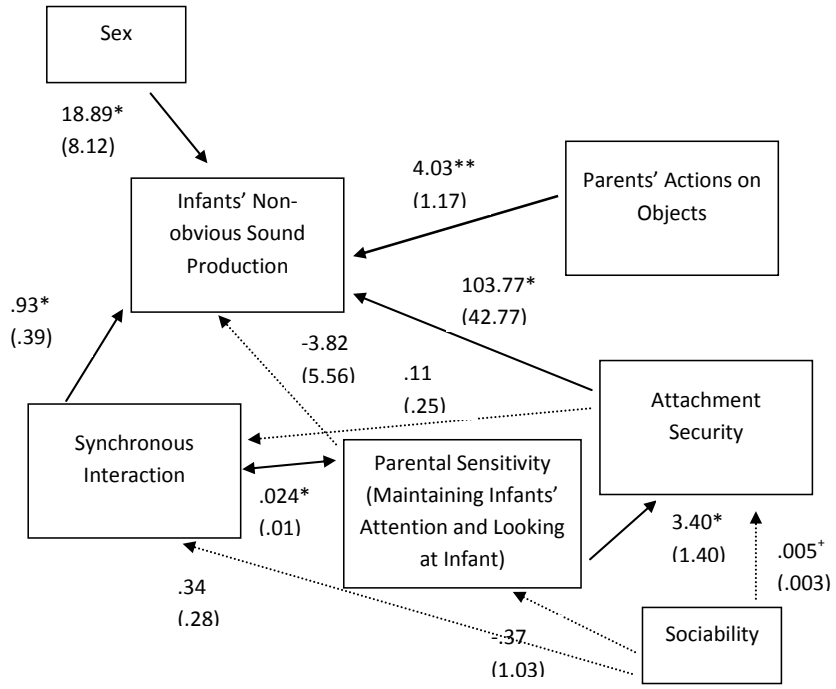

Figure 5. *Model 2A: 6-month-olds' fit for Research Question 2.*

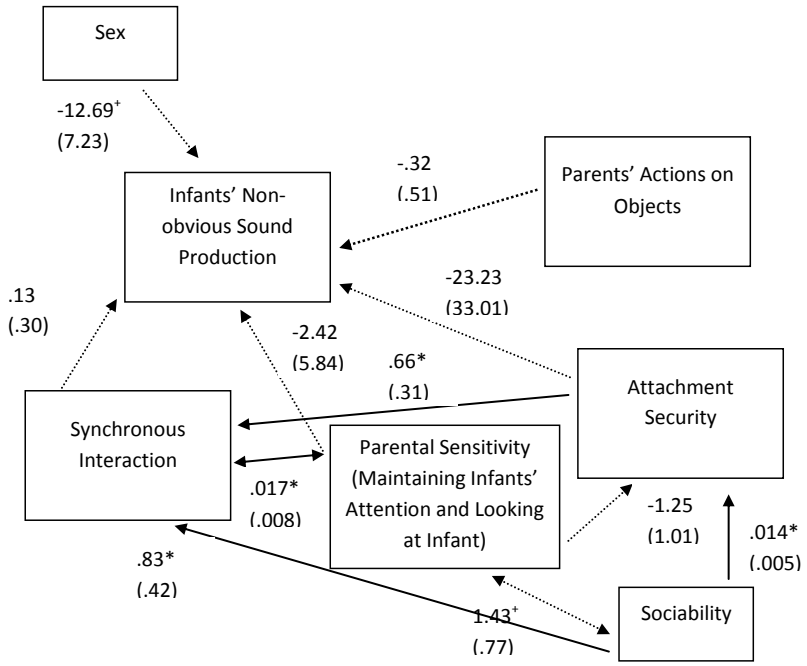

Figure 6. *Model 2B: 12-month-olds' fit for Research Question 2.*

4. DISCUSSION AND CONCLUSIONS

Inspired by the belief that "the individual does not exist independent of his or her relationships" (Jaffe et al., 2001, p. 3), the current research began with the overarching, theoretical framework that infants' behaviors are tied to (1) their parents' behaviors and (2) the relationship between infants and parents. From this perspective, we assessed the relation between infants' object exploration in a freeplay situation and (1) the degree to which parents interacted with the objects and (2) facets of the parent-infant relationship (i.e., parental sensitivity and attachment security). The first research question asked what relation exists between attachment security, parent behaviors, and infants' object exploration. We expected that a higher attachment security and more parental behaviors meant to facilitate infants' object exploration (e.g., parents' demonstrations of object manipulation and parental sensitivity) would be positively correlated with object exploration as measured by the production of non-obvious sounds. We only found this to be true with 6-month-olds, not 12-month-olds. Thus, as expected, we found an age-related change in the extent to which parents' object manipulation predicted infants' object exploration. In addition, we explored whether the degree to which infants and parents engaged in synchronous interactions, which we hypothesized to be a more sensitive measure of the nature of the parent-infant relationship than parental sensitivity and attachment security, improved the model fit (i.e., better predicted infant' object exploration). The second research question asked whether the degree to which parents and infants engage in synchronous interaction could help explain individual differences in attachment security, parent behaviors, and infants' object exploration. The prediction

was that synchronous interactions would also be positively related to attachment security, across age groups, although this was only true with the 12-month-old dyads. However, only with the 6-month-old dyads was synchronous interaction a better predictor of infants' object exploration than parental sensitivity and attachment security on its own. Finally, we assessed the relation between infant sociability, one aspect of infant temperament, and the nature of the parent-infant relationship. Three main findings emerged. First, overall the model fit better with the 6-month-olds