

CORRELATES OF PARENT RESPONSIVENESS IN THE INTERACTIONS OF
FATHERS AND MOTHERS WITH THEIR CHILDREN WITH AUTISM
SPECTRUM DISORDERS

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DEDICATION

In memory of my parents, John and Margaret Glynn. It is my lifelong goal to use the foundation of generosity, kindness, and humor you gave me to help make life a little lighter for children with disabilities and their families.

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ABSTRACT

MICHELLE FLIPPIN: Correlates of Parent Responsiveness in the Interactions of

Fathers and Mothers with their Children with Autism Spectrum Disorders

(Under the direction of Linda R. Watson)

Children with autism spectrum disorders (ASD) demonstrate early and marked deficits in communication and play abilities. Research indicates that the responsiveness of mothers plays an integral role in supporting communication development for children with ASD. Furthermore, interventions focused on increasing maternal responsiveness have been shown to be effective in improving communicative outcomes for children with ASD (McConachie & Diggle, 2007). Less is known about the relationship between the responsiveness of fathers and the social-communicative abilities of their children with ASD. However, father responsiveness has been linked to improved outcomes for children who are typically developing. To date, parent research in autism has primarily involved mothers with the implication that results will generalize to fathers. The current study investigated similarities and differences in the interaction styles of mothers and fathers and the relationship between their respective styles and child language and play skills.

Parental responsiveness has also been shown to impact play development for both typically developing children and children with developmental disabilities (Cielinski, Vaughn, Seifer, & Contreras, 1995; de Falco, Esposito, Venuti, &

Bornstein, 2008). In contrast, the contribution of parent responsiveness to the play development of children with ASD has not been examined. Given the deficits in play characteristic of the disorder and the strong correlations between symbolic play and language development for children with ASD, understanding the relationship between parent responsiveness and child play skills will have important implications for developing effective play-based communication intervention. The current study investigated the relationship between parent responsiveness and child play skills.

Successfully involving parents in interactions with their children with ASD may be complicated in some families by parental broad autism phenotype (BAP). Parents with the BAP show characteristics similar to those found in autism without the intensity to warrant a diagnosis of autism. Nonetheless, presence of BAP characteristics may influence the ability of parents to interact with and respond to the play and language skills of their children with ASD. The current study investigated the relationship between the BAP in parents and their language and play responsiveness when interacting with their children with ASD.

Findings of this study revealed that overall, mothers used more responsive verbal behaviors than fathers. However, for both fathers and mothers, verbal responsiveness was strongly correlated with the language skills of their children with ASD. Children engaged in higher symbolic level play with their fathers and mothers than with an unfamiliar adult. Comparisons between mother-child and father-child play revealed that children engaged in significantly more relational play with their mothers; they also tended to engage in more symbolic play with their fathers, although this latter comparison was not significant. In contrast to responsive verbal

behaviors, mothers and fathers used similar levels of responsive play behaviors in interactions with their children with ASD. For fathers, responsiveness in play was associated with higher-level symbolic play skills for their children with ASD. Finally, for mothers but not for fathers, parent verbal and play responsiveness was found to mediate the relationship between two characteristics of the parental BAP (i.e., aloofness, rigidity) and the language and play skills of children with ASD. Results of this study provide important evidence supporting the principle that both mothers and fathers contribute to the language and play skills of their children with autism. In addition, this study provided data consistent with a mediator model of maternal responsiveness between maternal BAP and the child language and play skills of children with ASD.

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CHAPTER 1: STATEMENT OF THE PROBLEM

Autism spectrum disorder (ASD) affects an estimated 1:110 children in the United States (CDC, 2006). Marked and persistent deficits in early social-communicative abilities including language and play skills are clinical features of ASD (Filipek, Accardo, Baranek, Cook, Dawson, Gordon, et al., 1999). Historically the developmental prognoses for children with ASD have been poor. However, in over thirty years since passage of the Individuals with Disabilities Education Act (IDEA), intensive early intervention has shown to improve social-communicative outcomes (McConkey et al., 2010). Part C of IDEA ensures intervention services to infants and young children with disabilities, such as ASD, throughout the United States. Two key provisions of the of Part C legislation mandate that interventions be “family-centered” and “individualized.” Unfortunately, despite the emphasis on a “family-centered” model (Bruder, 2000) with greater caregiver participation in key components of early intervention (Crais, Poston, & Free, 2006), Part C implementation for children with ASD does not always meet these mandates. Mothers are often the primary and exclusive focus of both autism research and clinical work (Rodrique, Morgan & Gefken, 1992). The contributions of mother-child interactions to the development of children with ASD are well established in the literature. For instance, mothers have been shown to be effective in delivering parent-mediated interventions (McConachie & Diggle, 2007). In addition, early maternal responsiveness has emerged as an important predictor of concurrent and later language

outcomes for children with ASD (Siller & Sigman, 2002, 2008). Responsiveness during mother-child interactions is also a powerful moderator of treatment effects for children with developmental disabilities (Fey et al., 2006). In contrast, similar evidence for fathers of children with ASD is limited. For children who are typically developing, however, responsive fathering is a strong predictor of better developmental outcomes including improved emotional regulation, and cognitive and language development (Gable, Crnic, & Belsky, 1994; Magill-Evans & Harrison, 2001; Shannon, Tamis-LeMonda, London & Cabrera, 2002). Responsiveness during father-child interactions may also be positively associated with social-communicative development for children with ASD. However, fathers have interaction styles, including language and play models that differ from mothers and may make an important and unique contribution to the development of their children with ASD. Therefore, research is needed to examine the specific contribution of fathers to their children with ASD. Understanding the contributions of both mothers and fathers is particularly important in light of the growing and more direct role fathers are now playing in their child's care. In fact, although the number of stay-at-home dads is still relatively small (i.e., 1%), fathers are now estimated to be the primary caregiver for 24% of preschool-age children with working mothers (U.S. Census Bureau, 2006). By not involving fathers in early autism intervention, clinicians may be missing important opportunities to maximize social-communicative gains for children. Moreover, overlooking fathers in intervention and research may have unintended consequences for families including increased levels of parental stress and decreased family cohesion. For instance, Tehee and colleagues reported that the higher levels of stress demonstrated by mothers of children with autism are likely due to the

challenge of taking on the dual roles of caregiver and intervention provider (Tehee, Honan & Hevey, 2009). Increased father involvement may ease the workload for mothers. Thus, enhancing the role of fathers in the development of children with communication and social deficits such as autism could be an important direction in realizing optimal, “family-centered” services for children with ASD and their families.

A second key provision of Part C legislation requires that intervention be “individualized” to meet the specific needs of children with disabilities and their families. For certain families of children with ASD, however, specific needs may be going unmet. In fact, some parents of children with ASD show characteristics that are milder but qualitatively similar to autism (e.g., social impairments, pragmatic language deficits, and restricted interests and activities) known as the broad autism phenotype (BAP) (Folstein & Rutter, 1977). Overall, these parents have been shown to have difficulty engaging in social interaction with other adults (Ruser, Arin, Dowd, Putnam, Winklosky, Rosen-Sheidley et al., 2007). The BAP may also influence parent-child interactions and by extension, affect social-communicative development for children with ASD. Parents who show characteristics of the BAP may need targeted supports to engage in maximally responsive interactions with their children. Moreover, parent responsiveness has been shown to be a powerful predictor of communication outcomes for children with ASD (Siller & Sigman, 2002, 2008) and a strong moderator of treatment effects for children with developmental delays (Fey et al., 2006). Thus, parent responsiveness may also mediate the influence of the parental BAP on the language and play skills of children with ASD. Understanding this potential influence of the BAP, and more importantly,

examining any possible mediating role of parent responsiveness, is an essential step in making early autism intervention individualized to fit the specific needs of each family.

The long-term goal of this program of research is to address two key Part C implementation issues by developing a truly “family-centered” and “individualized” early autism intervention program that effectively involves both fathers and mothers as stakeholders, and provides specific supports to parents who display characteristics of the BAP. The central hypotheses guiding the current study are based on the understanding that parents play an early and integral role in communication development of children with autism, and that fathers of typically developing children make important and unique contributions to their child’s language and symbolic play and by extension may for children with ASD. Given that maternal responsiveness is one of the strongest predictors of language outcomes for children with autism, paternal responsiveness is also likely to make unique and important contributions to language and play development for children with autism. Parent responsiveness may also mediate any influence of the parental BAP on the language and play skills of children with autism. The main aims of the current study are to investigate several unanswered questions regarding the relationship between parent responsiveness during father-child and mother-child interactions and the language and play skills of children with ASD. The specific questions, and the rationale for these questions, are as follows:

Research Question 1—To what extent are the responsive verbal behaviors of both mothers and fathers correlated with language ability of children with ASD? Studies of parent-child interactions in autism have primarily involved mothers. Although early maternal responsiveness has been shown to impact language outcomes for children with

autism through adolescence (Siller & Sigman, 2002, 2008), the role of fathers' responsiveness in the development of children with ASD has not been investigated. For children who are typically developing, paternal responsiveness is a strong predictor of positive developmental outcomes (Shannon et al., 2002). It is likely that paternal responsiveness is positively associated with language ability for children with ASD as well. To date, however, no studies have examined the relationship of father responsiveness to the language abilities of children with autism.

Research Question 2– What are the comparative symbolic levels of object play displayed by children with ASD in interactions with their fathers, mothers, and an unfamiliar adult? Fathers engage in different types and frequency of play than mothers. Fathers' play style has been shown to be facilitative for typically developing children as well as children with disabilities. Children with Down syndrome, for example, demonstrate higher-level symbolic play in interactions with their fathers than in solitary play (de Falco, Esposito, Venuti, & Bornstein, 2008). It is likely that children with ASD will also achieve higher levels of symbolic play in interactions with their fathers. Furthermore, given that fathers are their child's primary play partner (Pleck & Masciadelli, 2004), it is likely that children with ASD will engage in higher level, or symbolic play in interaction with their fathers compared to mothers or an unfamiliar adult. Understanding the unique contributions of fathers to the play development of children with ASD will provide important descriptive evidence of the potential benefits of greater father involvement in early autism intervention and potentially may help future intervention strategies.

Research Question 3—To what extent are the responsive play behaviors of mothers and fathers associated with levels of symbolic play demonstrated by children with autism? Children with ASD demonstrate early and marked deficits in both language and play development, and interventions targeting play have been shown to lead to significant gains in both play and language ability (Kasari et al., 2006). Responsive parent-child interactions during play are related to both higher symbolic level and overall amount of play (Frodi et al., 1985; Spangler, 1989), whereas parental behaviors such as intrusiveness negatively influence the play ability of children who are typically developing (Cielinski et al., 1995; Beeghly, 1998). Understanding the contributions of parental responsiveness to the child's play ability will have important implications for effectively involving both mothers and fathers in play-based communication intervention for young children with ASD.

Research Question 4--Does parent verbal responsiveness mediate any potential association of the parental broad autism phenotype with the language skills of children with ASD? There is growing evidence that the broad autism phenotype impacts communicative effectiveness for some parents of children with autism, particularly fathers when interacting with other adults (Ruser et al., 2007; Scheeren & Stuader, 2008). To date, however, studies of the communicative impact of the BAP have been limited to adult interactions. Given that the BAP affects some parents' language use in adult communicative exchanges, it follows that the BAP also likely influences the language parents use in interactions with their children, with cascading effects on child communication development. Indeed, parent responsiveness is a strong predictor of language outcomes for children with autism and a powerful moderator of treatment

effects for children with developmental delay (Fey et al., 2006). Examining whether parent responsiveness mediates any potential influence of the BAP on the language skills of children with ASD will have important implications for identifying appropriate intervention targets (e.g., increased parent responsiveness) in order to effectively involve all parents in “individualized” communicative interventions for children with ASD.

Research Question 5--Does parent play responsiveness mediate any potential association of the parental broad autism phenotype with the play skills of children with ASD?

Given that parents with characteristics of the BAP have demonstrated difficulty in engaging in effective communicative exchanges with adults, it is likely that the parental BAP may also influence parents’ interactions with their children. Play is a primary interaction context for children who are typically developing and children with disabilities (McCune, 1995). Furthermore, symbolic play is a strong predictor of language outcomes for children with ASD and thus an important target of autism intervention (Kasari, Freeman & Paparella, 2006). Similar to the question related to child language skills above, examining whether the parental BAP influences the play abilities of children with ASD and whether parents’ responsiveness in play mediates any potential influence of the BAP will help researchers in identifying appropriate intervention targets (e.g., increased parent responsiveness) in order to effectively involve all parents in “individualized” communicative interventions for children with ASD.

Summary

Although a goal of Part C legislation is to insure that early intervention services are “family-centered” and “individualized,” it is clear that current intervention practices are falling somewhat short of this mark. Despite the increased caregiving role of fathers along with growing evidence of the positive outcomes of paternal responsiveness on child development, fathers are generally overlooked in both autism intervention and clinical work. Whereas the role of maternal responsiveness on child outcomes is well established, in contrast, the contributions of paternal responsiveness to social-communicative and play outcomes for children with ASD have not been examined in the literature. To these ends, the current study investigates parent-child interactions to identify correlations between mothers’ and fathers’ responsiveness and the language and play skills of their children with ASD. This study also examines the contributions of mothers and fathers to their child’s level of object play. In addition, this investigation provides some initial information regarding the mediating role of parent responsiveness between the potential influence of the parental broad autism phenotype and child language and play skills. Understanding the contributions of both mothers and fathers to their child’s language and play skills and identifying the possible mediating role of parent responsiveness are essential first steps in developing early autism interventions that effectively involve both fathers and mothers as stakeholders, and provide specific supports to parents who display characteristics of the BAP.

CHAPTER 2: REVIEW OF RELATED LITERATURE

This chapter reviews key literature to provide a theoretical rationale for examining the correlates of parent verbal and play responsiveness during interactions between mothers or fathers and their children with ASD. First, the transactional model of communication is proposed as an appropriate framework for investigating interactions between parents and their children with ASD. The transactional model describes how child characteristics and parent behavior each influence the quality of parent-child interaction, and thus affect the child's communicative development. Second, child characteristics, or the unique patterns of language and play development in children with ASD are described. Next, relevant parent behaviors are described, and the unique language and play characteristics of mothers' and fathers' interaction styles are highlighted. Finally, a mediator model is proposed to explain the relationship between parental BAP, parent responsiveness, and the language and play skills of children with ASD.

Theoretical Underpinnings of Parent-Child Interaction in Autism: Transactional Model of Communication Development

Parent-child interactions serve as the primary context for communicative, cognitive and social development for children including children with disabilities (Vygotsky, 1978; Greenspan, 1977). The transactional model provides a useful

theoretical framework for investigating the predictors and outcomes associated with parent-child interactions for all children. As reflected in the transactional model, children develop increasingly sophisticated means to express themselves and interact with others through facilitative interactions with their parents. Importantly, both child and parent mutually affect each other to support development, or as McLean (1990) explains, “an infant’s observable responses are seen to serve as both the antecedent events that evoke subsequent responses from the environment and as the consequent events that either reinforce or punish (i.e., increase or decrease the rate of) those subsequent environmental events. Similarly, environmental events, consisting primarily of caregiver responses, also serve dual functions as both antecedent and consequent events, evoking and rewarding (or punishing) the infant’s responses” (Figure 1). For children who are typically developing, this dynamic interplay between parent and child serves as the foundation for rapid gains in cognitive, social, and communicative domains, following a smooth trajectory from prelinguistic to linguistic communication over the first two years of life.

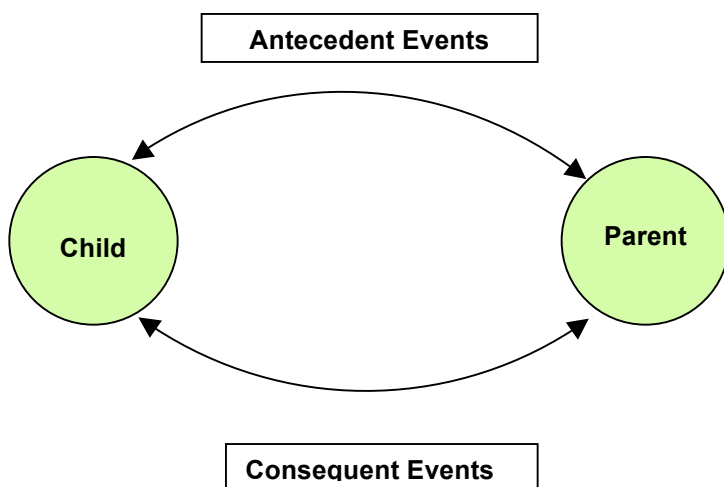


Figure 2.1. Transactional Model of Communication (McLean, 1990)

The earliest stage in the transactional model of communication development occurs from birth to roughly three months in typical development. Although at this *reactive perlocutionary* stage, the infant's responses are reflexive and unintentional, they have a communicative effect on the parent's response (Bates, 1976). Thus, infants play an early and active role in the regulation of reciprocal interchanges. Parents, in turn, offer responses contingent to the infant's reaction and respond to early reflexive behaviors as meaningful. As early as two months of age, infants start to organize communicative interchanges between themselves and their caregivers. As Tronick explains, "This endogenous organization allows for the occurrence of coordinated actions between adult and infant, although in and of itself does not imply how the coordination takes place or who is responsible for successful coordination" (Tronick, 1981, p.3). At this stage, mothers and fathers are similarly responsive to their child's cries and smiles (Berman, 1980) and modify their speech by speaking slowly, using shorter phrases and exaggerated intonation patterns, known as "motherese," or perhaps more appropriately, "parentese" (Dalton-Hummel, 1982; Golinkoff & Ames, 1979; Warren-Leubecker & Bohannon III, 1984).

The second, or *proactive perlocutionary*, stage occurs between two and nine months for typically developing children, as infants engage in face-to-face interactions, also known as "proto-conversations," with parents (Bateson, 1975). Children and their parents each play a role in mutually regulating one another's feelings and interests through the use of facial expression, vocalization and early gestures (Brazelton, Tronick, Adamson, Als & Wise, 1975; Crais, Douglas & Campbell, 2004). Accordingly, this stage marks the period when the child becomes increasingly purposeful in his/her actions

on people and things in the environment and starts to communicate likes and dislikes to the parent. Trevarthen and Aitken (2001) refer to the emergence of this early intersubjectivity as the “development of active ‘self-and-other’ awareness” (p.3). The child’s signals are now less ambiguous and parents respond by mapping or referencing what the child is attending to in their speech. Parentese also adapts accordingly. For instance, whereas during the reactive perlocutionary stage, the emphasis of parentese was on suprasegmental features of speech (e.g., intonation, phrasing), at this stage, parents now focus more on segmentals, using simple words to label what the child is referencing.

The third stage, *emerging illocutionary*, marks the development of both intentionality and joint attention. In typical development, this stage emerges at around 9 months, as the child begins to use eye gaze, gestures and vocalizations to intentionally communicate his/her wants and needs to others. The child’s active and persistent role in communicative exchanges now allows parents to identify the message as intentional and it becomes increasingly easier for parents to accurately interpret their child’s signal (Bates, Benigni, Bretherton, Camaioni & Voltera, 1979; Golinkoff, 1986). Later intersubjectivity, or joint attention, also develops at this stage. Unlike earlier dyadic intersubjectivity between parent and child, joint attention is triadic. The child and parent are now able to coordinate attention between an object and one another (Trevarthen & Huble, 1978). This ability of the child to coordinate attention with his/her parent serves to further clarify the communicative signal (Warren & Yoder, 1998). For their part, parents offer language models at and slightly above their child’s language level, thereby scaffolding learning (Vygotsky, 1978).

Finally, around 12 months, typically developing children enter the fourth or *conventional and emerging illocutionary* stage. This stage continues until around 24 months and marks the transition from prelinguistic to early linguistic communication. As the child learns to use single words, communicative exchanges between child and parent are closer to true conversation. In response, parents expand on the child's utterances and model increasingly complex language, which supports language learning. Overall, the developmental shifts in cognitive, social and communicative abilities that occur in over this relatively brief time period are remarkable. Not all children, however, follow this smooth developmental progression from prelinguistic to linguistic communication. In fact, children with ASD show marked deficits in social-communicative development, characteristic of the disorder.

Social Communication and Play Characteristics of Children with ASD

Children with autism develop language later and at significantly slower rates than typically developing peers (Lord, Rutter & LeCouter, 1994), and severe delays and deficits in language are often parents' primary concern at the time of referral for intervention services (Lord, Risi & Pickles, 2004). Although estimates vary, roughly 25% of children with ASD do not develop functional speech (Volkmar, Bailey, Lord, Schultz & Klin, 2004). However, the onset of communication deficits begins even earlier, at the pre-linguistic level. During the infant and toddler years, children with ASD demonstrate a restricted repertoire of early developing social communicative skills such as imitation, joint attention, and speech. Deficits in these early developing skills have a cascading impact on later social-communicative competence (Wetherby et al., 1988). For example,

in typical development, the ability to imitate emerges early, with some forms of motor imitation (e.g., tongue protrusion) present at birth (Meltzoff & Moore, 2002). In contrast, young children with ASD have been shown to have difficulty to imitating both facial and body movements. Children with ASD also have difficulty in both immediate and deferred imitation of actions on objects (Charman, 1997; Sigman & Ungerer, 1984).

Deficits in joint attention, the ability to share attention with another person in reference to some object or event, are another early marker of ASD (Mundy, Sigman & Kasari, 1990). Whereas typically developing children are able to coordinate attention between an object and another person as early as 9 months, children with ASD demonstrate striking impairments in their ability to respond to and initiate bids for joint attention (Carpenter, Nagell, & Tomasello, 1998). Interestingly, Adamson, Deckner and Bakeman (2010) recently found that for children with ASD, later deficits in joint attention correlated with an early preference to interact with familiar objects over both people and unfamiliar objects. There is similar evidence for the cascading effects of early preferential differences on speech and language development for children with ASD. For example, typically developing children preferentially attend to “parentese” or child-directed speech characterized by positive affect, higher and more variable pitch and simpler, more repetitive structure and content. In contrast, several studies have shown that young children with ASD do not show this expected preference for “parentese.” Children with ASD may even prefer to listen to non-speech stimuli rather than speech (Kuhl, Coffey-Corina, Padden & Dawson, 2005). Importantly, the extent to which young children with ASD attend to child-directed speech is highly correlated with their language skills (Paul, Chawarska, Fowler, Cicchetti, & Volkmar, 2007; Watson, Baranek, Roberts,

David, and Perryman, 2010). Thus, differences in early preferences of children with ASD may also impact the development of joint attention. Impairments in language development and these early developing social-communication skills, including imitation and joint attention, are some of the most striking and persistent clinical features of ASD. Children with ASD also demonstrate both quantitative and qualitative deficits in their play abilities.

For children who are typically developing, object play develops in a generally smooth trajectory over four increasingly sophisticated phases: (a) *exploratory play*, in which the child begins to investigate properties of a toy (e.g., holding a ball; mouthing a car); (b) *relational play*, in which the child starts to combine toys (e.g., stacking rings); (c) *functional play*, in which child begins to use toys and miniatures as intended (e.g., sweeping with a toy broom); and (d) *symbolic play*, in which the child starts to use substitute one object for another (e.g., a banana for a phone) and begins to engage in more elaborate pretend schemas, imagination and fantasy play (Ungerer & Sigman, 1981).

In contrast, children with ASD do not follow this smooth trajectory of play development (Libby, Powell, Messer & Jordan, 1998). Rather, children with ASD demonstrate severe deficits in play development. Overall, the play of children with ASD is less elaborate and more repetitive (Williams, Reddy & Costall, 2001). For instance, children with ASD spend a longer period engaging in exploratory play, past the point at which typically developing children move on to more sophisticated levels of play (Jordan & Libby, 1997). It follows that children with ASD spend less time than their typically

developing peers engaging in the more sophisticated levels of functional or symbolic pretend play (Jarrold, Boucher & Smith, 1993). However, as is the case for children who are typically developing, play is an important predictor of later speech development for children with ASD (Charman, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Toth, Munson, Meltzoff & Dawson, 2006). Functional and symbolic play skills in particular have been shown to be strong correlates of concurrent language ability for both typically developing children and children with ASD (McCune, 1995; Mundy et al., 1987). In fact, for children with ASD, early play levels are a significant predictor of later speech development (Charman, et al., 2003; Toth, Munson, Meltzoff & Dawson, 2006). Importantly, the work of Kasari and colleagues has demonstrated that interventions targeting higher-level functional and symbolic play improve both play and language outcomes for children with ASD (Kasari et al., 2006; Kasari, Paparella, Freeman, & Jahromi, 2008). Thus, play skills are an important intervention target for children with ASD.

In summary, success in establishing early developing social communicative skills including imitation, joint attention, and play, predicts later language ability for both typically developing children and children with autism (Bates et al., 1979; Charman, 2003; Stone & Yoder, 2001; Toth, Munson, Meltzoff & Dawson, 2006). These social-communication and play skills help link the child to his/her environment and support further communicative development and successful exchanges between parent and child. For children with ASD, deficits in these early social-communicative skills and play limit the frequency and clarity of communicative exchanges of children with ASD (Wetherby, et al 1988) and may have cascading effects throughout development. In the transactional

model of social-communicative development, outcomes are not predetermined solely by child factors, rather parent behaviors also play an integral role.

Parent Behaviors

Parent Verbal Responsiveness and Outcomes for Typically Developing Children and Children with ASD

In the transactional model, both child characteristics and parent behaviors each contribute to child communication outcomes. For children with ASD, their deficits in communication may make the contributions of parents even more relevant to achieving maximal outcomes. The bidirectional model "assumes that the increasing readability or clarity of the child's communicative behavior may influence the parent's style and frequency of contingent responsiveness in ways that will further scaffold the child's developing competence during the transition to linguistic communication" (Wetherby, Warren, & Reichle, 1998, p. 2). For children with ASD, however, the readability and clarity of their communication may not be increasing, or may be increasing at a slower rate than happens in typical development. In response, many parents of children with ASD take on a greater role in the communicative exchange by interpreting their child's ambiguous requests, establishing joint focus of attention with their child, and scaffolding more appropriate play from their child's limited or repetitive activities. Evidence of this expanded parent role was observed by Watson (1998) who reported that although mothers of children with autism used contingent language, or followed their child's lead in interactions as frequently as mothers of typically developing children, they also used more statements referencing something out of the child's focus of attention. Watson

hypothesized that this tendency reflected the mothers' attempts to adapt to their children's difficulties in attention and communication.

Both mothers and fathers may be uncertain about interpreting the cues of children that do not follow typical patterns of early communication and play. Although studies are limited, fathers of children with autism, for example, have reported frustration in not knowing how to play with their children (Elder et. al, 2003). However, given the social-communicative deficits inherent to the disorder, parental factors may play an even more important role in achieving communicative competence for children with ASD. Identifying which parent behaviors have the greatest influence on social-communication outcomes is an integral component of developing an effective family-centered intervention. For example, one often-researched parent characteristic is socioeconomic status. It is well established in the literature that parents with higher levels of income and education use more words with their children, and their children, in turn, have higher expressive vocabularies (Hart & Risley, 1995). Although parent income and education are undeniably important parent influences on child social-communicative outcomes, it can be argued that they are somewhat "distal" variables; influential, but essentially fixed, or at least difficult to change within the constraints of a parent-child intervention program. A more "proximal" parent behavior shown to impact child language and play outcomes is responsiveness.

Responsive parent behaviors are defined as "immediate, contingent, and affectively positive reactions to children's acts of communication and play" (Ruble, McDuffie, King & Lorenz, 2009, p.158). The responsiveness of mothers has been shown to have a strong and global impact on child development, including achievement of

earlier language milestones (Landry et al., 2001; Tamis-LeMonda, Bornstein & Baumwell, 2001) and cognitive and social-emotional outcomes (Bornstein & Tamis-LeMonda; Landry, Swank & Smith, 2006). Early maternal responsiveness is also a significant predictor of later social-communicative outcomes for children who are typically developing as well as children with developmental disabilities such as ASD (see Trivette, 2003 for a systematic review). For example, in perhaps the largest (n=183) longitudinal study of child outcomes and parent well-being for children with developmental disabilities, Hauser-Cram and colleagues (Hauser-Cram, Warfield, Shonkoff, Krauss, Sayer, & Upshur, 2001) collected data from the time of early intervention entry up to the child's 10th birthday. Predictor variables were measured at age three when the children exited from the early intervention program. After controlling for mental age, responsive mother-child interaction predicted multiple domains of children's development including language, cognitive, and adaptive skills. Strikingly, at age 10 years old, those children whose mothers used the most responsive strategies when the children were three showed a full 10-month advantage in communication skills when compared with children whose mothers used fewer responsive strategies. Thus the quality and frequency of maternal responsiveness are important influences on the communication, social and cognitive outcomes for both children who are typically developing and children with disabilities.

Parent Verbal Responsiveness and Outcomes for Children with ASD

A few studies have specifically examined the impact of parent responsiveness on various outcomes for children with ASD. For example, for children with ASD, parent

affect and responsiveness were found to be more important determinants of child engagement (i.e., attention, persistence, cooperation, initiation, joint activity, affect) than the child's developmental status (Kim & Mahoney, 2004). Early maternal responsiveness has also been shown to significantly influence long-term communication outcomes for children with ASD.

In examining maternal responsiveness across populations, Siller and Sigman (2002, 2008) examined the behavior of parents of children with autism (n=18), developmental delay (n=18), and typically developing children (n=18) during play interactions. From four-minute recordings of parent-child play interactions, the researchers selected four 30-second samples in which parent and child were both visible on screen to code synchronized parent initiating and verbal behaviors. Parent verbal responses that referred to at least one of the toys child played with were categorized as synchronous. Synchronous verbal responses were then classified into two categories: (a) demanding, in which the parent demanded a change in the child's ongoing activity (e.g., "Can you dump the truck?") or (b) undemanding, in which the parent maintained child's current activity by offering reinforcement or comment (e.g., "Oh, boy this truck is driving fast"). This parent synchronization variable was calculated as a proportion, with the percentage of synchronized and/or undemanding parent behaviors as the numerator and the percentage of total child toy-directed behaviors as the denominator. Two important findings emerged from this study. First, consistent with earlier findings reported by Watson (1998), mothers of children with autism followed their child's lead by synchronizing their behaviors to their children's attention and activities as often as mothers of typically developing children. In fact, at the start of the study, mothers across

all groups (i.e., ASD, DD, TD) were similar in their frequency of synchronized, responsive behaviors. Second, the level of responsiveness used by mothers of children with autism during early interactions significantly impacted their child's later development of joint attention and language skills. In fact, children with autism whose mothers showed higher levels of responsiveness showed superior joint attention and language skills over periods of one, 10 and 16 years. Given the strong relationship between parent responsiveness and child developmental outcomes, several researchers have investigated the effects of interventions designed to increase parent responsiveness for at risk children.

Interventions Targeting Parent Responsiveness

There is a growing body of evidence documenting the effectiveness of interventions focused on increasing parent responsiveness to improve social-communication outcomes for children with developmental disabilities (see metanalysis by Yoder, 1998). Several studies have specifically examined the effects of parent responsiveness training on the social-communication skills for children with ASD. For example, Greenspan and Weider (1997) conducted a chart review of outcomes for 200 children with ASD whose parents were trained in Floortime over a two- to eight-year period. The review suggested promising results for parent training, with 58% of children achieving "very good outcomes" including engaging in "spontaneous communication at the preverbal and verbal levels." However, this review was uncontrolled and no formal measures of language were reported. Aldred and colleagues (Aldred, Green & Adams, 2004) provided stronger evidence in support of parent responsiveness training for

children with ASD. In a randomized control trial of 28 children (14 treatment, 14 control), the researchers examined the effects of a monthly (6 months treatment, 6-month follow up) parent training program targeting pragmatic language. Parents in the program spent 30 minutes per day implementing the targeted techniques. Parents in the treatment group demonstrated significantly increased responsiveness, and their children showed improved scores in autism severity and expressive vocabulary. The effects were particularly large for younger, lower functioning children. No significant differences were found in levels of child adaptive behaviors or parental stress.

A relatively large, quasi-experimental study of the effects of targeting parent responsiveness for children with autism was conducted by Mahoney and Perales (2003). The authors trained mothers of 50 children with autism to use Responsive Teaching (Mahoney & MacDonald, 2007) in a one-year intervention. Similar to findings by Aldred and colleagues (Aldred, Green & Adams, 2004), Mahoney and Perales reported positive effects of the intervention for both children and parents. Overall, mothers engaged in significantly more responsive acts with their children. In turn, children had significantly higher ratings at post-treatment in social and communicative skills. The authors also reported related positive effects for children in areas such as attention, persistence, cooperation, initiation of joint attention and affect; and collateral effects for parents in improvement in levels of parental stress. Thus, maternal responsiveness is established in the literature as a significant predictor of communicative outcomes for children with developmental disabilities such as ASD. Maternal responsiveness has also been shown to be a powerful moderator of intervention effects. In fact, in their study of the effectiveness of pre-linguistic milieu training for children with developmental delays, Yoder and

Warren (2001) reported that treatment effects were observed only for those children whose mothers used more responsive strategies at the outset of intervention. As a result, in future studies, Yoder and Warren and colleagues supplemented their prelinguistic milieu intervention with a parent component targeting responsiveness (Fey et al., 2006).

To date, the majority of intervention studies focused on improving parent responsiveness have included only mothers. One study of responsiveness of fathers of children with disabilities was conducted by Mahoney, Wiggers and Lash (1996). These authors reported success in using a relationship-focused intervention designed to help fathers of children with developmental delay: (a) engage in more responsive interactions; (b) become more knowledgeable about their child's development; (c) spend more time in play and caregiving activities; and (d) be perceived by their child's mother as providing a higher level of support. The authors ran six weekly sessions of a "Fathers Group." Sessions were structured so that fathers first engaged in play interactions with their children and then received feedback from the program trainers. Fifteen-minute, father-child free-play observations were recorded two weeks prior to starting and two weeks following the training. The Maternal Behavior Rating Scale (MBRS; Mahoney, 1999), a measure of parent responsiveness previously developed by the authors, was used to document pre/post levels of fathers' responsiveness. Upon completion of the program, fathers showed significant gains on three of the 12 pre- post comparisons on the MBRS (i.e., responsivity, child orientation, and time spent interacting with the child on the weekend).

Taken together, results of these studies provide important evidence of the integral role of highly responsive parent-child interactions in supporting the social-

communicative development of children with developmental delays, including ASD. Further, the finding that parent responsiveness training (for both mothers and fathers) may have positive collateral effects for families of children with disabilities is interesting and provides further support for making early autism intervention truly family-centered. Unfortunately, most of the studies on parent responsiveness for children with ASD have been conducted primarily with mothers. Further, mothers and fathers show some important differences in their parenting interaction styles and their responsiveness to their children's acts of communication and play. As the main aims of the current study are to examine the correlates of responsive verbal and play behaviors for both mothers and fathers of children with ASD, the next sections will describe parent language and play behaviors, highlighting differences between mothers' and fathers' interaction styles.

Parent Communication Models

Studies of father-child interactions with children who are typically developing have established that fathers offer language models that are different from mothers and thus make important contributions to their child's language development (Clarke-Stewart, 1979; Gleason, 1975). Overall, fathers tend to use a higher-level vocabulary and more complex language model with their children than mothers. Compared to mothers, fathers use vocabulary that is more varied, more rare, and more abstract (Bernstein-Ratner, 1988; Gleason, 1975; Masur & Gleason, 1980; Pancsofar & Vernon-Feagans, 2006; Rondal, 1980). There is also evidence that fathers use more lexically challenging syntax. For example, fathers are more likely to direct questions to their children. Most father questions are "wh" questions that are more complex than "yes/no" questions more

frequently used by mothers (McLaughlin, Schultz & White, 1980; Walker & Armstrong, 1995). This higher-level language model used by fathers has an important role in communicative outcomes for typically developing children.

Similar differences between mothers' and fathers' language models have been documented for parents of children with ASD. In an earlier study, Wolchik (1983) examined the language patterns of mothers and fathers of 10 children with autism and 10 typically developing children matched for language age, sex, and parental education level. Syntactic and functional aspects of parent language were assessed during 20-minute parent-child interactions, and frequency counts of language categories were compared across parent groups. Variables of interest included average sentence length, total number of sentences, questions, direction, modeling, labels, reinforcement, non-language oriented language, adult -to-adult language, and other behaviors. Wolchik found few differences between the overall language models of parents of children with autism versus parents of typically developing children. Parents of children with autism used more non-language oriented language (i.e., language not specifically directed toward eliciting or responding to child's language or toward enhancing receptive language) than parents of typically developing children. In addition, parents of children with autism tended to use more questions and labels than parents of typically developing children although differences were not significant.

Wolchik reported more striking differences between mothers and fathers. Overall, mothers of children with autism and children who were typically developing were more active than fathers, across all language categories. Mothers used more requests, asked more questions, and labeled objects more often than fathers. Mothers also expanded their

child's language more often than fathers and used more non-language oriented language than fathers. Conversely, fathers engaged in more "other behavior," such as sitting quietly, sighing, talking on the phone, and laughing, than mothers. Similar differences in mothers' and fathers' language models were also observed by Konstantareas (1998), who examined the language used by in a study of twelve children with autism (40-151 months) and their mothers and fathers during 15-minute semi-structured play sessions. Compared to mothers, fathers asked an equal percentage of questions, but used a greater percentage of directives and a smaller percentage of prompts and statements than mothers. Overall, results of these studies provide important evidence that parents of children with ASD use language models that are similar to parents of typically developing children, with important differences between mothers' and fathers' language models evident in both groups.

In seminal work, Gleason (1975) hypothesized that fathers' complex language models provide the child with a bridge from the supportive language of home to the more complex linguistic demands of the outside world. In Gleason's model, children are tasked by their fathers with speaking more coherently, and clarifying misunderstandings, which helps foster their communicative development. Tomasello and colleagues (Tomasello, Conti-Ramsden & Ewert, 1990) found support for this "bridge hypothesis" in their observations that fathers' child-directed speech is closer in form to that of speakers outside the family. Indeed, Tomasello and colleagues (Tomasello, Conti-Ramsden & Ewert, 1990) also documented that children used this higher-level language both with unknown examiners as well as with their fathers. Although the finding that children use similar language with fathers and strangers may support the "bridge

hypothesis,” conversely, it may also be explained by children having less contact with their fathers (particularly at that historical time). This lack of contact also may account for the more frequent communicative breakdowns fathers experience with their children (Tomasello, Conti-Ramsden & Ewert, 1990). It is important to note, however, that the majority of studies examining father language models were conducted more than twenty years ago. There is recent evidence that fathers’ more linguistically challenging style supports child vocabulary development. In fact, father vocabulary use at 24 months has been shown to predict levels of child expressive language one year later, at 36 months. In contrast, mothers’ language did not account for significant portion of variance in child expressive language (Pancsofar & Vernon-Feagans, 2006).

In response to the more linguistically challenging models used by fathers, children have been shown to use higher-level language in interactions with their fathers, including longer and more complex utterances (Masur & Gleason, 1980; Rondal, 1980) and more advanced narratives (Tomasello, Conti-Ramsden & Ewert, 1990). Through these transactional exchanges with their fathers, typically developing children develop more complex language, greater awareness of the impact of their communicative signal on others, and an understanding of the need to clarify misunderstood messages. For their part, fathers respond to their child’s communicative gains by increasing the complexity of their model, and offering direct feedback to their child. Although it is likely that such father-child exchanges also support communicative development for children with ASD, there are few studies available to provide confirmation.

Despite the numerous unique contributions of father language models to child language development, paternal language styles have also been reported at times to be

directive. For typically developing children, directive parental interaction styles often have negative connotations and have been associated with authoritarian parenting styles and poorer developmental outcomes (Baumrind, 1991; Weiss & Schwartz, 1996). For children with disabilities, however, the relationship between directive parent-child interactions and developmental outcomes is not as clear. In general, parents of children with disabilities have been shown to use more directives in interactions with their children as compared to parents of children who are typically developing (Dunst 1984; Pelligrini, Brody & Sigel, 1985; Tannock, 1988). However, there is some debate as to whether directive language used by parents is facilitative for children with disabilities. For example, Mahoney (1988) found support for a negative relationship between the frequency of directives used by parents of children with Down syndrome and parents' level of responsiveness to their child's communication. However, Cielinski and colleagues (Cielinski, Vaughn, Seifer & Contreras, 1995) found that while mothers of children with Down syndrome were more directive of their child's play compared to mothers of typically developing children, this directiveness was also significantly correlated with the proportion of time their child was engaged in play. In contrast, for the typically developing children in the study, maternal directiveness was not correlated with sustained play engagement. Thus, there is some evidence that directiveness may be facilitative for some children with disabilities. For children with ASD specifically, Watson (1998) found that whereas mothers of children with autism were able to respond contingently or follow their child's lead with the same frequency as mothers of typically developing children, they also directed more out of focus utterances to their children. Watson hypothesized that this is likely a reflection of the difficulty mothers have in

establishing a joint focus of attention with their children with autism. Although more specific research is needed, there is some evidence to suggest that this directive language model used by fathers may in fact be facilitative for children with autism.

Shared focus of attention between parent and child may be one key factor in whether fathers' directive language is in fact facilitative for children with autism. In a study of directive language used by mothers, McCathren and her colleagues (1995) attributed the mixed effects of directives on child language outcomes to the existence of different types of directives that serve different functions in the language learning process. They distinguished between two main types of directives: redirectives (directives that initiate a new topic, thus causing a shift in focus for the child); and follow-in directives (directives that follow the child's lead). The authors postulated that redirectives requiring children to change referent topics may indeed hinder the language acquisition process. However, follow-in directives, which share the child's interests, may be effective in maintaining the child's engagement in communicative exchanges and thus help in learning vocabulary. The use of language that references the child's focus of attention is especially salient for children with autism who have difficulty in establishing and maintaining joint attention (Siller & Sigman, 2002, 2008). Given the impact of maternal follow-in directives, it is likely that some aspects of father directive language also may provide support to children with ASD in learning language.

A second important factor in examining whether fathers' directive models support the language development of their children with ASD is the degree to which fathers are able to match their language models to their child's level of communicative competence. For example, in his study of interactions between mothers and their children with Down

syndrome, Mahoney (1998) found that although some types of maternal follow-in directives were indeed facilitative, those follow-in directives that placed the burden on a child to produce behaviors that exceeded his/her current level of development did not elicit the desired response from the children. Matching directive parental language models to child competency levels may be particularly important for fathers, as fathers in general have been shown to use more complex language models with their children than mothers. In the studies examining the impact of maternal responsiveness on communication outcomes for children with ASD conducted by Siller and Sigman (2002, 2008), distinctions between the types of directives were not conducted to help with this distinction. Rather, parent utterances were coded only as demanding or undemanding. Distinctions were not made for whether a demanding utterance referenced or redirected the child's focus of attention. In light of the fact that mothers of children with disabilities have been shown to use more directives than mothers of typically developing children, along with the evidence that fathers of children with ASD have been shown to use more directives than mothers, looking at the type of directive examined is important. Thus, including utterances that are directive but that do not change the child's focus of attention as responsive paternal verbal behaviors is important to fully understanding the impact of fathers' and mothers' responsiveness on their child's communication outcomes.

Another factor to consider is the relationship between fathers' direct pragmatic communication style and their children's social awareness. For instance, Pelligrini, Brody, and Stoneman (1987) reported that while mothers tended to ignore their typically developing child's violations of conversational conventions, fathers used these opportunities to provide feedback to their child through repetition, modeling the correct

response, and sometimes requesting clarification. For children with ASD who have impaired awareness of the impact of their communicative signals on other people, this directive, didactic pragmatic style may support their language development and help them to clarify their message, and increase their awareness of the impact of their communication on others. Thus, although it is clear that not all directive language is facilitative of language development, some aspects of fathers' direct communication styles may indeed play a supportive role in fostering a child's communication development. Further observational research is needed on the language and interaction styles of fathers and their child with ASD to directly examine the correlation between responsive father language models and the child's communicative ability. To fully understand the impact of parent responsiveness on social-communicative development for children with ASD, further empirical evidence is also needed with regard to the contributions of mothers' and fathers' interaction style to their children's play abilities.

Parent Play Models

Play is one of the most significant tasks of child development, requiring cognitive, social, and emotional skills, and parents have an integral role in the development of their child's play skills. In fact, the responsiveness of parents during play interactions with their children is linked to both higher symbolic level and overall amount of play for the children (Frodi et al., 1985; Spangler, 1989; Steelman, Assel, Swank, Smith & Landry, 2002). Although both mothers and fathers help their child achieve higher-level language and symbolic ability through play, there are qualitative and quantitative differences between parents in play interactions with their children.

In the child's first year of life, mothers and fathers adopt similar roles in play and engage in primarily physical play interactions. From the ages of 12-24 months, however, parents shift focus from physical play interactions to more symbolic pretend play. Mothers seem better able to follow their child's interest and to allow their child to explore and self-select activities, whereas fathers are more directive of their child's play (Power & Parke, 1986). Power and Parke (1986) suggested that fathers might see directing their child's play as their role. In addition, mother-child play is typically more verbal and didactic (Goldberg, Clarke-Stewart, Rice, & Dellis, 2002; Lindsey, Mize, & Pettit, 1997; Parke, 1981; Roopnarine & Mounts, 1998), whereas fathers' play is more active, more complex, and more generative when compared to mothers' play (Clarke-Stewart, 1978; Parke, 1981). At this developmental stage, many researchers have documented that father play is also more physical or rough-and-tumble (MacDonald & Parke, 1986; Power, 1985). For example, mothers are more likely to engage in object play and conventional games such as peek-a-boo, but fathers are more likely to pick their children up, and move their child's arms and legs (Power & Parke, 1982). Interestingly, there is some evidence that the amount of physical play, typically engaged in by fathers, correlates with typically developing children's social competence with peers (MacDonald, 1987). MacDonald and Parke (1984) hypothesized that father-child physical play teaches the child to self-regulate levels of arousal (i.e., being highly engaged during play and returning to baseline when the play is finished).

In addition to self-regulation, Carson, Burks, and Parke (1993) explained that rough-and-tumble play also supports social-emotional development. Rough-and-tumble play requires that the child "decode" the emotional states of another person and interpret

his/her father's facial expression to order to engage in physical play. The authors suggest that this type of play father-child play may help children to "encode" their own emotional states, and better support them in expressing emotions and using facial expressions. It follows that rough-and-tumble play with fathers may be particularly important for children with ASD who have difficulty in establishing theory of mind, or imputing thoughts to others and in understanding and expressing emotion. Furthermore, the authors suggested that this social-communicative aspect of play may explain the correlation between levels of physical play in a child's home and popularity with peers, as popular children excel at expressing and interpreting nonverbal communications. These associations between physical play, social-emotional regulation, and social competence are important aspects to understanding the contributions of fathers to their child's play. Moreover, because rough-and-tumble play is appealing and engaging to children, it may help to establish joint attention between fathers and their children with ASD. Thus, although mothers may be more responsive in play overall, father-child interaction may also be uniquely supportive of play, and social-communication development for children with ASD. Furthermore, there is evidence that fathers spend a larger proportion of their time playing with their children than mothers, making fathers their child's primary play partner in most North American families (Horn, 2000). Fathers have a unique role in supporting their child's development through play.

Taken together, the contributions of fathers to their child's play development may be especially salient for children with ASD, given the pervasive deficits in play associated with ASD, and the link between early play ability and later communicative outcomes. There is a growing body of evidence documenting that higher levels of object

play are an important predictor of later language development for children with autism (Charman, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Toth, Munson, Meltzoff & Dawson, 2006). In fact, intervention targeting play skills has been shown to also improve language development (Kasari, Freeman & Paparella, 2006, Kasari et al., 2008). Thus, children with ASD need intervention focused on both language and play to help them meet their potential. Unfortunately, play intervention and research in ASD have focused primarily on mothers. Although it is likely that fathers of children with ASD demonstrate play styles similar to those used by fathers in interactions with typically developing children, it may also be the case that the bidirectional impact of a child's ASD affects the type of play fathers typically use. In one study, for example, fathers of children with autism engaged in less parallel play than mothers, while being more directive and less consistently responsive to child initiations (Elder et al., 2003). The four fathers in that study also reported being frustrated in not knowing how to play with their children with autism. In a study of father play with children with Down syndrome, however, fathers were shown to help their children achieve levels of symbolic play significantly greater than the children were able to demonstrate in solitary play (de Falco, Esposito, Venuti & Bornstein, 2008).

Parent responsiveness has been linked to improved play outcomes for both typically developing children and children with developmental delays. For instance, responsive parent-child interactions during play are related to both higher symbolic level and overall amount of play (Frodi et al., 1985; Spangler, 1989), while parental behaviors such as intrusiveness negatively influence the play ability of children who are typically developing (Cielinski et al., 1995). Venuti and colleagues (Venuti, de Falco, Esposito, &

Bornstein, 2009) studied the relationship between children's play and parent emotional availability, as measured by the Emotional Availability Scale (Biringen, Robinson, & Emde, 1998), which assesses parents' responsiveness, emotional warmth, and flexibility, and the variety and creativity of their play models and play, in children with Down syndrome. Findings from that study were mixed. Whereas all participating children showed greater frequency of lower level, exploratory play when interacting with their mothers, than in solitary play, only those children whose mothers were judged to be more emotionally available used more symbolic, or higher-level play in interactions with their mothers than in solitary play. Fathers' responsiveness has also been linked to the play quality of at-risk children. For example, Shannon and colleagues (Shannon, Tamis-LeMonda, London, & Cabrera, 2002) investigated the relationship between father-child interactions and cognitive development in children from low-income environments. The authors reported that high levels of paternal responsiveness, especially in combination with high language quality, were associated with quality of play and higher-level communication.