than the 12-month-olds. Parents' actions on the objects and/or the nature of the parent-infant relationship were significant predictors of non-obvious sound production in the younger but not the older group (i.e., better explained individual differences in how successful the infant was at discovering non-obvious object properties). Second, adding synchronous interaction to the model improved the predictive power of the model. However, this was manifested in different ways for the two age groups. In the 6-month-olds, the degree to which the infant and parent engaged in synchronous interactions explained individual variability in non-obvious sound production, whereas in the 12-month-olds synchronicity of interactions was more strongly related to individual variability in the parent-infant relationship. Finally, infant sociability was a better predictor of parent-infant interactions in the 12.5- than 6.5-month-olds. That is, in the 12.5-month-olds but not the 6.5-month-olds, sociability scores explained individual variability in security of attachment and the extent to which infants and parents engaged in synchronous interactions during free play.

Together, these data suggest that the extent to which infants explore objects in a free-play situation is affected by a different set of factors at 6.5 and 12.5 months of age.

In addition, the nature of the infant-parent relationship and the factors that influence this relationship also change. Explanations for these developmental changes will be explored for each of the factors assessed in the analysis: synchronous interaction during the parent-infant play, parental sensitivity, attachment security, parents' actions on objects, and infant sociability.

Synchronous Interaction

As expected, with synchronous interaction included in the model the predictive power of the model was enhanced. Because this was manifested differently for the 6-month-olds and the 12-month-olds, the age groups will be discussed separately. For the 6-month-olds, the extent to which infants and parents engaged in synchronous interactions explained variability in infants' discovery of non-obvious object sounds. That is, those infants who were part of an infant-parent dyad who engaged in synchronous interactions during the free-play situation were more likely to show an increase in their production of non-obvious sounds, from Phase 1 (infant playing alone) to Phase 2 (infant playing with parent) of the test session. This finding corresponds to previous research findings that synchronous interactions foster more object exploration in younger infants (Bakeman & Adamson, 1984; Kaye & Fogel, 1980).