Thus, the responsiveness of both mothers and fathers has been shown to play an important role in enhancing play development for both children with developmental delays as well as typically developing children. To date, however, associations between parent responsiveness and the quality of object play have not been investigated specifically for children with ASD. In addition, the unique contributions of fathers and mothers to their child's play development have not been examined in the autism literature. Understanding the influence of parent responsiveness and the unique contributions of mothers and fathers to the play skills of their children with ASD may

have important clinical implications for effectively involving all parents in play-based autism intervention. Given the pervasive deficits in play associated with the disorder, along with the link between early play ability and later communicative outcomes, the contributions of fathers to a child's play may be especially salient for children with ASD. Thus, involving fathers in communication, language, and play intervention for children with ASD, may allow clinicians to capitalize on an important opportunity to recruit the child's primary play partner in targeting social-communicative gains. An essential step towards effective father involvement is understanding the contributions of paternal responsiveness to the language and play development of children with ASD.

Parental Broad Autism Phenotype

As discussed throughout this review, parent-child interactions are influenced by multiple child and parent characteristics. One variable that may be specifically relevant to investigating parent-child interactions for families of children with ASD is the parental broad autism phenotype. The broad autism phenotype (BAP) describes the set of personality and language characteristics that reflect the phenotypic expression of the genetic liability to autism in non-autistic relatives of individuals with autism (Folstein & Rutter, 1977). In studies of the BAP, parents of children with autism have been shown to demonstrate a range of language and social deficits when compared to parents of both typically developing children, and children with developmental delays (Landa et al., 1992; Piven et al, 1994). Personality, social, and language features that comprise the BAP parallel the defining behavioral characteristics of autism including social deficits, communication deficits, and stereotyped, repetitive behavior (Piven and Palmer, 1997).

Specifically, researchers have defined three primary components of the BAP: (a) aloofness, (b) rigid personality, and (c) pragmatic language problems (Husley, Losh, Parlier, Reznick, & Piven, 2007). Aloofness is characterized by diminished interest or enjoyment of social interaction. Rigid personality is defined as difficulty adjusting to change. Finally, pragmatic language problems refer to deficits in the social use of language, resulting in reduced effectiveness of communicative exchanges.

There is emerging evidence that the BAP impacts the communicative effectiveness of parents during exchanges with other adults. For example, Ruser and colleagues (2007) reported that parents of children with autism demonstrated significant deficits in social language, and used less frequent eye contact in interactions with adult examiners compared to parents of children with Down syndrome. Moreover, in that study, fathers of children with autism used significantly less eye contact than mothers of children with autism. Similarly, fathers of children with autism displayed characteristics of the BAP in a study by Scheeren and Stauder (2008), comparing 13 fathers of children with ASD (ages 6 to 16 years) to fathers of children who were typically developing. The authors found that fathers of children with autism were more likely to exhibit gaze direction patterns similar to those found in autism. The BAP may also impact the quality of parent-child interactions, although this has not been examined empirically in the literature. Given the strong link between the quality of early parental interactions and later language outcomes for children with autism, understanding any potential impact of the parental BAP on child outcomes, and, more importantly, whether parent responsiveness mediates this relationship will have important clinical implications. Parents with characteristics of

the BAP qualitatively may benefit from more targeted support to maximize the effectiveness of parent-child interactions.

Summary and Research Questions

This chapter has provided an overview of the existing literature on the early language, joint attention and play deficits that impact the communicative effectiveness of children with ASD, and of the integral parent behaviors that may facilitate language and play development. The transactional model was proposed to describe how child characteristics and parent behaviors each influence the quality of parent-child interactions, and subsequently affect social-communicative outcomes for children with ASD. Child characteristics were described, including communication and play development characteristics specific to children with ASD. Parent characteristics, including responsiveness, language and play models, and the parental broad autism phenotype were also described. In addition, findings from several studies investigating the impact of parental responsiveness on communication and play outcomes for children who are typically developing and children with developmental disabilities including ASD were reviewed.

Several limitations were identified in the existing literature on parent-child interactions in ASD. To date, the majority of parent and intervention research in autism has involved mothers, with the presumption that findings generalize to fathers. However, as described previously in this chapter, mothers and fathers have different interaction and play styles. It is striking that few observational studies of parent-child interactions have involved fathers of children with ASD. In fact, little knowledge exists as to how and why

father-child interactions with a child with ASD may parallel or differ from the types of interactions other fathers have with their children. In addition, whereas several studies have demonstrated maternal responsiveness as a strong predictor of concurrent and later language outcomes, to date, no studies have examined the influence of paternal responsiveness on communication development for children with ASD. In order to understand the significance of the relationship between maternal and paternal responsiveness and their bearing on development for children with ASD, detailed information based on observations of father-child interactions is warranted. Such knowledge would facilitate greater understanding of the relationships among father language and play models and the developing language and play skills in children with autism. Furthermore, with this type of knowledge, the foundation could be laid to study the factors that may impact fathers' involvement in early intervention programs for their children.

Another limitation of the existing literature is that to date, no studies have examined the role of parent-child interaction on play development for children with autism. Children with autism demonstrate severe deficits in play. Furthermore, higher-level or symbolic play has been shown to be a strong correlate of language development for children with ASD (Mundy, Sigman, Ungerer & Sherman, 1987; Sigman & Ruskin, 1999; Ungerer & Sigman, 1981). Understanding the contributions of mothers and fathers to their child's play development is an important first step in effectively involving both mothers and fathers in play-based communication intervention for children with ASD.

Finally, no studies have examined the potential mediating role of parent responsiveness in any associations between parental BAP and child play and language

development. Understanding the contributions of both mothers' and fathers' responsiveness to the development of language and play in young children with ASD and examining whether parent responsiveness mediates any potential impact of the parental BAP on the language and play outcomes of children with autism will provide researchers and clinicians with important descriptive data necessary to design effective early autism interventions that meet the Part C mandates of being both "family centered" and "individualized."

Thus, this review of the literature makes apparent the need for further studies of father contributions to language and play development for children with ASD. The current investigation seeks to fill several gaps in the existing knowledge on parent-child interaction in autism by examining the associations between parent responsiveness during father-child and mother-child interactions and child language and play abilities. Specifically, the current study addresses the following five research questions.

1. *To what extent are the responsive verbal behaviors of both mothers and fathers correlated with language ability of children with ASD?*
2. *What are the comparative symbolic levels of object play achieved by children with ASD in interactions with their fathers, mothers, and an unfamiliar adult?*
3. *To what extent are the responsive play behaviors of mothers and fathers associated with levels of symbolic play demonstrated by children with autism??*
4. *Does parent verbal responsiveness mediate any potential association of the parental broad autism phenotype with the language skills of children with ASD??*
5. *Does parent play responsiveness mediate any potential association of the parental broad autism phenotype with the play skills of children with ASD?*

The model presented in Figure 2.2 depicts the various relationships that were examined in the current study.

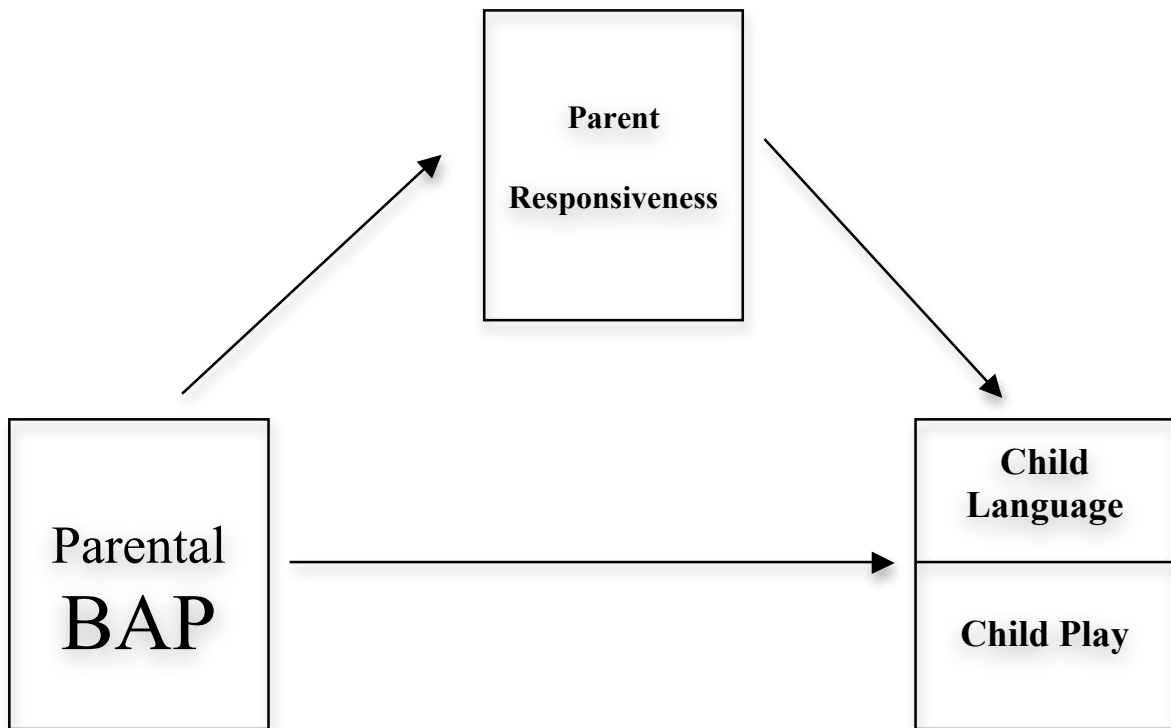


Figure 2.2. Proposed model of the mediating role of parent responsiveness between parental BAP and child language and play skills

CHAPTER 3: RESEARCH DESIGN AND METHODS

There were three main aims of this observational study. First, the relationships between parent verbal and play responsiveness during father-child and mother-child interactions and the language and play abilities of children with autism spectrum disorders (ASD) were examined. Second, the level of symbolic object play demonstrated by children with ASD in interactions with their fathers, mothers, and an unfamiliar adult were compared. Finally, the mediating role of parent responsiveness between the parental broad autism phenotype and child language and play skills was investigated.

Sample characteristics and Recruitment Procedures

A total of sixteen children with ASD and their mothers and fathers participated in this study. Inclusion criteria for children were: (a) chronologic age between 36 and 69 months; (b) diagnosis of autism spectrum disorder as confirmed by the Autism Diagnostic Observation Schedule (Lord et al., 2006); (c) no severe sensory or motor impairments; and (d) no identified metabolic, genetic, or progressive neurological disorders. In addition, each child was required to have two parents who were biological parents or caregivers residing with the child continuously since birth. Parents also had to be married. Table 4.1 and 4.2 describe the characteristics of the child and parent participants respectively.

Families were recruited from the Piedmont area of North Carolina. Thirteen of the 16 child participants were recruited from two ongoing grant projects, Social Communication and Symbolic Play Intervention for Preschoolers with Autism (Institute of Education Sciences R324B070056, L. Watson, Principal Investigator) and Predicting Useful Speech in Children with Autism (NIDCD R01 DC006893, P. Yoder, Vanderbilt University, Principal Investigator; L. Watson, University of North Carolina at Chapel Hill Site Principal Investigator). Three families were recruited via word of mouth. Once parents contacted project staff, a telephone screening was conducted and/or an email was sent to provide parents with information regarding the project. If appropriate, based on the telephone screening and parent interest, participating families were scheduled for the assessment session. The study was explained face to face and all questions were answered prior to asking the parent to sign the informed consent. Informed consent was obtained at the beginning of the assessment. Parents were told they would receive compensation for participating in the study and were given a money order for \$25.00 after completion of the assessments and observations.

Standardized Measures and Questionnaires

Autism Diagnosis

The Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 2006), a standardized play-based protocol consisting of a series of structured and semi-structured activities providing opportunities to observe interaction, communication, play and repetitive behaviors was administered or obtained for shared participants from ongoing projects to confirm entry diagnosis for child participants. Total algorithm scores on the

ADOS were used to confirm entry diagnosis for selection purposes. For one participating child, the ADOS was administered by the local Children's Developmental Services Agency.

Non-verbal Developmental Quotient

The Mullen Scales of Early Learning (MSEL; Mullen, 1995) was completed for thirteen child participants enrolled in two larger ongoing studies in order to establish a measure of children's non-verbal developmental quotient. The MSEL is a comprehensive measure of cognitive function for young children from birth to 68 months of age. The test generates six age-normed scores: (a) *Gross Motor* measures balance, mobility and motor planning; (b) *Visual Reception* measures visual processing skills, spatial organization and visual memory; (c) *Fine Motor* measures coordination, visual organization, fine motor planning and control; (d) *Receptive Language* measures understanding spoken language, auditory-spatial concepts, memory for commands and general information; and (e) *Expressive Language* measures the child's ability to use speech to communicate and express ideas, vocabulary, abstract thinking and reasoning, auditory memory and comprehension. Each subtest consists of 33 questions. Subtest standardized T-scores have a mean of 50 and a standard deviation of 10. The MSEL is conducive for evaluating verbal and non-verbal development quotients for young children with autism (Akshoomoff, 2006). As in previous studies, scores on the Visual Reception subscales were used as a measure of children's non-verbal developmental quotient (Boyd, et al., 2010; Chawarska & Volkmar, 2008).

Child Language Ability

The Preschool Language Scale-4 (PLS-4; Zimmerman, Steiner & Pond, 2002) was administered to assess child language abilities. The PLS-4 is a standardized measure of receptive and expressive language skills for children birth to 6 years, 11 months of age. The test is composed of two subscales: Auditory Comprehension and Expressive Communication. The PLS-4 yields norm-referenced scores for each subscale, as well as a total score computed from the two subscales. PLS-4 standard scores have a mean of 100 and a standard deviation of 15. In the current investigation, total raw scores were used as a measure of child language. The PLS-4 was administered either by the author, a licensed speech-language pathologist with 10 years of clinical experience working with children with autism, or by a Masters-level graduate student in speech-language pathology who had been trained to administer the PLS-4 with good fidelity and score it reliably.

Parental Broad Autism Phenotype

The Broad Autism Phenotype Questionnaire (BAPQ) (Hurley, et al., 2006) was administered to participating parents to assess personality and language characteristics of the broad autism phenotype (BAP). The BAPQ was used, because it is an efficient and valid informant report instrument designed for diagnosis and characterization of the BAP in adult relatives of individuals with autism. To avoid potential response bias, authors of BAPQ title the form distributed to parents “Personality Styles and Preferences Questionnaire.” The questionnaire is composed of a set of 36 items, organized into 3 subscales (Aloof; Rigid; Pragmatic Language), that reflect the social, stereotyped

repetitive, and communication behavioral domains characteristic of autism. Parents completed self-report and informant-report BAPQ items by rating how frequently a statement applied to them and their spouse along a 6-point Likert scale (1 = “very rarely”; 2 = “rarely”; 3 = “occasionally”; 4 = “somewhat often”; 5 = “often”; 6 = “very often”). Composite scores are calculated by summing the scores on the three characteristic subscales. Sensitivity and specificity of composite scores are 81.8% and 78.1% respectively (Hurley et al., 2006).

Demographics

Finally, participating parents completed a demographic questionnaire to indicate ethnicity (Hispanic or non-Hispanic) and race (i.e., American Indian/Alaska Native; Asian; Black/African-American; Native Hawaiian/Pacific Islander; White) and to measure levels of household income and parental education. Socio-economic status (SES) has been shown to be a strong moderator of language used by parents and learned by children. Generally, the more vocabulary children are exposed to early on in life, the higher their verbal ability will be (Hart & Risley, 1995). Therefore, levels of household income and parental education were measured to determine if either or both needed to be treated as a covariate in the planned analysis.

Household income was measured as one of six levels: (a) less than \$20,000 (b) \$20,000-\$39,999; (c) \$40,000-\$59,999; (d) \$60,000- \$79,999; (e) \$80,000-\$99,999; (f) greater than \$100,000. Parental education was measured as one of six highest levels of education completed: (a) grades 1-11; (b) high school graduate/GED;

(c) Associates/Technical degree; (d) Bachelors; (e) Masters; or (f) Doctorate/equivalent professional level degree.

Data Collection and Instrumentation

The study followed a standardized protocol approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. Upon consenting to be in the study, parents completed a demographic questionnaire and the Broad Autism Phenotype Questionnaire (Hurley, Losh, Parlier, Reznick & Piven, 2006). As noted above, copies of the latter distributed to parents were titled “Personality Styles and Preferences Questionnaire” to avoid potential bias. To confirm diagnosis of autism, scores from the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2006) were obtained via data sharing with the larger projects. Scores from the Mullen Scales of Early Learning (MSEL, Mullen, 1995), a measure of the non-verbal developmental quotient, were also obtained from the larger studies for thirteen of the child participants. For the thirteen children recruited from ongoing projects, ADOS and MSEL scores obtained within one year of participating in the current study were used. MSEL scores were not available for the three children recruited via word of mouth. In the current study, MSEL scores were used to describe the sample but not in the analysis of research questions. The ADOS was administered as part of the current study for two children not recruited from the ongoing projects. For one child recruited via word of mouth, ADOS testing and diagnosis of autism was completed through a local Children’s Developmental Services Agency. The Preschool Language Scale-4 (Zimmerman et al., 2004) was administered to all child participants to assess child receptive and expressive language

ability. Finally, three 15-minute free play observations (unfamiliar adult-child, mother-child, father-child) were conducted in the laboratory. Unfamiliar adult-child observations, that is, free play sessions with a research staff member present, took place first in order to serve as a baseline of child play behaviors. Next, mother-child or father-child observations were conducted. The order of observations was counterbalanced for mothers and fathers across participants to control for order effects.

Observations took place at the project office for the Useful Speech Study. The observation room measured 15' 8" x 16' 3." A one-way mirror separated the observation room from the adjoining recording room. A digital video camera positioned behind the one-way mirror captured video continuously. A small microphone was mounted to the ceiling of the observation room. A child-size table and chair, and an adult chair were placed in the center of the room and a round area rug was placed between the chairs and the one-way mirror. A timer was mounted to the wall and a large bucket was in the corner of the room.

As described in Table 3.1, the mothers, fathers, and unfamiliar adult each used a different set of toys when interacting with the children. These standard, parallel sets of age-appropriate toys were created to elicit a full range of object play (i.e., exploratory, relational, functional, symbolic) across the three play observations and to maintain novelty across adults, and. In addition, toys represented masculine, feminine and gender-neutral categories. The toys were arranged on top of the table and in a semicircle around the area rug.

Table 3.1

Standardized, Parallel Toy Sets for Mother-Child, Father-Child, and Unfamiliar Adult-Child Play Observations

Mother-child Toy Set	Father-child Toy Set	Unfamiliar Adult-Child Toy Set
Baby doll & bottle	Baby doll & bottle	Baby doll & bottle
Nesting cups	Stacking Rings	Wooden Blocks
Pop beads	Snap-together turtles	Jack-in-the Box
Little People® Barn, Tractor, and Figures: Famer, Pig, Cow, Horse, Donkey, Bushel of Apples, Water Pump, Corn	Little People® House, Minivan and Figures: Mom, Dad, Girl, Baby, Dog, Bed, Chairs, Table, Dog Bowl	Little Tykes® Dump Truck and driver figures; Doll feeding accessories: Plates, Spoons, Forks, Blanket
Toy Car	Little People® Helicopter	2 Die Cast Cars
Beads	Ribbon Twirlers	String
Monkey rattle	Alligator Push Toy	Musical Radio & Phone
Slinky®	Pinwheel	Mirror Disc
Tolo® Hard Plastic Ball	Glitter Ball	2 Bean Balls
Little Tykes® Poppin' Pals	Fisher Price® Barn Poppin' Pals	Sesame Street® Poppin' Pals
Board Books	Board Books	Board Books

Unfamiliar Adult-child Play Observation

The unfamiliar adult-child play observation was conducted to establish a baseline of the child's level of object play. To that end, the role of the unfamiliar adult was to redirect the child in order to manage any self-injurious, escaping, or excessively repetitive behaviors. Thus, the unfamiliar adult responded to any direct communicative attempts by the child, and manipulated a toy and/or physically placed toys near the child if the child perseverated on one toy or action. However, the adult did not direct the child's play, or provide models and/or play prompts for the child.

Parent-child Play Observations

Following the unfamiliar adult-child play observation, mother-child and father-child play observations were conducted. The order of parents was counterbalanced across mothers and fathers to control for order effects. At the start of the observations, parents

were asked to “Play as you would normally would at home. Feel free to use some or all of the toys. We ask that if you are going to sit, parents sit in the larger blue chair so that it is easier to see the child on video. ”

Observational Measures: Coding and Reliability

Parent responsiveness

Standardized 15-minute video recordings of mother-child and father-child free play interaction were coded at 5-second intervals for responsive parental acts using the Procoder DV software program (Tapp, 2003). Given that parent responsiveness is contingent upon child initiations, this variable is calculated as the proportion of 5-second intervals in which parents use responsive strategies out of the total number of 5-second intervals in which the child provides a lead to which the parent can respond.

Coding was conducted in three passes, using a coding system developed by Yoder, Fey, Thompson, McDuffie, & Lieberman (unpublished; see Appendix B for complete coding manual). On the first pass, coders indicated whether the interval was (a) codeable or (b) uncodeable. Codeable intervals required that the child was visible on screen for the entire 5-second interval. On the second pass, coders identified any child initiations and coded them to indicate whether the child provided a tactile (i.e., touching a toy) or attentional lead (i.e., looking at a toy) for the parent to follow. Child leads were coded under two conditions (a) if the child touched or looked at a toy spontaneously, without parental prompting (i.e., child initiated lead) or (b) if the parent first introduced a lead and the child was able to sustain play or attention to that toy for a full 10 seconds (two 5-second intervals), the child was credited with a “child adopted” lead in the third

interval. Finally, on the third pass, parent responses were coded for those intervals in which a child lead was first identified. Responsive parent behaviors consisted of either (a) responsive verbal behaviors (“follow-in-utterances”); or (b) responsive play behaviors (“physical play”); or (c) both verbal and play responses.

Follow-in-utterances. Parent verbal responses to their child’s leads that referenced the child’s immediate focus of attention were coded as follow-in-utterances. In coding this variable, distinctions were not made between types of responsive verbal behaviors (i.e., comments vs. directives) used by parents. Rather, this code was applied to all parent utterances that linguistically mapped to the child’s focus of attention. To be considered a “follow-in-utterance,” the parent utterance had to have two attributes: (a) it had to relate to the child’s focus of attention (object or event); and (b) it had to have a specific semantic relationship to the child’s focus of attention, including the object, properties of the object (e.g., color, size, textures, sounds associated with the object) and action, or qualities of the action. Affirmatives (e.g., “all right”; “good job”) and negative response words were not coded as follow-in-utterances. Interjections and vocatives were also not coded as follow-in-utterances (e.g., “um,” “Eh?”). Finally, routinized utterances were not coded as follow-in utterances. These routinized utterances included counting, alphabet recitation, songs, finger plays, and utterances consisting of all or part of a story text.

Physical Play. The nonlinguistic, responsive ways the parent played with their child’s focus of attention were identified as physical play. Here the term “physical” did not refer to a specific type of play (e.g., rough-and-tumble) but was used to denote the parent’s active manipulation of the child’s object of attention. The physical play variable is comprised of four types of responsive parent play behaviors:

(a) Parent *imitated* child action with the same or similar touch lead referent. The parent does a similar action as the child's. The parent play act could be reduced (not all of the child's action), or expanded (all of the child's action plus some other action), or exact (all components of child's action).

(b) Parent *aided the* child's action. The parent did something to receive or enable the child's action (e.g., moving something in the child's way; putting out a container for the child's action).

(c) Parent *demonstrated a new action* on the child's referent. The parent modeled what the child could do with the object s/he was currently touching.

(d) Parent demonstrated a new action on a *different object and related this object* to the child's referent. This included instances when the parent related a new object to the child's object of focus by moving the object to the perimeter of the referent, moving the adult or child object so they came in contact with each other or verbally relating the objects so that both were mentioned in the same utterance or adjacent utterances.

These parent responsiveness variables were coded reliably in previous research with children with autism (Yoder & Stone, 2006). The Yoder and Stone coding scheme was chosen over other measures of responsiveness (e.g., Siller and Sigman, 2002, 2008) because their scheme included both parental verbal and play behaviors in the operational definition of parent responsiveness. In addition, this coding scheme recognizes all parent utterances that reference the child's focus of attention as responsive behavior. Thus, directives were considered responsive if they referenced the child's focus of attention. Given that paternal responsiveness was a focus of this study and that fathers were

expected to use more directives in interactions with their children than mothers, it was considered important to use an operationally defined parent responsiveness variable which captured this aspect of father interaction style.

Child Symbolic Play Skills

For all codeable intervals that contained a touch lead (i.e., child spontaneously touched a toy or adopted a play act initiated by the parent for a period greater than two 5-second intervals), coders rated the symbolic level of the child's play in accordance with a mutually exclusive and exhaustive category system that covered four broad categories of object play: (a) exploratory; (b) relational; (c) functional; and (d) symbolic. These broader categories included fourteen levels of object play (Table 3.2). These play levels were derived from previous research on play development in children with developmental disabilities and ASD (Kasari, Freeman, & Paparella, 2006; Ungerer & Sigman, 1981). Scores were then summed to four broader categories of play: (a) exploratory; (b) relational; (c) functional; (d) symbolic.

Scores were computed separately for each free play session (unfamiliar adult-child, mother-child, father-child). Four measures were then calculated: the absolute frequency and the proportional frequency of intervals containing exploratory, relational, functional and symbolic play acts.

Table 3.2
Fourteen Coded Levels of Object Play

Level	Categories and Examples
I Exploratory	<p><i>1. Exploratory</i> Child performs indiscriminate actions on a toy that are unrelated to the toys' function (e.g., shakes, mouths, turns, bangs, rolls, bounces, throws, passes to another person).</p>
II Relational	<p><i>2. Presentation Combinations</i> Child combines toys with perceptual support based on specific physical structure of the toys in the original manner presented (e.g., nests nesting cups, stacks stacking rings).</p> <p><i>3. General Combinations</i> Child combines objects to create new relationships based on general properties of the objects (e.g., puts small objects into a bucket).</p> <p><i>Specific Physical Combinations</i> Child combines toys based on specific physical properties (e.g., stacks nesting cups in size order).</p>
III Functional	<p><i>4. Functional object-directed</i> Child uses one or more toys in a conventional (i.e., approximates pretense but without confirmatory evidence) play act (e.g., puts phone to ear without talking).</p> <p><i>5. Functional self-directed</i> Child uses conventional play act on him/herself (e.g., combs own hair).</p> <p><i>6. Functional other-directed</i> Child uses conventional play act on another person (e.g., combs another person's hair with play comb)</p> <p><i>7. Functional doll-directed</i> Child acts on doll as if it is an animate figure (e.g., gives the doll a bottle).</p>
IV Symbolic	<p><i>8. Doll-as-agent</i> Child attributes agency to a doll or action figure, and moves the doll/action figure's body as if it were alive (e.g., has figure knock on door of doll house).</p> <p><i>9. Symbolic substitutions</i> Child uses an object/toy to represent another object (e.g., pretends a cup is a telephone and talking into it)</p> <p><i>10. Single-scheme Sequences</i> Child uses the same conventional pretend act on a series of people and/or "animate" figures (e.g., gives bottle to baby and to observer).</p> <p><i>11. Imaginary object/ characteristics</i> Child uses imaginary objects or attributes imaginary characteristics to a toy. (e.g., a hot plate of food) or moves a certain way (a bumpy car ride), or when a child pretends that s/he has an object that is not actually present.</p> <p><i>12. Multi-scheme Sequences</i> Child links two or more pretense actions (e.g., pouring into an empty cup from the teapot and then drinking).</p> <p><i>13. Symbolic role play</i> Child pretends to be another person or character in a play routine (e.g., child takes role of "mom" while playing house)</p>

Interobserver Reliability

Interobserver reliability was assessed for all coded observational measures used in the analyses. Coding was carried out by two independent coders, with backgrounds in

public health and communication sciences and disorders, respectively. The primary coder was blind to the research questions and hypotheses. During training, coders scored four, 15-minute videos. Consensus discussions were conducted between the researcher and coders to clarify codes, finalize the coding schema, and ensure each coder was trained to 80% reliability on the 9 behavioral codes. Ongoing checks of reliability were conducted on a random 16% sample of the remaining videos. Average point-to-point reliability (Cohen 1960) for determining whether intervals were codeable was 95.6% (range = 89-100%). Average agreement for child leads was 95.3% for touch leads (range = 91-96%); and 86.8% for look leads (range = 75-100%). For parent response variables, average agreement was: follow-in-utterances (82%; range = 50-88%); physical play (90%; range = 75-100%); and for both (85.3% range = 63-96%) Average agreement for child play behaviors was: exploratory play (85.8%; range = 83-89%) relational play; (94.2%; range = 90-100%); functional play (87.8%; range = 80-100%); and symbolic play (90.8% range = 83-100%).

Power Analysis

A total sample size of 16 triads provided a 70% chance of detecting bivariate correlations of .5 or greater with 95% confidence. Correlations of this magnitude have been demonstrated in previous research by Siller and Sigman (2002, 2008), who reported associations between maternal responsiveness and gain in language for children with autism at one, 10, and 16 years with Spearman's *rho* values of .33, .67, and .79 respectively.

CHAPTER 4: RESULTS

Prior to answering the research questions, preliminary analyses of the data were conducted. Distributions of variables were examined to determine whether they met assumptions of normality. In addition, correlations were calculated to determine whether household income or parental education levels accounted for significant variance in parent verbal and play responsiveness, or child language or play skills. Then descriptive statistics were reported for variables used in the analyses. Further strategies for data analysis procedures are described relative to each of the research questions below. Results were considered significant when they fell at or below an alpha of .05. Cohen's guidelines (1988) were used for interpreting small, medium, and large effects in the social sciences, corresponding to correlations of 0.1, 0.3, and 0.5, respectively. Statistical analyses were conducted using SPSS 18.0 for Mac.

Sample Demographics

The sample included 12 boys and 4 girls, and children ranged in age from 40 to 69 months ($M = 53.3$ months, $SD = 9.6$ months); descriptive information for child measures is presented in Table 4.1. Participating mothers ranged in age from 30 to 47 years ($M = 38$ years, $SD = 4.5$) and varied considerably in their educational background: 12.5% had a doctorate or professional degree; 62.5% had a master's degree, 18.75% completed a baccalaureate college degree; and 6.25% had an associate's degree. Fathers ranged in age from 31-56 years ($M = 39.6$, $SD = 5.7$) and had similarly variable

educational backgrounds: 25% had a doctorate or professional degree; 37.5% had a master's degree; 18.75% completed a baccalaureate college degree; and 18.75% had an associate's degree. The sample was predominantly White (69% mothers, 63% fathers, 56% children), but included families of Hispanic (13% mothers, 19% fathers), Asian (19% mothers, 19% fathers, 19% children), and mixed (6.25% mothers, 25% children) ethnic origin. Levels of household income ranged from to \$20,000-\$39,999 to >\$100,000. As indexed by a median household income of \$80,000-\$99,999 per year, the participating families are best described as upper middle class on average.

Preliminary Analyses

Correlations were conducted to examine associations between levels of household income and parent education, with child measures of language and play skills and parent measures of verbal and play responsiveness. Levels of parent education and household income were not significantly associated with the other variables and were therefore not considered further.

Descriptive Statistics

Child Standardized Measures

Table 4.2 shows the means and standard deviations for the standardized child measures used in the current study: Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2006); Non-verbal Developmental Quotient from the Visual Reception subtest of the Mullen Early Learning Scales (NVDQ; Mullen, 1995); and Preschool-Language Scale-IV (PLS-4, Zimmerman et al., 2004).

Table 4.1
Demographic Information for Participating Families

	Mothers	Fathers	Children
Age	(Years)	(Years)	(Months)
Mean	38	39.6	53.3
SD	4.5	5.7	9.6
Range	30-47	31-56	40-69
Ethnicity			
White	69%	63%	56%
Hispanic	13%	19%	0%
Asian	19%	19%	19%
Mixed	6.25%	0%	25%
Education			
Associates	6.25%	18.75%	
Bachelors	18.75%	18.75%	
Masters	62.5%	37.5%	
Doctorate/ Professional	12.5%	25%	
Household Income			
Median	\$80,000-\$99,999		
Range	\$20,000->\$100,000		

Table 4.2

Descriptive Statistics for Standardized Child Measures

	Age (Months)	ADOS Total	NVDQ	PLS Total Language Raw Score	PLS Total Standard Score
Mean	40-69	15.9	31.6	65.4	65.6
Range	53.3	7-26	20-63	35-119	50-107
SD	9.6	5.4	15	23.7	19.0

Note. ADOS = Autism Diagnostic Observation Schedule, NVDQ= Non-verbal developmental quotient; PLS=Preschool Language Scale-4

Distribution of scores for the Visual Reception subtest of the Mullen Scales and PLS-4 total language raw and standard scores were negatively skewed, reflecting the cognitive and language impairments characteristic of children with ASD. However, child

scores on the ADOS were more normally distributed, suggesting a wide range of characteristics of autism were represented across the sample of participating children.

Child Observational Measures

Child Leads. A summary of the frequency of child look leads and touch leads during sessions with mothers and fathers is provided in Table 4.3. A paired samples t-test was conducted to examine differences in children's touch and look leads during free play interactions with their mothers and fathers. Results indicated that children used a similar frequency of look leads during play with their mothers and fathers, $t(15) = .243, p > .05$. In contrast, children used significantly more touch leads in the mother-child context than in the father-child context, $t(15) = 2.47, p < .05$.

Table 4.3
Child Leads during Interactions with Mothers and Fathers

	Look Leads		Touch Leads	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Child-Mother	8.56	7.03	138.3	25.7
Child -Father	8.06	9.0	118.25	48.3

Object Play. Table 4.4 presents the mean and standard deviations for the absolute and proportional frequencies of the 4 levels of object play (i.e., exploratory, relational, functional, symbolic) demonstrated by children during interactions with their mothers, fathers, and an unfamiliar adult.

In examining the distribution of levels of object play across mothers, fathers and an unfamiliar adult, one case with extreme values was identified. This child engaged in significantly more symbolic play acts with his father than with his mother or with an unfamiliar adult. Scores for the father's responsive play behaviors for this child's father were also extreme. The behavioral coding and video recordings were reviewed and it was

confirmed that this child engaged primarily in symbolic play with his father and lower-level play with his mother and unfamiliar adult; and that the father used a high frequency of responsive play behaviors when interacting with his child. The child's scores on the ADOS (Lord et al., 2004), PLS-4 (Zimmerman et al., 2006), and Mullen Visual Reception subscale (Mullen, 1995) were well within range of the study sample. Thus, scores for this case were included in the analyses, as this child likely represents an extreme although true member of the population of interest.

Table 4.4
Comparison of Child Object Play with Unfamiliar Adult, Mother, and Father

Level of Object Play	Child with Unfamiliar Adult		Child with Mother		Child with Father	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Exploratory						
Frequency	85.0	36.3	63.8	26.8	57.8	38.3
Proportion	.76	.23	.47	.18	.56	.30
Relational						
Frequency	10.9	13.0	31.0	13.5	7.8	8.5
Proportion	.08	.09	.23	.10	.07	.08
Functional						
Frequency	16.9	20.4	33.4	20.8	29.4	29.1
Proportion	.14	.13	.23	.13	.22	.18
Symbolic						
Frequency	4	9.5	9.9	14.9	23.5	39.7
Proportion	.02	.05	.06	.09	.14	.24

Parent Responsiveness

Parent Responses. Table 4.5 presents the means and standard deviations for parent responsive verbal and play behaviors for mother and father participants.

Table 4.5
Descriptive Statistics for Parent Verbal and Play Response Variables

	Follow-in-Utterances (FIU)		Physical Play (PP)		FIU + PP		Total Responsive Verbal Behaviors		Total Responsive Play Behaviors	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mothers	49.06	26.7	10.0	8.3	37.0	19.4	86.1	29.5	47.0	24.3
Fathers	31.1	15.2	15.6	18.8	22.7	15.1	53.8	28.6	38.3	31.0

Note. M= Means; S=Standard Deviation

Comparisons of verbal and play responsiveness between mothers and fathers. A paired-samples t-test was conducted to compare frequency of responsive verbal behaviors for mothers and fathers. There was a significant difference in the scores for mothers and fathers, $t(15) = 6.03$, $p < .01$. These results suggest that overall mothers used significantly more responsive verbal acts during play with their children than fathers.

A paired-samples t-test was also conducted to compare the frequency of responsive play behaviors for mothers and fathers. No significant difference in the scores for mothers and fathers was found, $t(15) = .834$, $p > .05$, indicating that overall mothers and fathers were similar in the frequency of their play responses.

Comparisons of verbal and play responsiveness within parent participants. A paired-samples t-test was conducted to compare frequency of responsive verbal ($M=86.1$, $SD= 29.5$) and play ($M=47.0$, $SD= 24.3$) behaviors within the sample of mothers. A significant difference in the scores for the verbal and play variables within the sample of mothers was found, $t(15) = 4.95$, $p > .05$, indicating that mothers in the sample were more likely to respond verbally than with play actions.

A paired-samples t-test was conducted to compare frequency of responsive verbal ($M = 53.8$, $SD = 28.6$) and play behaviors ($M = 38.3$, $SD = 31.0$) within the sample of fathers. No significant difference in the verbal and play responsiveness scores within the sample of fathers was identified, $t(15) = 2.081$, $p > .05$. These results suggest that verbal

and play responses were equally likely for fathers in the sample.

Parental Broad Autism Phenotype

Although the current study included only 16 mother-father dyads, a wide range of parent BAP characteristics was represented within the parent sample (Table 4.7). For example, three mothers and five fathers did not meet criterion on any of the BAPQ subscales (Aloof, Rigid, Pragmatic Rating Scale). At the other extreme, two mothers and three fathers met criterion on all three subscales.

A paired samples t-test was conducted to examine differences between mothers and fathers scores on the 3 subscales of the BAPQ. No differences were identified between mothers and fathers on any of the three subscale scores (Aloof, $t(15) = -.18, p > .05$; Rigid, $t(15) = -.50, p > .05$; or Pragmatic Language, $t(15) = -.83, p > .05$). As expected, differences between mothers' and fathers' summed scores on the BAPQ ($t(15) = -5.51, p > .05$) were also not significant.

Table 4.6
Scores for Mothers and Fathers on the BAP-Q

BAP- Q Scale	Mothers		Fathers	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Aloof (12 items)	2.83	.72	2.88	.84
Rigid (12 items)	3.13	.49	3.24	.60
Pragmatic Language (12 items)	2.55	.51	2.68	.40
Total	8.53	1.4	8.80	1.5

In addition to the wide range of BAPQ scores for individual mothers and fathers, there was also a wide range of combinations of BAP characteristics within and across married couples. For example, at one extreme, two mother-father dyads did not meet criterion for any of the subscales. At the other extreme, for one parent dyad, the mother

met criteria for all three BAPQ subscales whereas the father met for none. Table 4.7 presents the various BAP characteristics of the 16 married couples participating in the study.

Table 4.7
Parents Meeting Criterion for Subscales of the BAPQ

	None	Aloof Only	PLS Only	Rigid Only	Aloof + Rigid	Aloof + PRS	PLS + Rigid	Aloof+ PLS+ Rigid
Mothers	E I N	K L	A H	B F G	J	C P	D	M O
#Mothers	3	2	2	3	1	2	1	2
Fathers	A E I J O	B	F K N	L M	H	P		C D G
#Fathers	5	1	3	2	1	1	0	3
Total Parents	8	3	5	5	2	3	1	5

Note. Upper case letters identify married mother-father dyads

Analyses of Research Questions

Several statistical analyses were necessary to address each research question. Results are described relative to each of the five research questions driving the proposed investigation. Given the non-normal distribution of several variables of interest, a non-parametric statistic, Spearman's *rho*, was used in all correlational analyses, as is custom in the social sciences (Black, 2003).

Research Question 1: To what extent are the responsive verbal behaviors of both mothers and fathers correlated with language ability of children with ASD?

The purpose of the first research question was to examine the relationship between parent verbal responsiveness and child language ability for young children with autism. Spearman's rho was calculated between the frequency of father and mother verbal responsiveness variables, derived from the parent-child free play session, and children's raw total scores from the PLS- 4.

A significant, positive relationship between the frequency of mothers' responsive verbal behaviors and child language scores was found ($\rho = .695$, $p < .05$) indicating that as mothers' verbal responsiveness increased, child language skills also increased. The association of mothers' responsive verbal behaviors and child language scores is depicted in Figure 4.1.

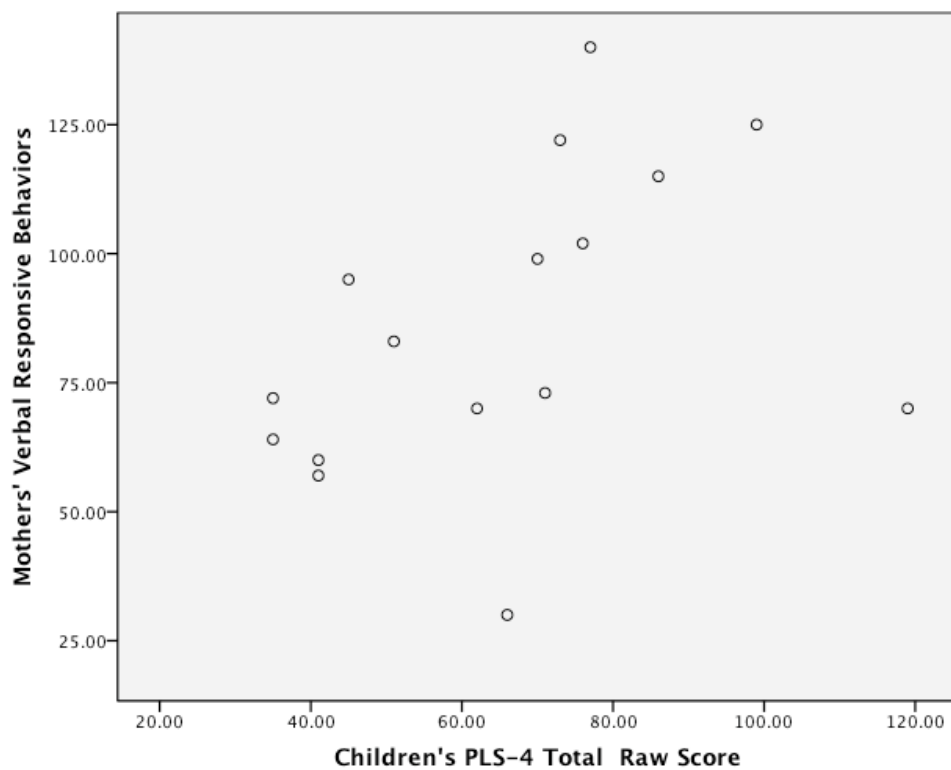


Figure 4.1. Scatter plot of mothers' responsive verbal behaviors and child PLS-4 total language scores.

For fathers, a significant, positive relationship between the frequency of responsive verbal behaviors and child language scores on the PLS-4 was also found ($r_{ho} = .791$ $p < .05$), indicating that as fathers' verbal responsiveness increased, child language skills also increased. The association between fathers' responsive verbal behaviors and child language scores is depicted in Figure 4.2.

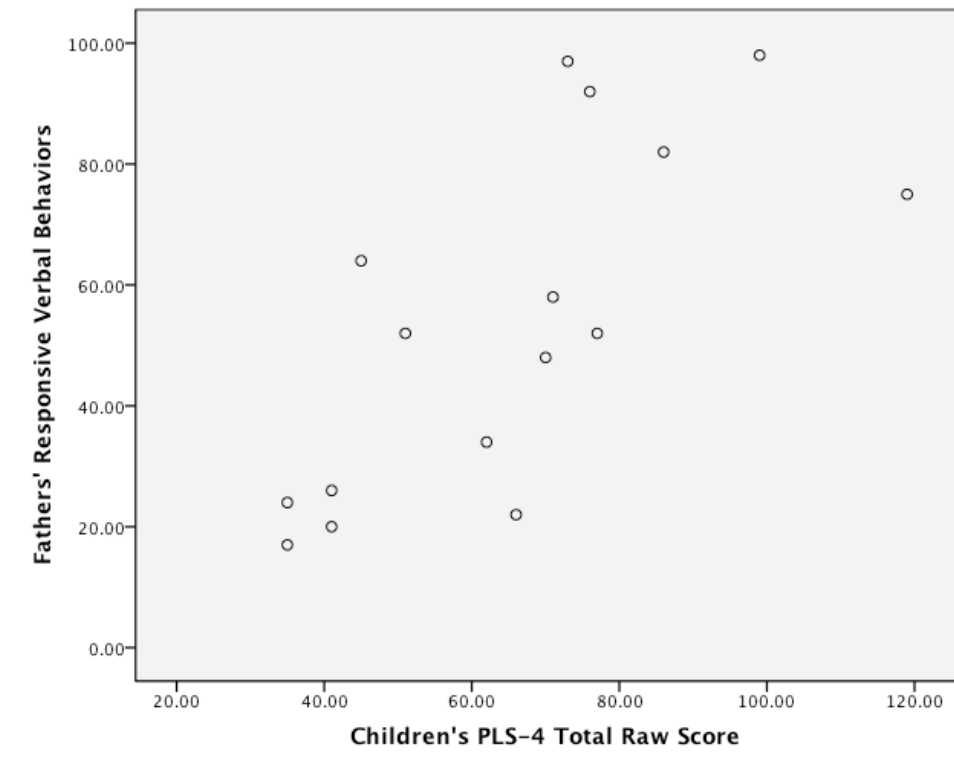


Figure 4.2. Scatter plot of fathers' responsive verbal behaviors and child PLS-4 total language scores.

Research Question 2: What are the comparative symbolic levels of object play achieved by children with ASD in interactions with their fathers, mothers, and an unfamiliar adult?

The purpose of the second research question was to investigate any differences between frequency and levels of symbolic play in father-child, mother-child, and unfamiliar adult-child interactions. The means and standard deviations for both frequency

of each level of object play and proportion of overall play represented by each of the four symbolic levels (i.e., exploratory, relational, functional, and symbolic) are reported in Table 4.8 and depicted graphically in Figure 4.3. A paired samples t-test was used to compare the frequency of each child's object play at four symbolic levels (i.e., exploratory, relational, functional, and symbolic) in interactions with mothers, fathers and an unfamiliar adult.

Table 4.8
Comparison of Child Object Play with Unfamiliar Adult, Mother, and Father

Level of Object Play	Child with Unfamiliar Adult		Child with Mother		Child with Father	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Exploratory						
Frequency	85.0	36.3	63.8	26.8	57.8	38.3
Proportion	.76	.23	.47	.18	.56	.30
Relational						
Frequency	10.9	13.0	31.0	13.5	7.8	8.5
Proportion	.08	.09	.23	.10	.07	.08
Functional						
Frequency	16.9	20.4	33.4	20.8	29.4	29.1
Proportion	.14	.13	.23	.13	.22	.18
Symbolic						
Frequency	4	9.5	9.9	14.9	23.5	39.7
Proportion	.02	.05	.06	.09	.14	.24

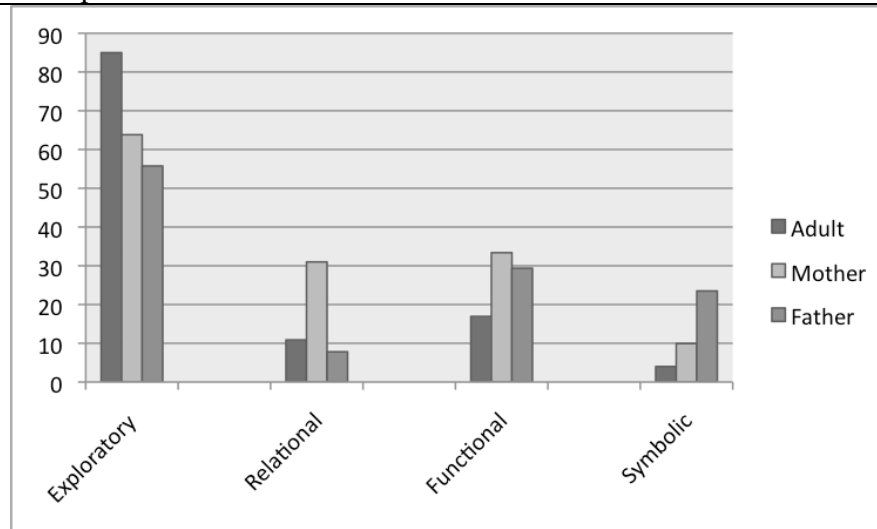


Figure 4.3. Frequency of child object play-acts at four symbolic levels in interactions with unfamiliar adult, mother, and father.