For the 6-month-olds, adding synchronous interaction to the model also enhanced the predictive power of attachment security: security of attachment now explained a significant amount of individual variability in infants' increase in non-obvious sound production. Attachment security's ability to predict object exploration is consistent with previous literature and the basic premise of attachment theory, that

securely attached infants have more resources available for exploring their environment and thus are more successful and thorough at object exploration in general (Wentworth & Witryol, 2003; Cassidy, 1986; Belsky, et al., 1984; Hazen & Durrett, 1982; Ainsworth, Blehar, Waters, & Wall, 1978; Ainsworth & Bell, 1974). However, given the predictive power of synchronous interaction, in and of itself, why does including synchronous interaction in the model increase the predictive value of the path between attachment security and sound production? This could be explained by the mediated path of synchronous interaction, through parental sensitivity, to attachment security (MacKinnon, Krull, & Lockwood, 2000). Synchronous interaction is significantly predictive of parental sensitivity, and when parental sensitivity increases, so does attachment security, as evidenced by their significant relationship. Thus, not only does synchronous interaction significantly predict infants' greater production of non-obvious sound production, but synchronous interaction also adds explanation power to attachment security as it significantly predicts infants' non-obvious sound production.

A different pattern of results was obtained with 12-month-olds: synchronous interaction did not predict non-obvious sound production nor did it enhance the predictive power of attachment security. The data obtained with the 6-month-olds are consistent with previous research indicating that synchronous interactions foster more object exploration in younger infants (Bakeman & Adamson, 1984; Kaye & Fogel, 1980). Why was a different relation between synchronous interactions and sound production observed at 12 than 6 months? At least two possible explanations for these findings are possible. One possibility is at 6 months infants are not as capable,

motorically, of fully exploring objects on their own, so are more likely to benefit from interaction with their parents. As the parent interacts with the objects the younger infants recognize that the objects afford interactions that they, themselves, did not discover. This only occurs, however, when the infant and parent are both focused on the same activity. The older infants may not need this experience to ascertain non-obvious object properties. Another possibility is that older infants assert greater independence in the free-play setting, and hence their object exploration behaviors are less likely to be influenced by the nature of the relationship between them and their parent.

In contrast, in the 12-month-olds synchronous interaction was strongly related to other factors (i.e., relationship factors) within the model For, example, the degree to which infants and parents engaged in synchronous interactions was related to attachment with the 12-month-olds (but not the 6-month-olds). That is, attachment security predicted the extent to which the infant-parent dyad engaged in synchronous interactions. This was a different trend than found by previous researchers, who reported that synchronous interactions at 1,3, and 6 months, but not at 9 months, predicted attachment security at 12 months (Isabella, Belsky, & von Eye, 1989). One possible explanation for the discrepancy in findings is how synchronous interactions and/or attachment security were measured. Our attachment security measure is a mother-reported survey, and mothers' reports of their infants' characteristics reflect past experiences and expectations formed over time. For this reason, the synchronous interaction may be more related to attachment security at 12 than 6 months, when enough time has passed to establish the relationship in a way that can predict how

interactions will look when the dyad is playing together. Correspondingly, the synchronous interaction measured at 6 months is more related to our *online* measure of parental sensitivity measured simultaneously. It may be that the younger dyads' (6 months) synchronous interaction can better be predicted by an online measure, parental sensitivity. In contrast, for the older dyads (12 months), who have had more time to build up relation expectations for interactions over time, what is occurring online may not be as important for predicting synchronous interaction. Rather, by the end of the first year, the attachment security measure is more appropriate for predicting synchronous interaction, as shown by our results.

At the same time, synchronous interactions and parental sensitivity were related to each other across both age groups (6 and 12 months). This suggests that the way in which infants and parents interact, within a freeplay situation, is strongly related to the degree to which parents attempt to maintain and support their infants' attention to the task. Those parents who demonstrate behaviors aimed at focusing their infants' attention to the task, while at the same time demonstrating sensitivity to their infants' individual needs, are the same parents who are part of infant-parent dyads that engaged in synchronous interactions. That is, parents who sensitive to their infants' individual needs are more likely to engage in synchronous interactions, and their infants is also more likely to engage in synchronous interactions, than those who are not sensitive to their infants' needs.