Child-Mother vs. Child-Unfamiliar Adult Play. Children engaged in significantly fewer play acts at the exploratory level with their mothers than with an unfamiliar adult, $t(15) = -2.47, p < .05$. Children also engaged in significantly more relational play acts with mothers versus unfamiliar adults, $t(15) = 5.97, p < .01$, as well as functional play acts, $t(15) = 5.96, p < .05$. Interestingly frequency of children's symbolic play acts was not significantly different for mothers versus an unfamiliar adult, $t(15) = 1.49, p > .05$, but symbolic acts also occurred at the lowest frequency among the four categories of play acts.

Child-Father vs. Child-Unfamiliar Adult Play. Compared to play with an unfamiliar adult, children engaged in significantly fewer play acts at the exploratory level with their fathers than with an unfamiliar adult, $t(15) = -2.66, p < .05$. Children engaged in similar frequency levels of relational play acts with fathers versus unfamiliar adults, $t(15) = -.967, p > .05$, as well as a similar frequency of functional play acts, $t(15) = 1.59, p > .05$. The frequency of children's symbolic play acts approached, but was not statistically significantly different for fathers versus an unfamiliar adult, $t(15) = 2.09, p = .054$.

Child-Mother vs. Child-Father Play. Compared to play with mothers, children engaged in similar frequency of play at the exploratory ($t(15) = -.738, p > .05$), functional ($t(15) = -.829, p > .05$) and symbolic ($t(15) = 1.43, p > .05$) levels when playing with their fathers. The only significant difference between play with mothers and fathers was found at the relational play level, with children engaging in significantly less relational play acts with their fathers than with mothers, $t(15) = -6.87, p < .01$.

Research Question 3: To what extent are the responsive play behaviors of mothers and fathers associated with levels of symbolic play demonstrated by children with ASD?

The purpose of the third research question was to examine correlations between the responsive play behaviors of mothers and fathers and the frequency of child object play at four symbolic levels (i.e., exploratory, relational, functional, symbolic).

Spearman's *rho* correlations were calculated between the frequency of the mother and father responsive play behaviors, and the frequency of child object play at each of the four symbolic levels. Table 4.9 presents the correlation coefficients for mothers' and fathers' verbal and play responsiveness at the four levels of object play.

Table 4.9
Correlations Coefficients (*rho*) for Responsive Parent Play Behaviors and Child Object Play

Level of Object Play	Mother Play Responsiveness	Father Play Responsiveness	Mother Verbal Responsiveness	Father Verbal Responsiveness
Exploratory	.23	.12	-.11	.22
Relational	-.26	.00	-.12	.22
Functional	.00	.33	.58*	.62*
Symbolic	.19	.59*	.80*	.61*

* $p < .05$

In the mother-child context, we found no significant relationships between mother play responsiveness and frequency of child object play at any of the four (i.e., exploratory, relational, functional) play levels. In contrast, we found a significant, positive relationship between fathers' responsive play behaviors and children's play at the symbolic level ($rho = .59$, $p < .05$), indicating that as fathers' play responsiveness increased, child symbolic play skills also increased or vice versa. Fathers' play responsiveness accounted for 35.2 % of the variance in the frequency of child object play

at the symbolic level. Figure 4.4 presents a scatter plot of father responsive play behaviors and child symbolic play.

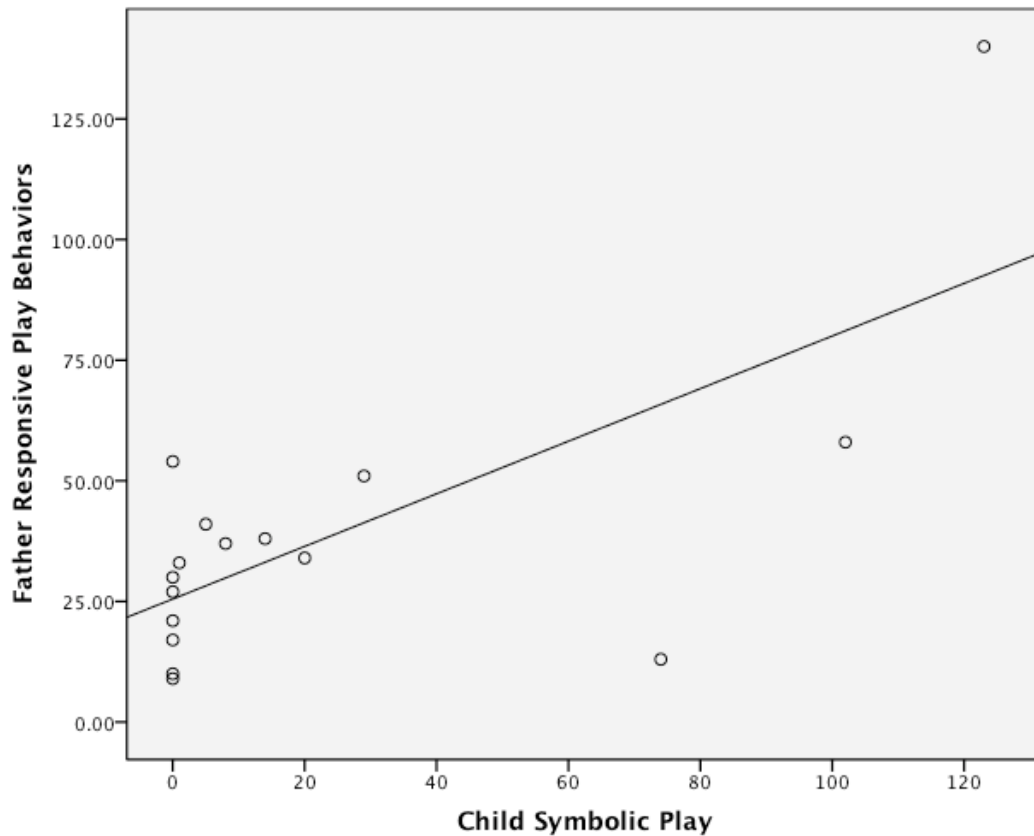


Figure 4.4. Scatter plot of fathers' responsive play behaviors and child symbolic play.

Additional correlational analyses were conducted to further examine the relationship between parent *verbal* responsiveness and child play. Significant positive correlations between both mothers' and fathers' verbal responsiveness and frequency of child object play at the functional ($rho = .58$, $p < .05$ for mothers; $rho = .62$, $p < .05$ for fathers) and symbolic ($rho = .80$, $p < .05$ for mothers; $rho = .61$, $p < .05$ for fathers) play levels were found.

Research Question 4: Does parent verbal responsiveness mediate any potential association of the parental broad autism phenotype with the language skills for children with ASD?

The purpose of the fourth research question was to examine the potential mediating role of parent responsiveness between the parental BAP and child language and play ability. Table 4.10 presents the correlations coefficients for these variables.

Table 4.10 Correlations Coefficients (rho) for Parent BAPQ Scores, Responsive Parent Play Behaviors and Child Language Ability

	Responsive Verbal Behaviors	PLS-4 Total Language Scores
Mothers		
Aloof	-.62*	-.50*
Rigid	-.38	-.69*
Pragmatic Language	.01	-.29
Fathers		
Aloof	-.08	-.01
Rigid	.14	.17
Pragmatic Language	.40	.23

*p<.05

A path analysis model (Figures 4.5 - 4.6) was constructed using parent scores from the three subscales of the BAPQ (Hurley et al., 2006) (i.e., aloof, rigid, pragmatic language) for fathers and mothers as the independent variable (X), child total language scores from the PLS-4 (Zimmerman et al., 2004) as the dependent variable (Y) and frequency of responsive parent verbal behaviors derived from the free play sessions as the mediating variable (M). Bivariate correlations were also conducted to determine effect sizes for the *a* path (X→M; parent BAPQ subscale scores: parent responsive verbal behaviors); *b* path (M→Y; parent verbal responsive behaviors and child total language

scores on the PLS-4); and *c* path ($X \rightarrow Y$; parent BAPQ scores: PLS-4 scores). Measures of effect size provide an indication of the size and meaningfulness of an effect, independent of sample size (MacKinnon, 2008). Correlations were then run separately for mothers' and fathers' scores on each of the 3 BAPQ subscales and child language scores on the PLS-4 partialled for the frequency of parent verbal responsiveness (MacKinnon, 2008).

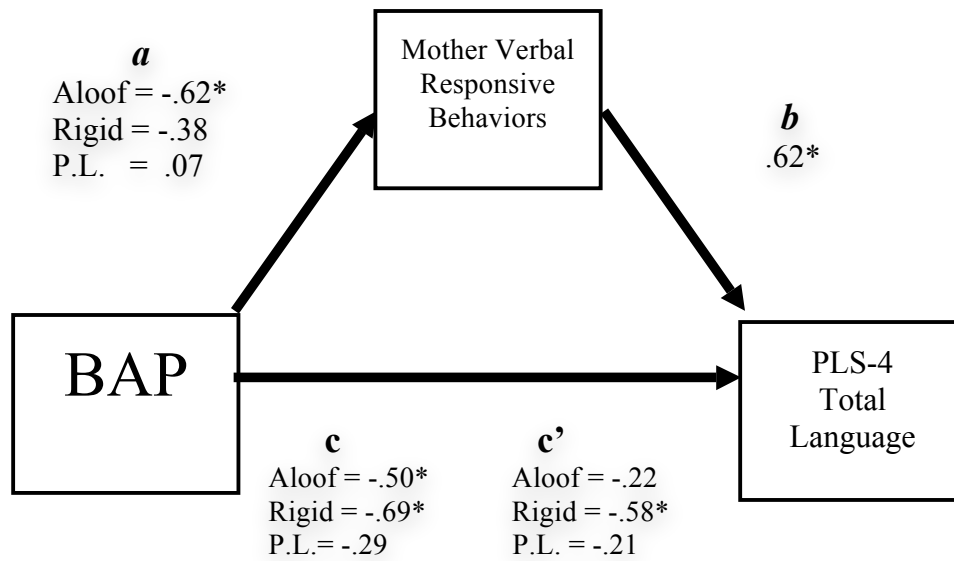
Path a. For mothers, correlations between scores on the BAPQ and mothers' responsive verbal behaviors were negative, large, and significant for the Aloof subscale ($\rho = -.62, p < .05$); medium and negative for the Rigid subscale ($\rho = -.38, p > .05$); and negligible for the Pragmatic Language subscale ($\rho = .07, p > .05$). For fathers, no significant correlations were found between scores on the Aloof ($\rho = -.08, p > .05$) or Rigid subscales ($\rho = .13, p > .05$) and responsive verbal behavior. A non-significant though medium-sized positive relationship ($\rho = .41, p > .05$) was found between father scores on the Pragmatic Language subscale of the BAPQ and fathers' verbal responsiveness.

Path b. As reported previously, for both mothers and fathers, large positive correlations ($\rho = .62, p < .05$; $\rho = .79, p < .05$ respectively) were found between parent verbal responsiveness and child total language scores on the PLS-4.

Path c. For mothers, large, negative, and significant associations were found between scores on the Aloof ($\rho = -.50, p < .05$) and Rigid ($\rho = -.69, p < .05$) subscales of the BAPQ and child language scores. Correlations between scores on the Pragmatic Language subscale and child language scores were small and non-significant ($\rho = -.29, p > .05$).

Mediated effect. For mothers, significant negative correlations were found between mothers' scores on both the Aloof ($\rho = -.50, p < .05$) and Rigid ($\rho = -.69, p < .05$) subscales of the BAPQ and the child's total language scores on the PLS-4. After partialling out responsive verbal behaviors, correlations between mothers' scores on the Aloof subscale and child language scores were no longer significant ($\rho = -.22, p > .05$) indicating that verbal responsive behaviors mediate the association between mothers' Aloof scores on the BAPQ and child language scores on the PLS-4. In contrast, after partialling out mothers' verbal responsive behaviors, correlations between the scores on the Rigid subscale and child language scores remained significant ($\rho = -.58, p < .05$), indicating that there is no evidence that mothers' responsive verbal behaviors mediate the influence of rigid BAP characteristics on child language skills. As would be expected, mediated correlations for mothers' scores on the Pragmatic Language scale were largely unchanged ($\rho = -.21, p < .05$).

For fathers, partialled correlations between the BAPQ and child language scores were essentially the same as unpartialled correlations for the Aloof ($\rho = .13, p > .05$) and Rigid subscales ($\rho = .14, p > .05$). After partialling out fathers' responsive verbal behaviors, correlations between fathers' scores on the Pragmatic Language subscale and child language scores were negligible ($\rho = -.13, p > .05$).



* $p < .05$ Note. BAP= broad autism phenotype; P.L. = pragmatic language subscale of the BAPQ

Figure 4.5. Mediation path analysis for mothers' verbal responsiveness.

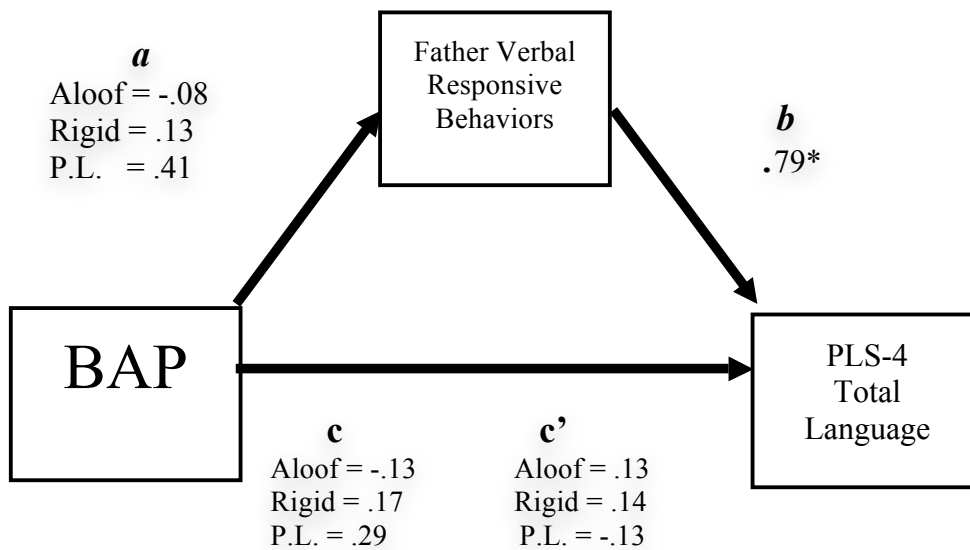


Figure 4.6. Mediation path analysis for fathers' verbal responsiveness

Research Question 5: Does parent play responsiveness mediate any potential association of the parental broad autism phenotype with the play skills of children with ASD?

The purpose of the final research question was to examine the potential mediating role of parent responsiveness between the parental BAP and child object play ability.

Correlations between parent scores on the BAPQ subscales, parent responsive play, and frequency of child play behaviors at each symbolic level of object play (i.e., exploratory, relational, functional, symbolic) are provided in Table 4.11. To address the research question, a second path analysis was constructed (Figure 4.7) with parent scores from the three BAPQ subscales (i.e., aloof, rigid, pragmatic language) as the independent variable (X), frequency of child object play at four levels (i.e., exploratory, relational, functional and symbolic) as the dependent variable (Y), and frequency of parent responsive play behaviors as the mediating variable (M). Bivariate correlations were conducted to determine effect sizes for: *a* path (X→M; parent BAPQ subscale scores and parent responsive play behaviors); *b* path (M→Y; parent responsive play behaviors and frequency of child object play across at each of the four symbolic levels); and *c* path (X→Y; parent BAPQ subscale scores and frequency of child object play at each of the four symbolic levels). Then correlations between mothers' and fathers' scores on each of the three BAPQ subscales and the frequency of child object play, partialled for the frequency of parent verbal responsiveness were completed as described by MacKinnon (2008). Table 4.11 presents the correlation coefficients for the variables examined.

Table 4.11

Correlations Coefficients (ρ) for Parent BAPQ Scores, Responsive Parent Play Behaviors and Child Object Play

	Responsive Play	Levels of Object Play			
		Exploratory	Relational	Functional	Symbolic
Mothers					
Aloof	.18	-.02	.13	-.36	-.49*
Rigid	.04	-.36	.34	-.34	-.45*
Pragmatic Language	.27	-.18	.24	.03	-.17
Fathers					
Aloof	-.09	.39	.31	-.05	-.34
Rigid	.05	.26	-.05	.13	-.07
Pragmatic Language	.42	.46*	.09	.15	.13

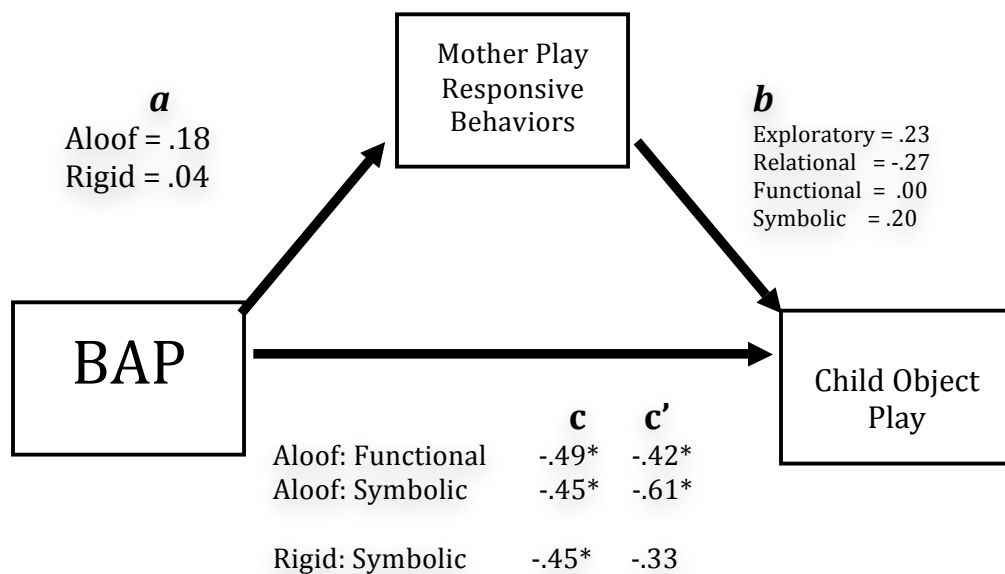
* $p < .05$

Path a. For mothers, negative correlations were found between responsive play behaviors and scores on the Aloof ($\rho = -.62$, $p < .05$) and Rigid subscales ($\rho = -.38$, $p > .05$) of the BAPQ. No correlations were found between mothers' responsive play behavior and scores on the Pragmatic Language subscale ($\rho = .07$), $p > .05$). For fathers, no correlations were found between responsive play behaviors and scores on the Aloof ($\rho = -.08$, $p > .05$); and Rigid ($\rho = .13$, $p > .05$) subscales. Unexpectedly, a positive though non-significant relationship was found between fathers' responsive play behaviors and scores on the Pragmatic Language subscale ($\rho = .42$, $p > .05$).

Path b. No significant correlations were found between mothers' responsive play behaviors and child object play at any of the 4 play levels: exploratory ($\rho = .23$, $p > .05$); relational ($\rho = -.26$, $p > .05$); functional ($\rho = .00$, $p > .05$); and symbolic ($\rho = .19$, $p > .05$). Also, no correlations between fathers' responsive play behaviors and child object play were found: exploratory ($\rho = .23$, $p > .05$); relational ($\rho = -.26$, $p > .05$); functional ($\rho = .00$, $p > .05$); and symbolic ($\rho = .19$, $p > .05$).

Path c. Large negative correlations were found between mothers' scores on the Aloof and Rigid subscales and child play at the symbolic levels. This indicates that as

mothers scores on the Aloof and Rigid subscales of the BAPQ score increased, children engaged in less frequent higher level play during interactions with their mothers. Relationships between mothers' BAPQ scores and child exploratory, relational, and functional play were not significant. In addition, no significant relationship was found between mothers' scores on the Pragmatic Language subscale and child play at any of the four symbolic levels. In addition, fathers' scores on any of the BAPQ subscales were not significantly correlated with child play at any of the four symbolic levels.



* $p < .05$

Note. BAP= broad autism phenotype; P.L. = pragmatic language subscale of the BAPQ

Figure 4.6. Meditational path analysis for mothers' play responsiveness

Mediated effect. Given that no significant relationship was found between fathers' BAPQ scores and the frequency of children's object play, the mediated effects for fathers were not examined. For mothers, the correlation between scores on the on the Rigid subscale and child symbolic play were no longer significant ($\rho = -.33$, $p < .05$) after

responsive behaviors were partialled out, indicating a mediating relationship between mothers' responsive play behaviors and the influence of the rigid BAP characteristics on child play skills. In contrast, the correlation between mothers' scores on the Aloof subscale and child functional and symbolic play continued to be significant ($\rho = -.42$, $p < .05$; $\rho = -.61$, $p < .05$, respectively) after partialling out responsive play behaviors.

CHAPTER 5: DISCUSSION

In this study, the relationships between the responsive verbal and play behaviors of mothers and fathers and the language abilities and play skills of children with autism spectrum disorders (ASD) were investigated. In addition, the frequency and symbolic level of object play demonstrated by children with ASD in interactions with their mothers, fathers, and an unfamiliar adult across four symbolic levels were compared. Finally, the potential mediating role of parent responsiveness in the relationships between parental scores on a measure of the broad autism phenotype (BAP) and the language and play skills of children with ASD was examined. One issue that is central to the interpretation of results from this study is related to the direction of effects. A definitive answer to the question of whether parents were more responsive because their children had higher-level language and play skills or whether children had higher-level language and play skills because their parents provided responsive models was not achievable within the constraints of the study design; however, the transactional model discussed as a framework for this study suggests that both directions of effects are likely to be operating. The present findings provide descriptive support for the argument that mothers and fathers each make important albeit different contributions to the language and play skills of their children with ASD. Findings are discussed relative to each of the five research questions examined in this study.

Associations between Parent Verbal Responsiveness and Child Language Skills

The first important finding of this study is that for both fathers and mothers, more frequent use of responsive verbal behaviors in interactions with their children with ASD was strongly related to higher-level child language skills. In addition, although mothers used significantly more verbal responsive behaviors during play interactions, the correlations between verbal responses and child language scores on the PLS-4 (Zimmerman et al., 2004) indicated large effect sizes for both mothers and fathers. The significant correlations between maternal verbal responsiveness and child language skills reported in this study are consistent with findings by Siller and Sigman (2002, 2008) regarding the longitudinal impact of maternal verbal responsiveness on the language developmental of children with ASD. In contrast, this is the first study to demonstrate a strong relationship between fathers' verbal responsiveness and the language skills of children with ASD, and the findings provide new evidence regarding the importance of studying fathers as well as mothers when trying to improve the language skills of children with ASD. As previously discussed, the interpretation of whether children had higher language scores because their fathers were more verbally responsive or whether fathers were more verbally responsive to their children who had more language is not definitive. However, fathers' verbal responsiveness was not significantly correlated with children's non-verbal developmental quotient. Therefore, the relationship between father responsiveness and child language is not explained by cognitive ability alone.

Children's Play Skills in Interactions with Mothers, Fathers, and an Unfamiliar Adult

A second key finding of this study is that children with ASD display different

levels of play with their mothers and fathers. To address the second research question, play behaviors displayed by children with ASD were studied across three contexts: (a) play with an unfamiliar adult; (b) play with mothers; and (c) play with fathers. Compared to play with an unfamiliar adult, children engaged in significantly less exploratory play, and significantly more relational and functional play, in interactions with their mother. In contrast, no differences were found between children's play with their mothers and an unfamiliar adult at the symbolic level. This finding was unexpected, as the role of the unfamiliar adult in this study was to redirect the child if s/he engaged in self-injurious or escaping behaviors, or if s/he was engaged in excessively repetitive play with a toy, but not to provide models or scaffold play for the child. Given the passive role of the unfamiliar adult, it was expected that children would engage in less play at higher symbolic levels with the unfamiliar adult than with either parent.

Similar to findings for mothers, in play with fathers, children engaged in significantly less exploratory play than they did in play with an unfamiliar adult. In contrast to findings for mothers, however, there were no significant differences between children's play with their father versus an unfamiliar adult in the frequency of play at the relational and functional levels. At the symbolic level, however, children tended to engage in more symbolic play with the fathers than with an unfamiliar adult. Results of the paired t-test were not significant but approached the criterion level ($p = .054$). The non-significant results may be a function of the small sample size, as the effect size (i.e., correlation coefficient) was medium ($ES = .37$), suggesting that a significant difference may have been found with a larger sample. The finding that children with ASD tended to engage in higher frequency of symbolic play with their fathers than with an unfamiliar

adult suggests that fathers enhance the symbolic play of their children with ASD in ways that mothers do not. Furthermore, these findings are consistent with findings in other research that suggest that fathers' play the role of primary play partner for young children (Pleck & Masciadelli, 2004) and have a positive influence on play outcomes for both typically developing children and children with disabilities (de Falco et al., Cielinski et al., 1995; Venuti et al., 2009)

The differences that were found in the current study between mothers' and fathers' play with children with ASD reflect the differing play styles used by mothers and fathers in play with typically developing children (Power, 1985). Overall, children engaged in more frequent object play with their mothers than with their fathers. Specifically, mother-child play was comprised of significantly more relational play (e.g., nesting cups, stacking blocks; putting together pop beads; putting toys into and containers). Interestingly, though, children tended to engage in more symbolic level play when playing with their fathers than with their mothers (14% of intervals versus 6% of intervals, respectively). In addition, fathers were observed informally to engage in more frequent rough-and-tumble play with children, without the use of objects. This may explain the finding that children used fewer touch leads in play with their fathers than with their mothers. Anecdotally, it was noted that children showed a high level of engagement with their fathers during physical play. As the main aims of the current study were to examine parent influence on object play, rough-and-tumble play was not coded or examined in this investigation, but should be explored in the future.

Relationship between Parent Play Responsiveness and Symbolic Level of Child Play

A third key finding of the current investigation is the strong relationship between fathers' play responsiveness and their children's play at the symbolic level. In the third research question, associations between parents' responsive play behaviors and their children's frequency and symbolic level of object play were examined. Fathers and mothers were found to use similar proportions of responsive play behaviors. For mothers, however no significant relationships emerged between responsive play behaviors and levels of child symbolic play. Again, this likely reflects that the verbal-didactic play style used by mothers of typically developing children (Power, 1985) is also used with children with ASD. Mothers verbally mediated their children's play, using significantly more responsive verbal behaviors than responsive play behaviors. For mothers, verbal responsiveness, but not play responsiveness, was significantly correlated with higher levels of play (i.e., functional and symbolic) demonstrated by the children. In contrast, strong correlations were found between fathers' responsive play behaviors and child play at the symbolic level.

As the primary play partner for most young children (Pleck & Masciadrelli, 2004), engaging in higher-level play interactions may be in fathers' proverbial "wheelhouse." The findings of the current study suggest that fathers use more responsive play behaviors with their children who can engage in symbolic levels of object play. In contrast, fathers whose children engage only in lower-level object play do not use as many responsive play behaviors. As discussed earlier, the direction of effects is undetermined—father's responsive play may foster child symbolic play or child symbolic

play may elicit father responsive play (or both). Considering the possible impact of child behavior on fathers, possibly fathers are not as comfortable in their play responses when their children only engage in low levels of play. This may explain the frustration expressed by the four fathers in a study by Elder (2005) who reported not knowing how to play with their children with autism. In general, fathers may know how to play responsively with their children when their children demonstrate high levels of play, but do not have the knowledge and skills to play responsively with their children when they engage in lower levels of play. Clinically this is an important finding, as fathers may need tailored supports to successfully engage in responsive play at lower play levels.

In the current study, fathers' verbal and play responses correlated with higher levels of child language and play. To explain associations between higher-level language modeled by fathers and higher-level language used by children in interactions with their fathers, Gleason (1975) proposed a "bridge hypothesis." According to this hypothesis, fathers' more complex language model provides children with a bridge from the more supportive language of home to the linguistic challenges of the outside world. Findings from this study suggest that a focus of parent training should be to increase fathers' use of responsive verbal and play behaviors specifically with children who demonstrate emerging abilities in language and object play. To extend the bridge analogy, clinicians may need to help fathers create an "entrance ramp" to support their children with ASD with emerging language and play skills so that they can learn higher-level language and play skills.

Relationship between Parental BAP, Child Language Skills, and Parent Verbal Responsiveness

Findings regarding the influence of the parental broad autism phenotype (BAP) on child language and play skills were somewhat surprising. No significant differences were found between mothers and fathers on any of the three subscales of the Broad Autism Phenotype Questionnaire (BAPQ, Hurley et al., 2006). These results are not consistent with findings from other studies in which fathers showed more overall features of the BAP than mothers (Ruser et al., 2007; Scheeren & Sauder, 2007). The second unexpected finding was that the data did not support a mediator model for fathers. Only maternal BAP was related to child language. Furthermore, only two subscales, Aloof and Rigid, were related to child language. It is possible that the Pragmatic Language subscale was not related because of the way the construct is defined on the BAPQ. For example, questions measuring Pragmatic Language on the BAPQ prompt parents to consider interactions other than those with close friends and family. The way this construct is measured on the BAPQ may not translate to language use during parent-child interactions because the items focus on their interactions with other adults (e.g., “I can tell when someone is not interested in what I am saying”; “I can tell when it is time to change topics in the conversation”). It is possible that other measures of pragmatic language that focus more specifically on parent-child interactions would result in a stronger correlation. Development of such a measure or inclusion of such items on the BAPQ may be necessary to better understand the influence of this aspect of the parental BAP on the language and play skills of their children with ASD.

The associations that were found between maternal but not paternal BAP and child language skills are likely a function of mothers' higher overall frequency of responsive behaviors. Another explanation is that mothers in the sample are more likely to be the primary caregivers and spend more time with their children than fathers. Thus, participating children may be exposed to and influenced by maternal BAP characteristics. Therefore, the finding is that the frequency of mother's verbal responsiveness mediated the relationship between the Aloof subscale on language but not the Rigid subscale it is a particularly interesting and potentially clinically important. For mothers with a generally more aloof interaction style, using more frequent verbal responsive behaviors mediated the influence of parental BAP on child language abilities. Conceptually, this makes sense, as aloofness and responsiveness are somewhat mutually exclusive constructs. Another explanation may be that mothers' tendencies to be aloof with other adults (the relationships of primary interest on the BAPQ) do not generalize to their interactions with their children. In contrast, for mothers who showed a generally rigid interaction style, greater frequency of responsive verbal behaviors did not significantly lessen the influence of the parental BAP on their child's language skills. This finding provides important descriptive evidence to guide the development of future studies. Specifically, for parents who demonstrate specific characteristics of the BAP, it may be important to tailor interventions to investigate and target the quality and not just quantity of responsive parent verbal behaviors on outcomes for children with ASD.

Relationship between Parental BAP, Child Play Skills and Parent Play Responsiveness

Findings regarding the mediating relationship between parental BAP and child play skills were also surprising. Similar to results for verbal responsiveness, for play responsiveness, maternal but not paternal BAP characteristics were negatively associated with children's higher-level (i.e., functional and symbolic) play. In contrast to findings for the mediator model of verbal responsiveness, for mothers identified as having a rigid personality style, responsive play behaviors mediated the influence of the BAP and child play skills. However, responsive play behaviors did not mediate the influence of the parental BAP on child play for mothers identified as having an aloof personality style. Again, differences in the mediation paths for rigid and aloof BAP characteristics are likely explained by differences in the quality of play responses. Physical play responses were defined as those in which the parent: (a) imitated their child's action by reducing or expanding the child's action; (b) aided the child's action; (c) demonstrated a new action on the child's referent; or (d) demonstrated a new action on another object and related this to the child's referent, or expanded the child's action with the same or similar touch lead referent. Thus, there is a degree of flexibility in the operational definition of responsive play behaviors used in this study. Furthermore, responsive play by parents, particularly when a child is exhibiting play at the functional and symbolic levels, requires flexibility. It follows that for mothers identified as having rigid personality styles, using flexible play responses mediates the influence of the parental BAP on their child's higher-level play skills. In contrast, for mothers identified as aloof, using expansions or new play actions that relate to their child's play may not necessarily require mothers to be tuned in to their child to the same extent required to use a verbal response that linguistically maps to the child's object of attention.

Finally, as described in the results section, within families there was variability in terms of whether one or both parents showed characteristics of the BAP, the specific characteristics they exhibited, and the extent to which they were exhibited. Given the small size of the sample in the current study, it was not possible to investigate the interaction effects between mothers and fathers of the same family. However this may be one important consideration in future studies of the influence of the parental BAP on child language and play outcomes. For example, for one child whose mother met criterion on all three subscales of the BAPQ and whose father met only one, the ADOS total algorithm score (26) was the highest in the sample and total language scores on the PLS-4 (i.e., raw score = 35; standard score = 50) were among the lowest. In addition, this child engaged primarily in exploratory play and demonstrated no symbolic play in interactions with his mother, father, or an unfamiliar adult. At the other extreme, for one child whose father met criterion on all three subscales of the BAPQ, and mother met criterion for only one subscale, the total algorithm scores on the ADOS (i.e., 12) and PLS-4 (raw score = 76; standard score = 92) fell in the median range of the sample. Furthermore, the child engaged in the highest number of symbolic play acts (i.e., 40) used by children in the sample with their mothers, and third highest number of symbolic play acts (i.e., 76) in play with his father. For the small sample of children in this study, it appears that having a mother with many BAP characteristics may have a different influence on play and language development than does having a father who exhibits many BAP characteristics. This is further supported by the pattern of findings that maternal but not paternal BAP characteristics correlate with child language and level of play, but suggest the possibility of complex interactions between the extent and type of

BAP characteristics of the mother and father associated with child behaviors within family units.

Taken together, these findings on the influence of the parental BAP on child language and play skills and the mediating role of parent responsiveness may have important implications for future intervention studies and clinical work. For parents identified as having aloof interaction styles, targeting greater frequency of responses may be an effective goal. However for parents who are identified as having a rigid interaction style, it may be more effective to focus on improving the quality and flexibility of the parents' verbal and responses as opposed to only increasing frequency. Finally, although future studies are needed, the BAPQ (Hurley et al., 2006) or similar instruments measuring aspects of the parental BAP may provide clinicians with a useful tool in customizing interventions to fit the specific needs of families.

In summary, findings from this study underscore the importance of paternal contributions to language and play outcomes for children with ASD and provide a theoretical rationale for increased involvement of fathers in intervention for their children with autism. Overall, results from this study warrant future studies of parent-child and specifically of father-child interactions to add to the body of research on parent-child interactions in children ASD in order to determine the specific magnitude and direction of fathers' impact.

Limitations

There are several limitations of the current study. First the small sample size was a limitation. Given that autism is a low incidence population, a small size was expected

and appropriate analyses were planned and conducted, but the interpretation and application of the results are nonetheless limited by the size. The sample also came from ethnically mixed background but had predominantly middle to high socio-economic status, which could have affected results. Furthermore the sample for the current study was primarily recruited from two larger ongoing studies. Families who chose to participate in the current study may not be representative of all families of children with ASD. In addition, due to the nature of the research questions, a condition of participating was that parents were married; however recruiting a sample of married couples is not reflective of all families of children with ASD.

Although the analyses conducted were appropriate given the research questions and sample size, correlation analyses can identify associations between two or more variables but cannot predict long-term outcomes or causal relationships. Finally, the research questions in this study focus on examining the associations of parent verbal and play responsiveness and child language and play skills. It is likely that additional variables play a role in influencing these relationships (e.g., parental stress levels). Including such as other variables in future research will provide a more complete picture of the parental influences on play and language development for children with ASD.

Future Directions

This study is the first in a program of research intended to develop and test the efficacy of an early autism intervention that involves both mothers and fathers. Results from the current investigation have provided important descriptive data to drive future observational and intervention research. A next step expansion of the current study

should include a longitudinal design in order to examine whether the associations between the verbal responsiveness of mothers and fathers and the language and play outcomes of their children with ASD found in the current investigation hold over time. In addition, an expansion of the current study to include a larger sample of children and parents will allow for significance testing of the mediator model of the influence of the BAP on child language and play outcomes. Furthermore, a larger sample would allow for examination of interaction effects between mothers and fathers to investigate the impact of parents who show varying levels of the BAP on language and child play outcomes.

The large, significant correlations between fathers' verbal responsiveness and child language skills, as well as fathers' play responsiveness and child symbolic play found in the current investigation warrant future intervention studies to determine whether a parent-training program targeting father responsiveness impacts short-term and long-term language and play outcomes for children with ASD. In addition, in future studies of father-child interactions, it would be informative to specifically investigate the contributions of fathers' physical, rough-and-tumble play to the language and play development of children with ASD. An additional area that warrants investigation in the expanded study would be the association between rough-and-tumble play and engagement for children with ASD. Kim and Mahoney (2004) hypothesized that parent responsiveness impacts children's developmental functioning through its mediating effects on children's engagement.

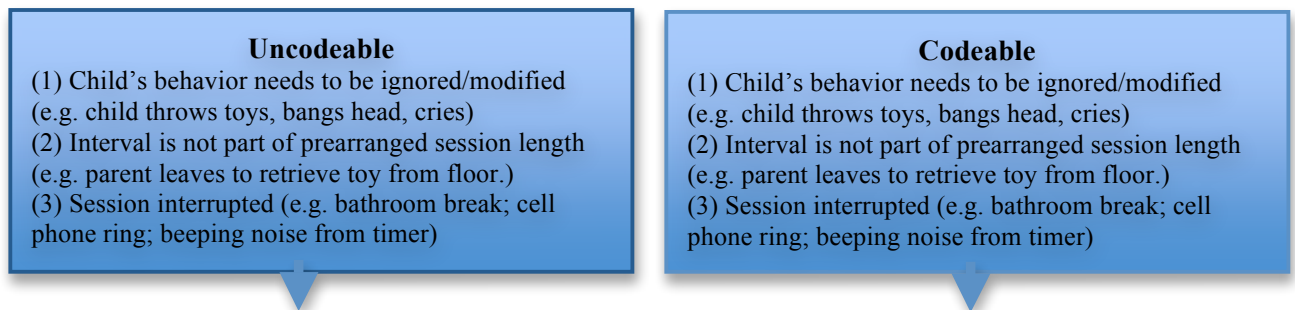
Finally, research is needed to examine the feasibility and efficacy of father-implemented interventions. In the autism literature to date, only one group of researchers has examined father-implemented interventions, in a small sample and with mixed results

(Elder et al., 2003, 2005). The strong associations between fathers' verbal and play responsiveness and their child's language and play skills found in this study provide important new evidence of the potential contributions fathers of children with ASD may make to their child's communication and play development. The need to include fathers in intervention is clear. However, for father-implemented intervention to be successful, it must be responsive to the unique interaction and communication styles of fathers. Interventions must be developed that increase fathers' responsiveness while still maintaining the integrity of their play and communication styles. Such interventions are more likely to improve outcomes for children with ASD than those that ignore or otherwise attempt to change fathers' interaction styles. Moreover, including fathers in communication interventions in a way that supports their communication styles and learning needs will likely help fathers feel more effective in their interactions with their child with ASD. Findings from this study provide essential first steps towards understanding how to effectively include both mothers and fathers in early intervention for their children with ASD and how to tailor interventions to fit the specific needs of individual families of children with ASD.

APPENDIX A: FLOWCHART FOR CODING MANUAL

Coding is completed in 4 passes of 15 minute standardized video recordings of free play observations, divided into 180, 5-second intervals

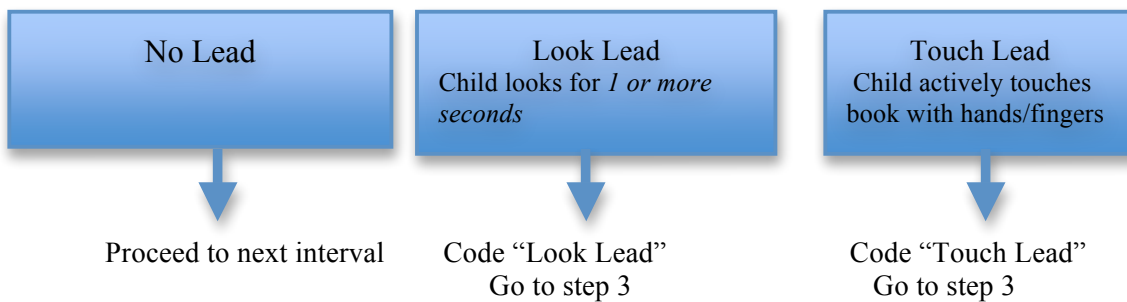
1. Decide whether the interval is *Uncodeable* or *Codeable*.



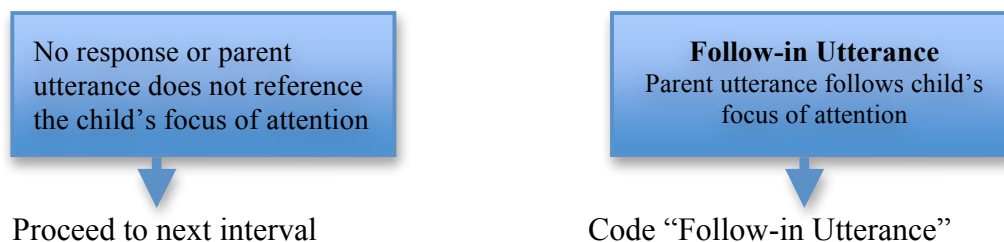
Proceed to next video interval

Go to step 2

2. For all *codeable* intervals, determine whether child produced: (a) *no lead*; (b) *look lead*; or (c) *touch lead*. Leads can be *initiated* (child begins a look or touch lead without explicit prompts or verbal directions) or *adopted* by child (child looks at or touches objects first introduced by parent). *Child-adopted* leads are coded in the third interval after the adult has introduced a new object



3. For all intervals with a *child lead*, code the *parent verbal response*.



4. For all intervals with a touch lead, code as “Physical Play”; then code for Level of Object Play

Exploratory

Relational

Functional

Symbolic

APPENDIX B: CODING MANUAL

Partial Interval Time Sampling of Adaptive Strategies for the Useful Speech Project
Yoder, Fey, Thompson, McDuffie, & Lieberman

5/27/09

Revised by Flippin & Watson

1/19/10

Coding Manual Contents

Overview

Purpose of the coding system

This manual is designed to guide observers through a process that will yield variable scores thought to reflect the amount of responsivity parents deliver to their children pro-rated by individual differences in the number of 5-second intervals that are codeable. By "pro-rate," we mean dividing the number of a coded response strategy by the number of intervals that are "codeable." Once data are collected on all children, the data analysis program will determine whether number of codeable intervals will be used to pro-rate the responses. Considering whether this pro-rating is necessary is particularly important for the PCFP procedure because (a) the child and parent are allowed to move, thus potentially rendering the camera angle non-optimal and (b) the degree to which events are controllable is less in parent-child sessions than in examiner-child sessions. Some of these controlled events and off-screen or obscured camera angle periods are likely to occur more often in the PCFP than in other procedures.

Theory posits that parents who use many responses have children with better language later in development. The nonlinguistic responses (physical play) are thought to create more opportunities for the linguistic responses (follow-in utterances), which, in turn, are thought to stimulate language development by providing words at times the child is looking at, and has a short-term memory of the referent for the word, thus aiding the association of the adult-provided word and its meaning.

To reliably code these two types of responses, experience tells us that key terms need to be defined. Sometimes we define the terms because they have accompanying separate symbols (i.e., "codes") that are recorded in the Procoder data file. All "codes" are defined in a file used by Procoder called a "code file." Usually, we define the terms because they are used frequently and in a specific way in this manual. This degree of specificity will

seem "picky" at times, but is necessary for variable values to be very similar across different observers for the same session (i.e., reliable).

Overview of coding process

Observers will do the following:

1. Download the code file onto his/her hard drive. This may only have to be done once for the project period.
2. Download the media file onto his/her hard drive. This will have to be done for all sessions and all participants.
3. Set up ProcoderDV software to use a 5-second interval behavior sampling method.
4. Use the Procoder DV software to code the media file.
 - a. Because different types of behaviors are to be considered for coding for each interval, the decisions are grouped into 3 "sets" of mutually exclusive codes. These 3 sets are: (a) Uncodeable vs. codeable; (b) look lead vs. touch lead vs. null; (c) physical play vs. follow-in utterance vs. null. "Null" means the interval is left blank (i.e., no code is selected from the pull-down menu for the target group for the target interval).
 - b. Two "passes" through the media file are strongly suggested. A "pass" through the media file means that the observer looks at each interval (perhaps several times) and makes a decision how to code each interval until all 180 intervals are coded for that mutually exclusive set of codes.
 - i. It is strongly suggested that a pass be used to determine codeability of interval (i.e., uncodeable vs codeable) that is separate from the pass used to code lead (i.e., look vs touch vs null) and response (i.e., physical plays vs follow-in utterances vs null). The rationale for this is that the mindset for deciding codeability is quite different from the mindset for deciding lead and response. Lead and response are thought to be best coded in the same "pass" because once a lead has been identified it is natural to determine if a response occurs.
5. Save the ProcoderDV data file on your personal hard drive and derive the variable scores using a software program called MOOSES.
6. After MOOSES analysis, store the ProcoderDV data file and the MOOSE analysis summary file on the secure text server.
7. Indicate in the coding progress chart that the coding has been completed.

Rationale for Level of Distinctions, Inclusion of Categories, Need for the Definitions, and Identification of Terms to be Defined

As mentioned earlier, a certain number of 5-second intervals will be "uncodeable" because (a) it isn't appropriate for the adult to use a coded type of "response" or (b) either interactor or a potential referent is off-screen. Because this is a difficult category to reliably code, we define what is considered an uncodeable interval. To aid in coding uncodeable reliably, we will define the term "off-screen." Any interval that is *not*

uncodeable is, by definition, codeable. That is, all intervals are either "uncodeable" or "codeable." There is no "null" option for the codeability decision.

Both types of coded caregiver responses "follow the child's attentional focus." The child "owns" the focus of attention if it is (a) child-initiated or (b) child-adopted. These terms are not accompanied by separate codes but are defined to aid reliable application of the concept "child's attentional focus."

There are two ways children show attention that have separate codes: look leads and touch leads. These are given separate codes because experience tells us that coders are more reliable in coding responses if they mark (i.e., code) the type of lead the child provides. This occurs because different examples of responses can occur after different types of leads. For example, a type of nonlinguistic response, "imitates the child's action," can only occur after a child's touch lead. In contrast, the type of linguistic response coded here, "follow-in utterances," can occur after either a child's look lead or after a child's touch lead (or both).

A lead is, by definition, *to* something (i.e., an object, person or activity.) We refer to this "something" as a "referent" and thus define this term.

In this code, the types of nonlinguistic responsivity we code are ways parents physically play with their children's focus of attention. We label this type of nonlinguistic response as "physical play" to emphasize to the coder that we want to see whether the parent does more than just "sit back and talk to their child" (a common occurrence). None of the types of physical play (imitates child's action, aids child's action, elaborates or demonstrates new action in ways that relates to child's object) have separate "codes" due to infrequent occurrence of separate types and reliability issues. That is, if any of these occur, the interval is coded as having "physical play." However, these different types of physical play are defined to aid reliable coding of physical play. Historically, coders have had the most difficulty coding this category reliably out of the set of responsivity types coded in this project. The parental actions coded as "physical play" are those thought to maintain the child's focus of attention.

Maintaining the child's focus of attention is considered important so the adult has the opportunity to talk about the child's focus of attention. Talking about the child's focus of attention is thought to aid the child in learning new spoken vocabulary. We call talking about the child's focus of attention "Follow-in utterances." Therefore, follow-in utterances will be defined. Although one can distinguish types of following utterance (e.g., comments vs. directives), we do not do so because recent evidence shows that follow-in directives (a) are highly correlated with follow-in comments, and (b) are as highly correlated with later language in children with ASD as are follow-in comments.

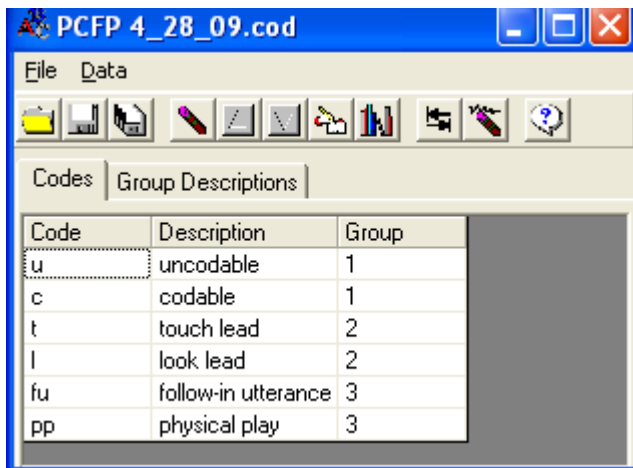
The type of talking about the child's focus of attention that is thought most to aid the child in learning new spoken vocabulary is using words that usually have a grammatical function. Most words have a grammatical function. We provide a list of "ungrammatical words" (i.e., those that typically do NOT have grammatical functions in speech to children) to aid the coder in making this judgment. It is an exclusive and exhaustive list, not just examples. The coder will likely think of other ungrammatical words; however, we ask that coders not add to the list to avoid unreliable coding about this point.