Parental Influence on Infants' Non-obvious Sound Production

Parents' actions on the objects in the presence of their infants proved beneficial in leading 6-month-olds to more fully explore the objects and their non-obvious properties. Specifically, in the younger infants the extent to which parents acted on the objects significantly predicted infants' production of non-obvious sounds with the objects.. In contrast, in the 12-month-olds a relation between parent actions and non-obvious sound production was not observed. These results are inconsistent with previous research reporting that the more opportunities infants 10 to 18 months have to observe adults manipulating and playing with objects, the greater the likelihood that infants will explore and manipulate the objects, in turn (Bono & Stifter, 2003; Huang & Charman, 2005). The reason for our age difference (positive results were obtained with 6- but not 12-month-olds), and the discrepancy in findings (a relation between parent actions and object exploration was obtained with older infants in previous research but not the current study) may be explained by the nature of our task. Our task differed from that of previous studies in that it was an unstructured, "free"-play task: parents were instructed to interact with their infant as they would at home. In contrast, in previous studies (Bono & Stifter, 2003; Huang & Charman, 2005) parents were given specific instructions as to what actions to complete or what behaviors to teach their infant. The more naturalistic setting of the current research allowed parents to decide on the amount of intervention they would implement with their infant and to play with their infant in whatever way they were most comfortable. This type of task also allowed more control for the infants; the infants could play with the toys independently of their parents' actions. The

differences between the 6- and 12-month olds cannot be accounted for by differences in parent actions on the objects, , because there was no effect of age on the percent duration of parents' object manipulation. Consequently the task is designed in a way to allow parents to act in response to their infants' behaviors rather than taking the lead to force infants to be the "responders." This may cause the task to be less sensitive to particular parent variables and more sensitivity to infants' patterns of behavior. Infants' behaviors, in turn, affect parents' behaviors and both change across the developmental maturation of infants during the first year.

Relational Paths: Attachment Security, Parental Sensitivity, and Infant Sociability

To more fully understand our model fit and paths, we broaden our perspective to include social and cognitive changes across the first year. The current research found that attachment security and parental sensitivity were significantly related in the 6-month age group but not in the 12-month group. This may illustrate that on-line parent behaviors are more indicative of attachment security at 6 months, but by 12 months, other factors are better for predicting attachment security. For example, McElwain and Booth-LaForce (2006) observed mothers and infants playing together at 6 months and at 15 months, then assessed attachment security at 15 months. They measured parental sensitivity to infant distress and non-distress behaviors during the free play session. They found a developmental change on the ability of parental sensitivity to infant distress to predict attachment security. To specify, parental sensitivity assessed during a play session at 6 months predicted a more securely attached dyad (as measured at 15 months). Interestingly, parental sensitivity assessed at 15 months did not predict attachment

security at 15 months. As children are developing the ability to regulate their own emotions (e.g. distress) and their language and locomotor skills are maturing, perhaps parental sensitivity, responsiveness and coordination becomes less salient over time in the process of sustaining a secure attachment and in the successful exploration of the child's environment. This finding that parental sensitivity predicts attachment security only when parental sensitivity is measured at 6 months (as opposed to 15 months) are consistent with our own findings: infants were exploring the non-obvious properties of the available objects at 6 and 12 months though only with the 6-month group did parental sensitivity significantly predict attachment security and attachment security significantly predict infants' production of non-obvious sound (Model 2). In fact, the present research conclusions may help to explain the 6- versus 15-month-old data in the McElwain and Booth-LaForce research (2006). Parental sensitivity was not significantly related to attachment security for our 12-month-olds. By 12 months, infants' expectations for parent behaviors and interactions have been built and established, so what parents are doing at that moment may not be as important for predicting a secure attachment.