Putting The Media Files on Your Hard drive:

The media file will initially be on the secure media server (yousendit.com). See the Yousendit.com manual for downloading files to your hard drive. Copy the media file from the secure media server to a folder on your desktop that is labeled something like "Parent-Child Free Play procedure media files" Do not code from a CD or from the media server.

Putting the Code File on Your Hard drive:

The code file named PCFP code file 4_28_09.cod will initially be on the secure text server. See the manual for downloading files to your hard drive from this text server. Copy the code file from the secure text server to a folder on your desktop that is labeled something like "code files for procoder." Do not use the code file from the secure text server because it can cause later corruption of files. It should resemble the following:

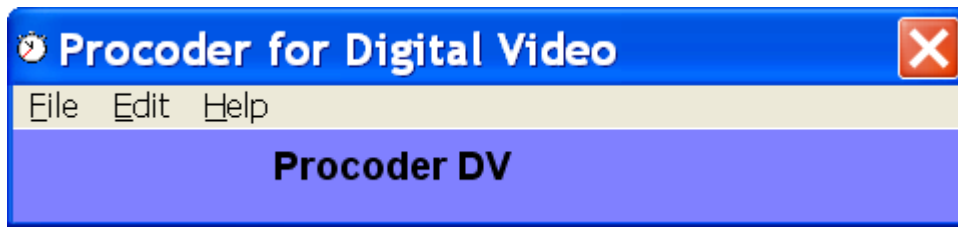


Code	Description	Group
u	uncodable	1
c	codable	1
t	touch lead	2
l	look lead	2
fu	follow-in utterance	3
pp	physical play	3

Loading ProcoderDV:

To use ProcoderDV to code, do the following:

- Load ProcoderDV (2-left-click on the procoder icon-looks like an analogue clock).
- You should get the following:

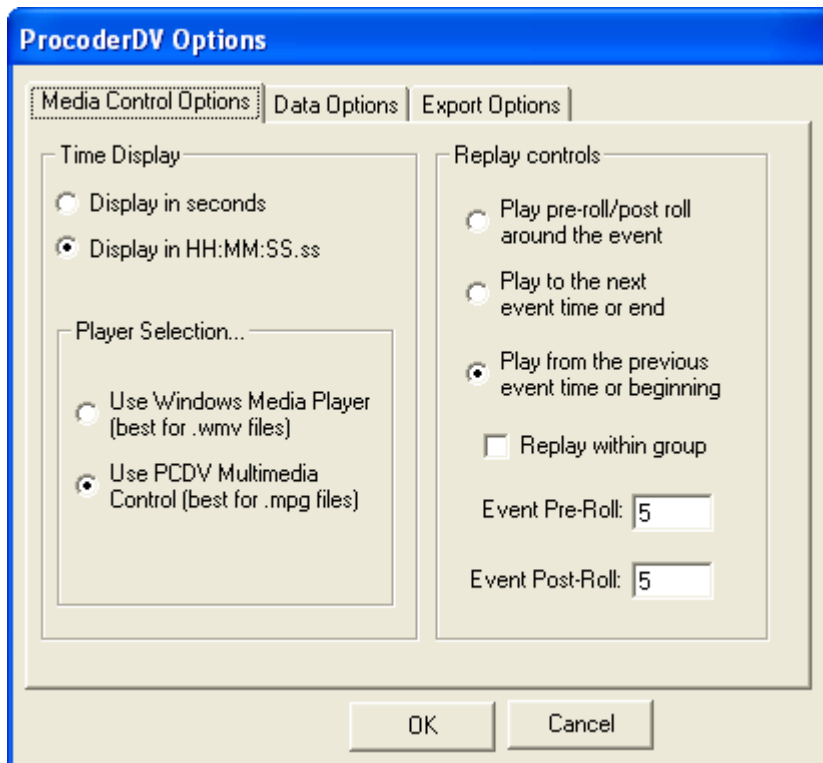


Setting ProcoderDV options:

If you are using ProcoderDV for the first time, you'll need to activate it. Select "Help," "Activate this copy," enter your email and user number. These can be obtained by emailing Jon.Tapp@vanderbilt.edu.

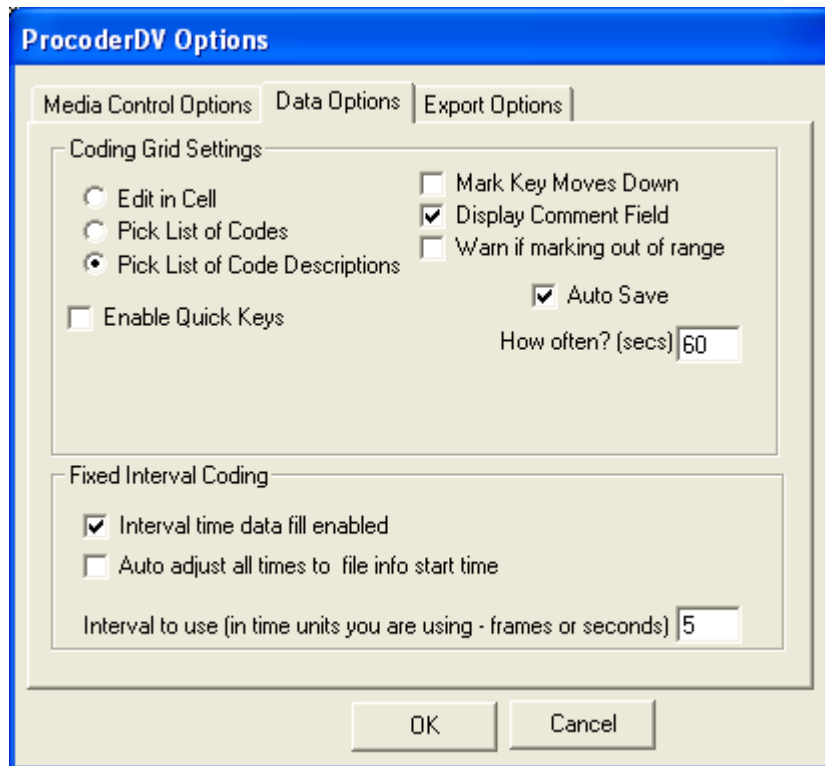
If you are setting up ProcoderDV for interval coding for the first time, check the option settings to make sure they are set correctly for interval coding (i.e., the type of coding you are doing).

Select, Edit, Option to get the following:



Under the "Media control options" tab, "Time display" should be set for "display in HH:MM:SS.ss." "player selection" should be set for "mpg," "Replay controls" should be set for "play from previous event time or beginning." The event pre-roll or event post-roll don't matter.

Select the “Data options” tab and get something like:



1. Now select “Data options” tab. Check “pick list of code descriptions” and “display comment field.” Check “auto save” and enter 60 seconds. Under “fixed interval coding,” select “interval time data fill enabled.” Enter “5” in “interval to use.”

The export options don’t need to be changed. So select “OK” to end the options set up.

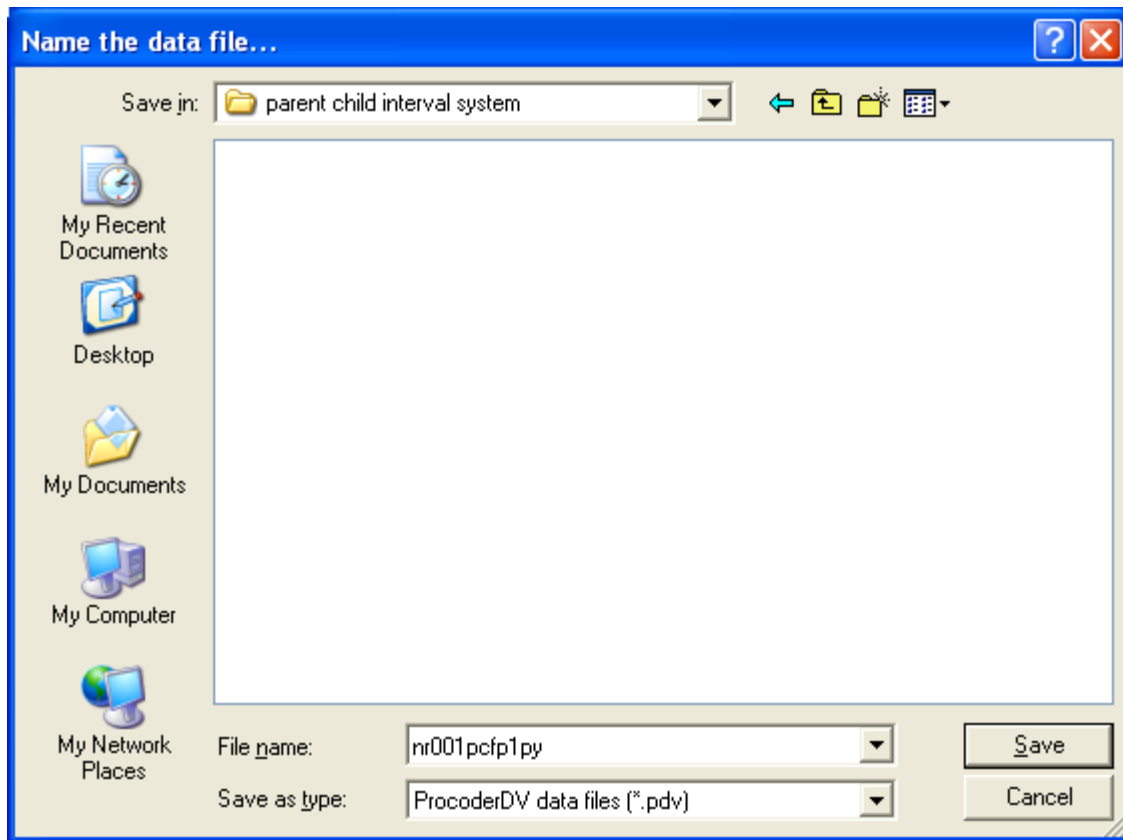
Once set, you won’t have to change the options unless they are changed for another type of coding system (e.g., timed event coding for child communication coding.).

Using Procoder to Code.

Once the ProcoderDV software options are set up, you’ll need to (a) open an observation file (a file containing your record of the coding for each interval), (b) open the media file (a digital record of the parent-child procedure for the participant you are about to code), and (c) open the cod file (a list of letter symbols that are short hand for what you are coding) for the Parent-child code.

Open an observation file

On the welcome bar for procoderDV select, File, new (if haven't started one yet for this session-but "open" if have already created an observation file for this session), observation data file. You'll get a window that looks like the following:



In the "save in:" box, navigate to where the file is to be saved. These should be saved first on your desktop in a folder labeled something like "Parent-child coded Useful Speech files" and after you are finished coding you will upload the completed procoder data file to the secure text server. In the "file name:" box, label the filename using the following convention:

Site initial-3 ID numbers-procedure initials-time period number-coder initials-coding type initial (primary or reliability). No extension is needed because procoder will attach ".pdv."

Eg., for a Nashville participant with the ID 001 in the Parent child free play procedure at time 1 coded by Paul Yoder as primary data would have a file name as follows:

"N001PCFP1PYP." Case does not matter for these filenames.

Press "save" to create this file in the indicated location with indicated filename.

The screenshot shows a software window titled "nr001pcfp1py.pdv" with a menu bar (File, Media Control, Data) and a toolbar with icons for Save, Export, Media, Replay, Seek, Delete, Insert, Mark, and Add Row. The "File Info" tab is selected, displaying a form with the following fields:

- Start Frame: (dropdown menu)
- Subject Identifier: (text field)
- Session Date: (text field)
- Session Time: (text field)
- Location: (text field)
- Session Code: (text field)
- Observer/Coder: (text field)
- Start Time: (text field) with a "Ctrl+Click to Mark" tooltip
- End Time: (text field)
- Date Started: (text field)
- Date Completed: (text field)
- Notes: (large text area)
- Media File: (text field) with "Browse..." and "Use Current" buttons
- Code File: (text field) with "Browse..." and "Use Current" buttons
- Seek Start and Seek End buttons
- Length: 00:00:00.00

You should see something like the above.

Choose the **File Info** Tab. Fill in this information:

Start Frame:

- Subject Identifier: e.g., N001 (Subject ID#)
- Session Date: e.g., 12/4/05 (date the procedure was recorded)
- Session Time: e.g., 1, 2, 3, 4 or 5 (assessment time period)
- Location: e.g., VU or UNC (site at which procedure occurred)
- Session Code: e.g., PCFP (initials of procedure)
- Observer/Coder: e.g., PY (your initials)
- Start Time: leave blank
- End Time: leave blank
- Date Started: e.g., 1/15/09 (date you begin coding)
- Date Completed: e.g., 1/20/09 (date you complete coding)

Notes: Indicate whether the data is primary or reliability data.

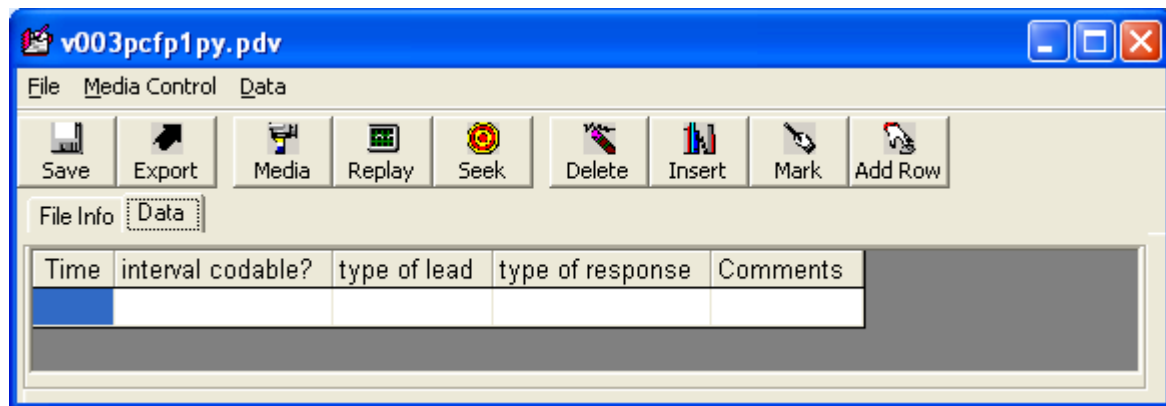
Media File: **Browse** to locate the media file to be coded; a link is created to this file. Make sure that file is copied to your hard drive. The folder containing your media file should be labeled something like "Parent-Child Free Play procedure media files." It is very important not to code from a CD or from the media server.

Code File: [Browse](#) to locate the .cod file; a link is created to this file.

It will initially be on the shared text server but should be copied on your hard drive. This file is labeled "pcfp 4_28_09.cod."

It is important that you SAVE the data file at this point. Doing so will enable the program to "recall" the media and code file that you have linked. Otherwise, the files will not remain linked for the next time you open the data file.

Once the File info is inputted and you have saved the media and code file links, re-open the data file and select the "data" tab. You should see something like the following:



Set up the Data page for coding.

Adjust the comments field and the time cell by putting the cursor on the margins of the cells and holding the left mouse button down while you stretch the margin of the cells (like you might in excel).

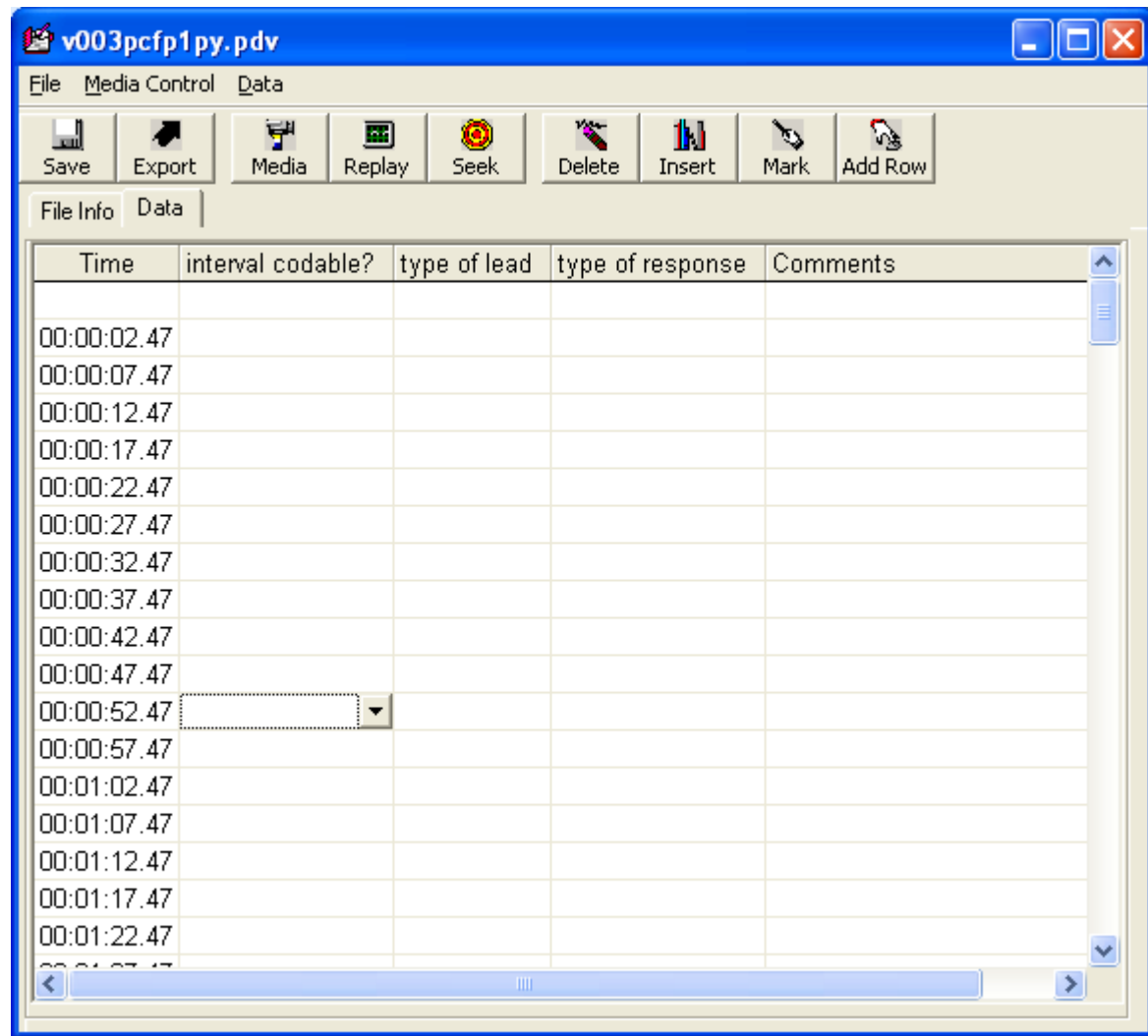
Open Media for coding.

Select Media button: The media file will open on your screen. If you are using two monitors, in the media window, select "options," "size," "fit to window" (not stretch to window). If you are using one monitor, use the cursor in the corner of the media file window to resize it to retain its width-to-height ratio while filling half the width of the monitor (the data file should fill the other half of the monitor display).

Create the times for the intervals in the data file.

In the data file window, (not media window), put the cursor in the first "time" cell. Use Ctrl+D to begin the media file. Mark the beginning of the session by using Ctrl+X keystroke at the offset of the examiner saying "start coding" or when the parent places a toy on the table. **If you are coding a reliability file, then begin the session at the point that the primary coder began the session by typing in that time in the 1st "time" cell.** If you do this, make sure that you attend to whether a " : " or a " ." is used to denote the time. Select "Data" from menu bar (not data tab), select "add rows" (not "add a row"), enter the number of rows you need to code for the duration of the session (e.g., you usually will have a 15 minute session and 5 second intervals, giving 180 intervals [15

minutes x 12 intervals per minute = 180.]. This will result in 180 rows being inserted with time for 5 seconds after start time.



Begin coding in the 2nd interval. Place the cursor in the cell for the 2nd interval (the 2nd row from the top with a time by it) and use the replay function (e.g., ctrl-A) to “replay” this interval from the previous interval.

Begin coding in the 2nd interval.

Use the mouse or arrow key to move down to next interval. Repeat viewing the interval as often as needed to code each dimension. Assuming the cursor is "registered" on the cell for the interval, use the Ctrl A keystroke to do so.

Tips for Coding and Definitions

Tips for coding the codeability column.

1. One of the following codes (u or c) is coded in all intervals on a 1st and separate pass. That is, the codeability dimension is an exhaustive one. All intervals **MUST** have either a "u" or a "c" recorded in the corresponding cells.
2. Ask whether the interval is uncodeable first. If it is not, then it is by default codeable.

Definitions needed to code the codeability column.

Uncodeable:

A. The following are *examples* of distractions/situations that may occur during the session. During these instances, a parent would not be expected to use the coded responses, and therefore the interval would be marked as “uncodeable.” **Regardless of the duration of the distraction during the interval (1 second versus entire 5 second interval), the interval will always be marked “uncodeable.”** The interval will always be “uncodeable” when:

(1) child is engaging in behavior that needs behavior modification (ignoring or intervening)

a. child is engaged in behavior that is reasonably judged as in need of active ignoring to extinguish

e.g., child playing with diaper bag, mother’s handbag, etc

e.g., child attending to door/door knob possibly indicating that he /she wants to leave the room

e.g., trying to get out of chair.

b. child is engaged in behavior that is in need of behavior control methods

e.g., Throwing toys.

e.g., Climbing on furniture.

e.g., Hitting/biting adult.

e.g., child crying uncontrollably; child is unable to attend to objects/adult

e.g., A parent attempts to stop a child from putting toys on the floor.

(2) interval is not part of the prearranged session length.

e.g., Parent leaves table to retrieve toys from floor (or to obtain any other item away from the table)

(3) part of session is interrupted

e.g., bathroom break

e.g., fire drill

e.g., interruption for transition to books from toys, includes door opening and closing

e.g., cell phone ringing

e.g., child coughing/sneezing/parent wiping child's nose

(4) beeping noise from timer to end session is heard during any part of the interval.

B. There may be instances when due to point of view of the camera and arrangement of the referents and/or parent and child, the coder cannot determine whether a lead or response has occurred. Because we do not want these unclear instances to count in the number of responses, we mark these intervals as uncodeable.

(1) coder can't see adult's hands or what she is doing to judge whether adult "physically plays."

(2) coder cannot see child's hands to determine what object he/she is actively moving in order to score a touch lead or "physically play."

(3) coder cannot see child's face to determine if there is attention to a referent.

(4) child is off screen for part of interval or video is so unfocused can't tell what child is doing.

(5) adult is leaning down towards the floor with 1 or both hands off the table .

Codeable: Any interval that is not "uncodeable."

Tips for coding the "lead" column of the data file.

1. Intervals coded with "c" in the codability column are considered on the 2nd pass for "lead" codes.
2. The type of lead is indicated in the "lead" column or it is left blank.
3. Sometimes the child's foci of attention are unclear because the apparent referents of their gaze and touch differ. In such cases, looking is credited before touching.
4. However, if the referent for a touch and a look are the same, the touch lead is recorded in the interval cell. That is, look and touch codes are mutually exclusive (both cannot be coded). Because physical play can only be coded after a touch lead, when both types of leads occur, we code the touch lead.

Definitions needed to code the lead column.

Referent (the object of the child's "lead")

- i. table
- ii. parent or adult
- iii. any toy from the toy sets provided, including books
- iv. snack items (cheerios, juice bottle that child brings to session)
- v. jewelry on parent
- vi. pacifier
- vii. child's chair, chair buckle

A lead is shown by the child demonstrating attention. Attention is shown via looking for at least 1 second or actively touching for at least one second. Looking is inferred by the direction the nose is pointing, because we often cannot see the pupils or eye lashes. Active touching means to move the referent with one's hand or to move one's hand or fingers on the referent.

Adult responses can only be coded when the child "owns" their lead. Therefore, we only code leads the child "owns." The child comes to "own" a lead by (a) initiating it or (b) adopting it.

Child-initiated referents: Child attention (look or active touch) that the child begins without adult explicit verbal prompts or adult verbal direction. Child attention that is in response to the adult's NONVERBAL material arrangements (e.g., connecting the fences together in the play set) will be considered "child-initiated."

Child-adopted referents: (i.e., objects introduced by the parent to which the child has attended for at least 2 intervals prior to the target interval). When an adult introduces an object to the child, it is believed the child needs to be engaged with the new item for a period of time before benefitting from responses used by the parent. For this coding manual, this amount of time is defined as 2 consecutive intervals of child attention. The onset of the count for the 2 intervals is the interval after the interval in which the adult has introduced the new object. For example, if the adult modeled pushing the train and saying "choo-choo" in interval 40, and the child does this for interval 41, and 42, then child's touch lead is coded for interval 43.

Tips for coding adult response column.