The current 12-month-old data revealed that infant sociability significantly predicted individual differences in attachment security. This is not to say that infants are the sole cause of attachment security, but once a secure attachment is formed, perhaps the result or outward display of such a relationship is more evidenced by infant characteristics, specifically aspects of sociability (Schölmerich, et al., 1997; Claussen, et al., 2002). In turn, infant sociability may predict a secure attachment, when viewing an

infant as an "active child" who affects his/her own environment and as an active contributor to the formation of a secure attachment (Thomas & Chess, 1977; Thomas, et al., 1963). For example, previous research findings have linked attachment classification with social sharing abilities, or lack thereof (Schölmerich, et al., 1997). Claussen and colleagues (2002) investigated how disorganized attachment is manifested in the form of social sharing impairment, causing them to rank lower on a scale of infant sociability. Thus, children at 12 and 18 months were assessed for social attention coordination behaviors in whether they responded to joint attention (RJA), initiated joint attention (IJA), and initiated behavior regulation/request (IBR) for joint attention as a means to an end, such as getting help in reaching a toy. Attachment was assessed at 15 months, and dyads were classified as secure, insecure-avoidant, insecure-resistant, or insecure-disorganized. Results revealed that disorganized (insecurely attached) infants displayed lower scores of initiating joint attention (IJA) than any other attachment group. Observing infants' instances of responding to joint attention (RJA), securely attached infants always performed better than the insecure groups, showing superior ability in following adults' gaze and sharing attention toward a target object, obviously making securely attached infants more sociable. Being able to engage in joint attention is important for positive interactions with others. Infants classified with disorganized attachment may lack this particular skill since this attachment group has typically been taught to associate fear with interactions, largely due to a frightening care-giving atmosphere. Through this study, Claussen and collaborators (2002) certainly showed a relation between development and active seeking of social sharing with attachment

quality, in 12- to 18-month-olds. Thus, our results in the present study may reflect this conclusion that a secure attachment can foster infants' social abilities, causing sociability to be a significant predictor of attachment security at 12 months. Hence, the finding that sociability is what predicts attachment security at 12 months may be because 1) infants' role in attachment security increases (while parents' role decreases or balances out) as infants' become more adept at initiating and setting the tone for parent-infant interactions and because 2) sociability scores are based on parents' experiences and built-up expectations from across the first year of the infants' life. The reasoning behind this second explanation will be explored in the following paragraph.

In other words, a developmental shift occurs from parent characteristics holding higher importance for fostering parental sensitivity and attachment security to infant characteristics being more predictive of parental sensitivity and attachment security. These developmental changes are evidenced by how attachment security seems to go from being more related to on-line *parent* behaviors (parental sensitivity during the test period) to infant sociability, as experienced by parents across the first year. Attachment security shifted in its relation to other variables, from parent behaviors to infant behaviors. Unlike the on-line measure of synchronous interaction, mentioned previously, that taps into parent and infant behaviors as they are intertwined, the on-line measure of parental sensitivity is purely based on parent behaviors. Nevertheless, these findings may reflect a difference in the nature of our measures; attachment security and sociability were both assessed using a maternal-report questionnaire covering *infant* characteristics. Thus, the measure taps into maternal expectations built up over time and experiences,

based on a longer period of time for the 12-month-olds than the 6-month-olds. This method for collecting attachment data has been demonstrated as a valid measure that reliably agrees with the Strange Situation measure (Tarabulsy, et al., 2008; van Ijzendoorn, et al., 2004; Tarabulsy, Avgoustis, Phillips, Pederson, & Moran, 1997; Teti & McGourty, 1996). On the other hand, parental sensibility was a behavioral measure collected simultaneously with the infant outcome variable of change in non-obvious sound production, providing a more on-line, concurrently relevant measure of parental influence. For this reason, the age differences found in path relations may be interpreted in two ways: 1) that the 6-month-olds attachment security was more related to the on-line measure of parental sensitivity because they have fewer experiences built up for parents' expectations and 2) that the 6-month-olds attachment security was more related to the parental input (sensitivity) because of the nature of the attachment relationship paired with the infant maturation and development across the first year.

To explain, the nature and timing of the formation of a secure attachment may explain why 6-month-old dyads' attachment security was more related to parental sensitivity while 12 months' attachment security was more related to infants' sociability. The findings of McElwain and Booth-LaForce (2006) suggest that the attachment relationship has already been established by 15 months since the 6-month dyads' parental sensitivity was more predictive of attachment security than the 15-month interactions, as was also the corresponding findings with our 6 – and 12-month-old dyads. Van den Boom (1997) echoes these sentiments by suggesting the amount of parental sensitivity predictive of high levels of infant competence reaches a plateau

when infants reach a certain age or competence level, beyond which the maternal behaviors become intrusive or over stimulating. Parental sensitivity looks differently at different developmental levels or ages of the growing infant when interacting with his/her parent, and consequently relate differently to attachment security. This could explain our findings that paternal sensitivity was related to attachment security with the 6-month-old group but not with the 12-month-old group. However, both attachment and the interactions between parent and infant in sharing attention and activities have proven of the utmost importance in the early development of social and cognitive competence (Thompson, 1999).

Final Comments

These research findings paint a beautiful picture of the reality of infants' understanding of the world, not through purely cognitive eyes, but through eyes that have a mind and a heart, with social, cognitive, spiritual, emotional, and physical needs. Rather than viewing infants' cognitive development and object exploration as occurring solitarily on an island of the infants' mind and growth, this research reveals the importance of considering the social setting of cognitive processes. The attachment relationship between caregiver and infant plays a critical role on infants' cognitive readiness and adeptness for exploration, important for object processing in its own right, and the quality of interaction between adult and infant also influenced infants' ability to explore and learn about objects, through aspects including interactional synchrony, parental sensitivity, and parents' behaviors with objects in the presence of their infants. Furthermore, this research gives support the dynamic systems theory of Thelen and

Smith (2003) to reveal the changes and influence of multiple social and cognitive systems, such as attachment security, infant sociability, and parent-infant interaction traits. These systems vary as they contribute to the infant and parent factors affecting object play and interaction qualities.

One direction of future research is to more directly assess the relation between attachment security and cognitive outcomes. More specifically, researchers can investigate direct relations between attachment security and infants' development of object processing and play. It is interesting to note that much of social development research that assesses parent-infant play, attachment security, and interactional synchrony, all involve assessments of infants' interactions with objects. Infants' competence at object play and demonstration of more sophisticated play reflect social development characteristics, such as attachment security and the nature of parent-infant interactions. This paper has mentioned the importance of studying object processing within a social context since much of infants' learning about objects typically occurs within social settings. Object processing abilities are often reflective of infants' social development, meaning that object exploration and manipulation are measures used to assess attachment security, interaction quality, and other social issues of infancy. Infants' object processing gives information about their social processing and competency. Simultaneously, infants' object processing benefits and is enriched by the quality of social developments, such as attachment and interaction quality. From cueing an object by an adult's gaze toward an object to parent demonstrations of object manipulation to attachment security, social contexts for object processing leads infants

to greater brain activation, increased object memory, and more likelihood for success in object manipulation, tool use, and competent exploration and play (Reid & Striano, 2005; Reid, Striano, Kaufman, & Johnson, 2004; Bono & Stifter, 2003; Belsky, Garduque, & Hrncir, 1984; Hazen & Durrett, 1982). This symbiotic relationship between object processing and social development deserves more attention and acknowledgement in future research. Certainly worthy of study and of great interest, the social setting not only plays a great role but secures an important basis for object processing during infancy.

Bowlby wisely advised, "if a community values its children it must cherish their parents" (1951, p. 84). We know lots about social factors influencing cognitive development and object processing. One reason, of many, for doing research is to facilitate healthy growth and development in infants and children. To accomplish this, we must get the research findings into the public sector. Future directions with this research should include making it more available to the general public. Parents, teachers, and caregivers need to be taught and made aware of how important their behaviors on objects and with the infants, the type of nurturing and stimulating environment they provide, the efforts made for attention-sharing with the infant, all play a role in fostering infants' development and ability to process and learn about objects and the world around them. Supplying pure academic insight as well as public application, the social setting of object processing during infancy is a rich and important area of study.

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