1. All intervals with a lead are considered for a "response."
2. Only touch leads are opportunities for "physical plays" responses.
3. Either type of lead is an opportunity for a "follow in utterance" response.
4. An interval may be left blank if neither physical play nor follow-in utterance occurs.
5. When determining whether an adult's action is an example of physical play, the coder may need to advance the file 1-2 intervals to decide whether a parent's action is an elaboration. Once this determination is made, the coder must decide when the adult physical play began. The onset of the action is coded in the interval in which the parent action becomes recognizable to the coder as an imitation, aid, or demonstration. This requires more than the parent contacting an object. The onset of a behavior to sustain attention can begin as soon as the adult moves the object.
6. Adult responses (both physical play and follow-in utterances) must occur during the interval with the relevant child's lead (not an immediately following interval).
7. If there are multiple child leads or referents identified in the interval and the adult response is to only one of these still code the interval as having an adult response.
8. If there is both a physical play and a follow-in utterance response, code the follow-in utterance response.
9. If you cannot determine what the parent has said after listening to the utterance three times, the utterances will not be marked as a follow-in utterance. The physical play of the adult may still be codeable even if you cannot determine what the adult has said.
10. If at least one follow-in utterance occurs in an interval with a child lead, code "follow-in utterance" for that interval.

Definitions needed to code adult response column:

Physical play: There are 4 types that are defined below but not distinguished with different codes.

Adult imitates the child's action with the same or similar touch lead referent (child and adult may be holding the object at the same time). The adult does a similar action as the child's. It may be a reduced (not all of the child's action) or expanded (all of the child's action plus some other action) or exact (all components of the child's action) imitation of the child's action.

Examples:

1. Rolling a ball back and forth between the child and adult (or driving a car back and forth).
2. Child shakes rattle. Adult picks up another rattle and shakes.

Nonexamples: Imitations of child's laugh or cough or other vocalizations are *not* coded.

Adult aids the child's action. The adult does something to receive or enable the child's action. This can involve moving something in the child's way, stabilizing the object the child is acting on, putting out a container or receptacle for the child's action.

Adult demonstrates a new action on child's referent. Modeling for the child what the child could do with the referent of the child's touch lead.

Adult demonstrates a new action on a different object and relates this object to the child's referent.

Relates to object child is actively touching. Our definition of "relating" to the child's object of attention is **(a)** deliberately moving objects into the perimeter of the child's object of attention, **(b)** deliberately moving the adult and/or child object so that they come into contact with each other, or **(c)** verbally relating the objects such that both are mentioned in the same utterance or adjacent utterances are conjoined (one begins with "and") or the combination of adjacent utterances and actions indicate to the coder that the adult intends for the two objects to be related.

Examples of Play Demonstration and Aiding

Baby doll + Bottle:
Feeds baby the bottle
Takes hat off baby

Undresses/dresses baby
Sits baby upright
Rocks baby in arms
Puts baby to sleep
Walks baby across floor
Hugs baby
Sits baby on/in car
Puts beads on baby
Pretends to drink from bottle
Gives baby drink from nesting cups
Makes baby shake rattle
Feeds baby food from the farm set

Nesting Cups:

Stacks cups
Line cups in row
Takes cups apart
Nests cups
Put other toy/s inside cups
Pretends to drink from cups
Puts cup on head (adult or child)
Puts cup on baby's head
Pours toys from one cup to another
Pretend pouring from cup to cup
Hides toys under cup

Beads:

Puts beads on neck/wrist
Puts on child's neck/wrist
Puts beads on baby
Puts beads in nesting cup
Puts beads in car

Rattle:

Shakes rattle
Physically assists child to shake the rattle
Puts rattle in car
Gives to baby to shake
Pretend to give monkey drink from cup or bottle (rattle is a monkey)
Makes monkey rattle climb up or down the nesting cups
Feeds monkey food from farm set

Snap Beads:

Removes lid from container
Loosens lid for child to remove from container of beads
Places beads in nesting cups or bead container

Snaps beads together
Takes beads apart
Makes necklace
Puts necklace around neck
Swings connected beads back and forth
Aids child in putting beads together
Puts necklace on head
Pretends bead is a piece of food by eating or feeding to adult or toy

Pop Up Toy:

Pushes pop up buttons
Closes pop up
Physically assists child in pushing buttons or closing pop up
Pretends to give drink or feed the animals on the pop up toy

Car:

Spins tires
Pushes car along floor
Puts baby on/in car
Puts pop beads in car
Puts bead necklace in car
Helps child open car door
Pushes car back and forth with child
Places little people or animals in car
Crashes car into stacked nesting cups
Uses wooden plank to create a bridge with nesting cups as posts
Drives car under or over wooden bridge

Farm Set:

C: actively manipulating the tractor

puts person on tractor
drives same tractor around table
puts animal in the trailer connected to the tractor
connects trailer to the tractor
rolling tractor back and forth
connects trailer/add person/add animal
places Little Person from either toy set in the tractor
pushes tractor back and forth with child
moves tractor towards barn
opens doors of barn so tractor can go in

C: actively manipulating the water pump (use as a vehicle/pushing water pump/connect to barn)

pushes the water pump

connect it to the barn
brings animal to pump to drink
takes farmer to pump the water
places animal at water pump to drink
pretends to drink from water pump herself
puts hand under water pump and drinks from her hand

C: Active manipulation with barn

opening and closing barn doors
adult puts animal inside, along perimeter of the barn, puts farmer inside
drive the tractor towards the open doors or through it
put tractor inside for storage
connect water pump to side of barn
put the basket of apples/corn inside the barn
knocks on door
opens door w/ or w/out Little Person

C: Active manipulation with an animal

feeds the corn stalk or animals to the animal
presents the water pump for animal to drink
presents Little Person to ride on the animal's back or vice versa
present little person or animal to hug or kiss the child's animal

C: Active manipulation with little person

presents corn stalk or basket of food for littler person to pick from

Books:

Aids in opening flaps to reveal pictures underneath
Helps child turn page if child has difficulty turning and separating pages

Slinky:

Demonstrates how to make slinky step down
Bounces slinky up and down in the air
Extends/pulls up from floor or table
Demonstrates movement from hand to hand
Peeks through slinky at child
Puts small toy/animal inside a standing slinky

Adult follow-in utterance.

Parental utterance that is a **follow-in utterance** has the following attributes:

- a. it is about the child's focus of attention (object or event):

- the referent of the adult's utterance is considered the same as the child's focus of attention if it:
 - has the same label as the child's referent (i.e., "block") **OR**
 - is spatially proximal to the child's referent/ in the child's field of vision **OR**
 - is related (through the parent's words or actions) to the child's focus of attention
- The parent can comment on her own actions IF the child has adopted that referent (i.e., has been attending to the object of the parent's action for two immediately preceding intervals). For example, the child has been looking at the horse for two intervals. In the third interval, the parent says "jump, jump" while making the horse jump along the table. This may be coded as a follow-in comment.
- The parent can comment on a specific item or action, as well as the entire item or set of actions within the child's focus of attention. For example, if the child is looking at the barn set and the parent picks up a dog from the set, places it next to or in the barn (within the child's field of vision) and says, "Here is the dog," this would be a follow-in comment.

AND

- b. contains at least one grammatical word. A grammatical word is in the unabridged English dictionary AND is a member of the major grammatical classes of Noun, Pronoun, Verb, Adverb, Adjective, Prepositions, helping Verbs, linking Verbs, or Articles. The list of exclusions is in Appendix 1, which includes symbolic sounds and interjections, and highly routinized speech. The principle for considering a word candidate "grammatical" is that the word either conveys important semantic content on its own or is a word that is "attached" to other word(s) in the utterances that carry semantic content.

Word-like non-words or "non-grammatical" words

These forms are word-like and considered to be words by many people. However, in our system, though, adult utterances that have only these types of words are not coded as follow-in utterances because it can be argued that they do not aid the child's language development as much as words that usually fill a grammatical roles. Some of these are difficult to distinguish from random noises, some are overlearned in highly contextualized parent-child routines, and/or they carry little or no information without referring to prior utterances. They do not have a grammatical role in the utterances in which they are found.

Animal Sounds: exhaustive list

Bak (or any sound a chicken makes)

Grr (or any sound a bear, lion, tiger makes)

Meow (or any sound a cat makes)*

Moo (or any sound a cow makes)

Neigh (or any sound a horse makes)
Oink (or any sound a pig makes)
Tweet (or any sound a bird makes)
Woof (or any sound a dog makes)
(any attempt to sound like any animal)

These same forms *can* be used as a part of a sentence and thus are grammatical words in those contexts (e.g., “The bird said tweet.”)

Transportation Sounds

Beep (any horn sound; honkhonk, beepbeep, etc. - or siren sound)
Boom (or any crashing/loud noise)
Choochoo (or any sound a train makes; Whoowhoo)
Zoom (or any sound a plane makes)
Vroom (or car, bus, truck, etc. driving sounds)
(any attempt to sound like any vehicle)

Again, these same forms *can* be used as a part of a sentence and thus are grammatical words in those contexts. , in which case, they are transcribed as grammatical words (e.g., “The car went vroom.”)

Miscellaneous Sounds

Bang (shooting gun)
Bonk (while hitting something)
Dingding (cash register, doorbell, and bells ringing)
Hoho (Santa Claus)
Hush (be quiet)
Knockknock (door sounds)
Pop (bubbles popping)
Smack (kissing sounds)
Thumpthump (heartbeat sounds)
Tick (clicking sound)
Wah (crying sounds)
Knockknock

These same forms *can* be used as a part of a sentence and thus are grammatical words in those contexts (e.g., “Santa goes hohoho”).

Acknowledgment and Response Words

Acknowledgments use the words in this class in response to adult declaratives, and responses use these in response to adult behavior regulators.

Allright

No (or any form reflecting simple negation, like “nah,” “nope”). In contrast, forms of “no” *are* transcribed when they are part of a multiword grammatical construction

meaning “not” [e.g., “no mine,” “no hot”] or “don’t/doesn’t” [e.g., “no touch,” “no go there”], or “not any” [e.g., “there’s no beans,” “no cookie now”].

Okay (used as a simple response to a

Request [Child: “Get that.” Adult: “Okay”; or as a conversational device, “Okay, let’s try.”])

Right

Sure

Yes (or any form of the simple affirmative, like “yeah,” “yep”).

These same forms *can* be used as a part of a sentence and are grammatical words in such contexts (e.g., “I wasn’t SURE.” “That’s ALLRIGHT.” “not OKAY.” “He said YES.”)

Interjections and Vocatives

Ah (screaming sound; satisfaction, delight, pain)

Eh? (as in requesting clarification)

Ew (to mean yuck)

Ha (resentment, wonder, triumph)

Hey

Hu (expression of surprise or fright - vocalized intake of breath)

Huh? (as in requesting clarification)

Mmm (that’s good)

Mommy, Daddy, and the examiner’s name when used as a vocative (e.g., “Mommy, get that.”)

Oh (pleasure, satisfaction, surprise)

Ow (ouch, that hurts)

Uhhuh (as indicating “YES”)

Uhoh (something bad just happened)

Uhuh (as indicating “NO”)

Ugh (as in “yuck”)

Whee

Whoa

Woopsy

Woopdy-doo

Yea (praise)

Yuck (Note that “yucky” is an evaluation in an adjective form. It would be transcribed as a grammatical word)

Politeness Markers

Bye/Goodbye

Hello/Hi

Nightnight

Please

(I’m) Sorry

Thanks/Thank you

(You're) welcome

******And any other form of greeting or salutation (e.g., Hi there, howdy....)

Routinized Forms and Songs

*Counting (rote counting or counting with one-to-one correspondence)

*Alphabet

Peekaboo (words such as boo within this routinized game)

Songs

Rhymes

Fingerplays

Routinized word(s) or phrase(s) said in a sing-song like manner (e.g., rockyrockyrocky, teetertotterteetertotter)

Routinized phrases such as "Ready, set, go"

Child plays a circumscribed role in a well defined, conventional routine. This would include the child taking turns in nursery rhymes, finger plays, songs, riddles, jokes, and the like (e.g., Adult: "knockknock," Child: "who's there?" or "who is it?").

Examples of Follow-In utterances:

Some of these don't tell the child what to do

- "The ball rolled away. Go get it." or "The ball rolled away. Where is it?" The initial comment ("The ball rolled away.") is a [fc].
- "There's the ball. You like the big blue ball."
- A parent pretending to be the voice of toy or animal may provide follow-in comments as long as the statements are not directive. For example, the child is holding a basket of apples and parent brings horse to the basket while narrating, "I'm hungry, I'm eating apples."

Some of these do tell the child what to do

- a. The child has been playing with the horse for at least 2 intervals and the adults says, "Put it in the barn."
- b. The child has been looking at the book for at least 2 intervals, and as s/he reaches for the book the adult says, "Turn the page."
- c. The child initiates play with the blocks, and as the child holds a block above the container the adult says, "Block in."
- d. A child is playing with blocks for at least 2 intervals, and the adult uses a rising intonation with the statement "Put it back in?" This may be coded as a follow-in directive as it directs the child to perform an action with an object that is the focus of attention using a questioning tone of voice. A child

is playing with blocks for at least 2 intervals, and the parent offers the choice, “Do you want the red one or the green one?” This may be coded as a follow-in directive because it obligates the child to respond to a question about his/her current focus of attention

NONexamples of Follow- in utterances:

- a. Descriptive comments about the parent’s actions IF the child has NOT been attending to the object of parent’s play for 2 immediately preceding intervals.

Examples:

- Child is looking at the horse. Parent pushes tractor on table and says, “I’m pushing the tractor.”
- Child is not attending to anything. Parent is looking at book and says, “I’m turning the page.”
- Child is pushing the car. Parent is shaking rattle. The child reaches for the rattle (lasting about 1 second). Parent says, “Mommy is playing now. You can play later.”

- b. Parental utterances that only contain non-grammatical words

Examples:

- Child drops a toy and parent says “Whoopsie Daisey.”
- Child is spinning a top and parent says “Wow.”
- Child is playing with a cow and parent says “moo.”
- Other examples of non-grammatical words
 - Animal sounds
 - Environmental sounds, such as vehicle sounds, object sounds (bells, hammer, etc.) or toy sounds (“pop” for bubbles)
 - Politeness markers (bye, hi, please, thank you, etc.)
 - Routine forms and songs (rote counting, reciting alphabet, songs)

- c. Verbatim reading-Adult utterances that are being read verbatim from a book (during book sharing) are not follow-in comments. This does not include labeling picture items in a book.

- d. Adult statements intended to keep the child from doing something in the future.

Examples:

- “You’re supposed to play with that, not eat it.”
- “Don’t throw the toy.”

e. Comments that do not pertain to the child’s focus of attention or child’s actions or adult’s actions that the child has been attending to for at least 2 immediately intervals, but do pertain to the current play session are not coded as follow-in comments.

Example:

- Parent says “We hardly ever get to play together, do we?”

For example, statements that ask the child to recall experiences from memory. These are not about the child’s immediate focus of attention. “You had cereal for breakfast today, didn’t you?”

Another example of statements that are not coded as pertaining to the child’s focus of attention are descriptive comments in which the child’s focus of attention cannot be seen or determined (see criteria for determining codeable and uncodeable intervals when this occurs).

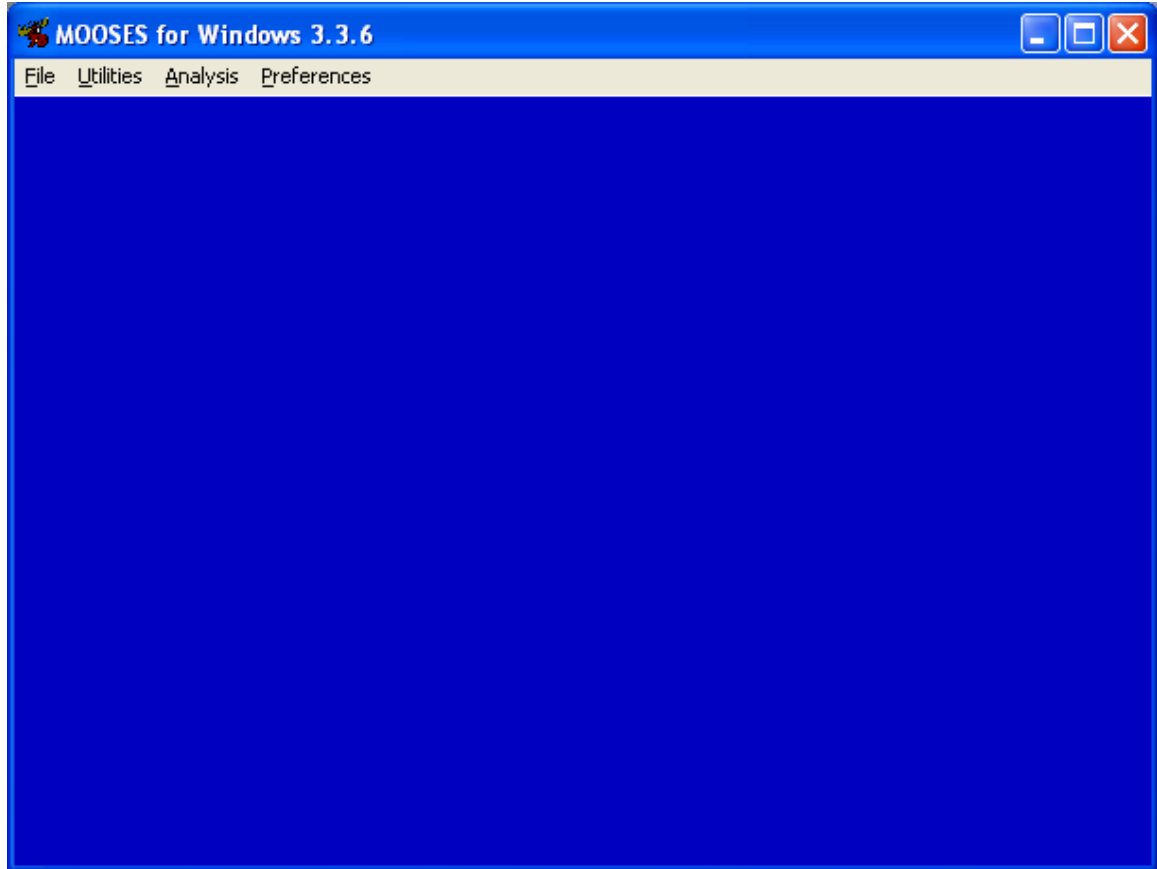
- a. The adult initiates play with the horse, gives it to the child and says, “Put it in the tractor.” This is not a follow-in utterance because the child has not been attending to the horse for 2 immediately preceding intervals and the adult initiated the play with the horse.
- b. The child is playing with the tractor and the adult says, “Give the sheep a drink of water.” This utterance is not considered a follow-in utterance because it is a directive about the adult’s, not child’s, focus of attention given at a time when the child is already engaged with something else. .
- c. The child is not engaged with anything and the adults says, “Look at the truck.” This is a not coded as a follow-in utterance because the child was not already attending to the truck.

Save the file: Press the SAVE button. SAVE FREQUENTLY. Many coders save after every coding decision.

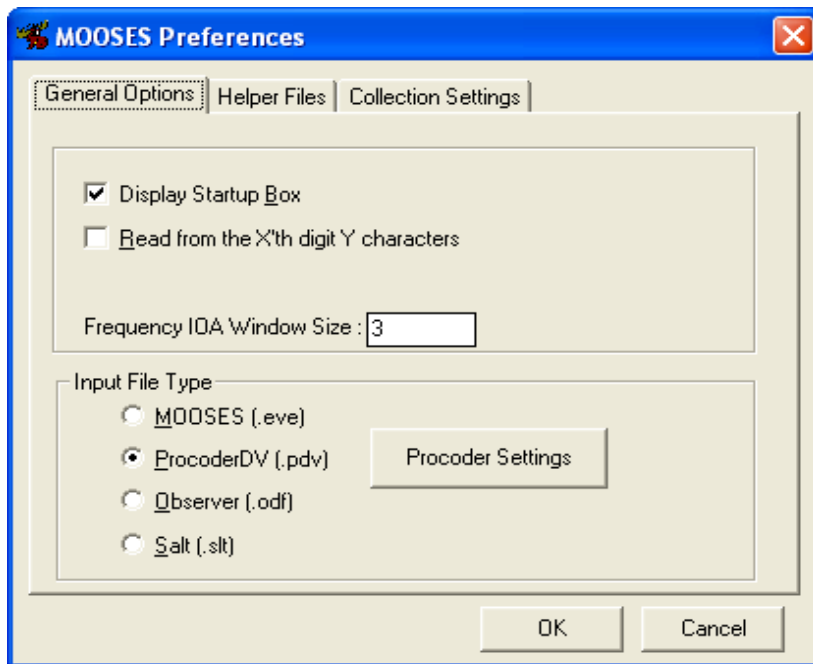
To exit ProcoderDV. Go to the toolbar, select, “file,” “save and close.”

Count the number of instances of each code using MOOSES

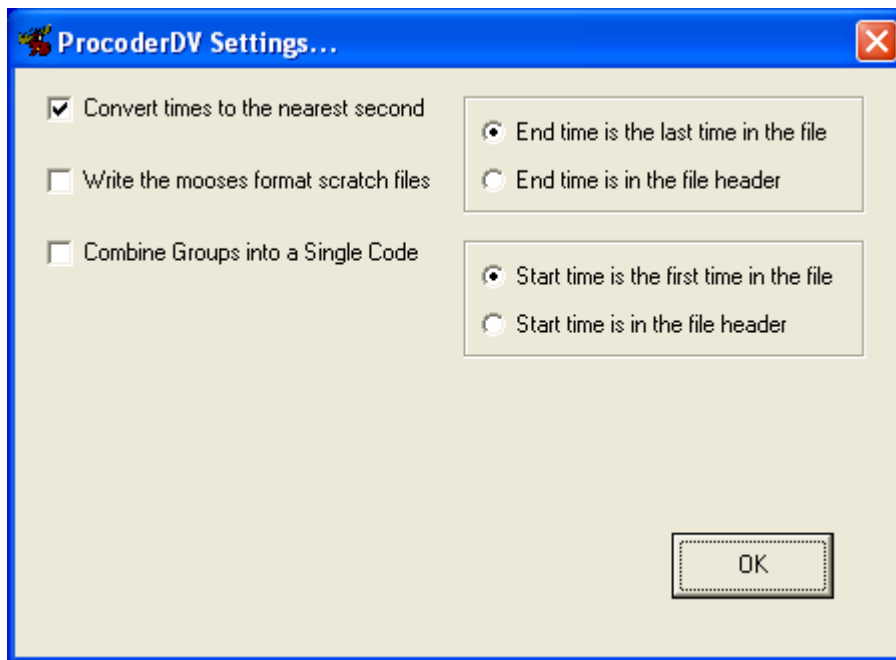
1. Boot MOOSES.



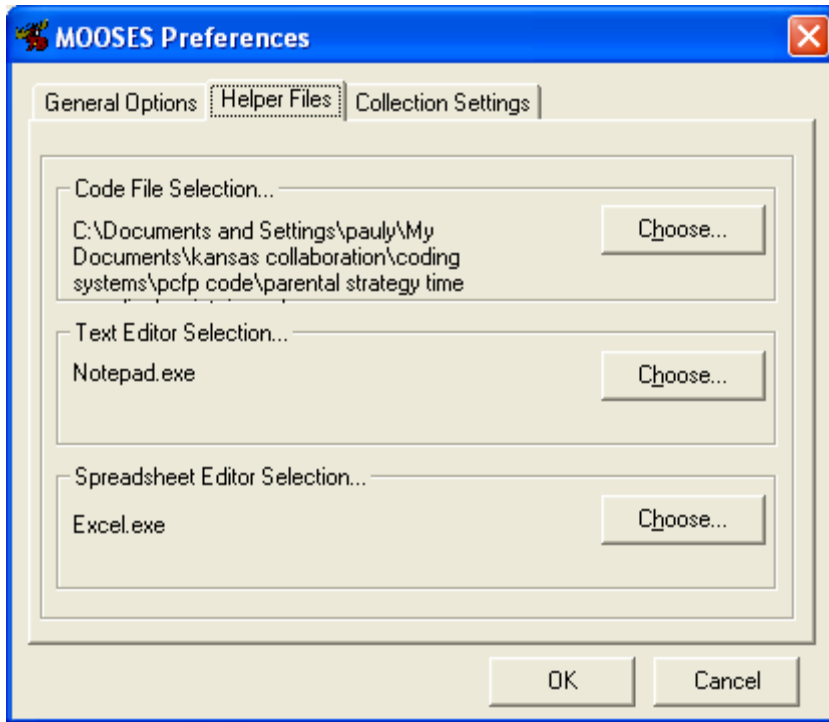
1. Select Preferences on the MOOSES toolbar. Under the General Options tab, check boxes to set as follows:



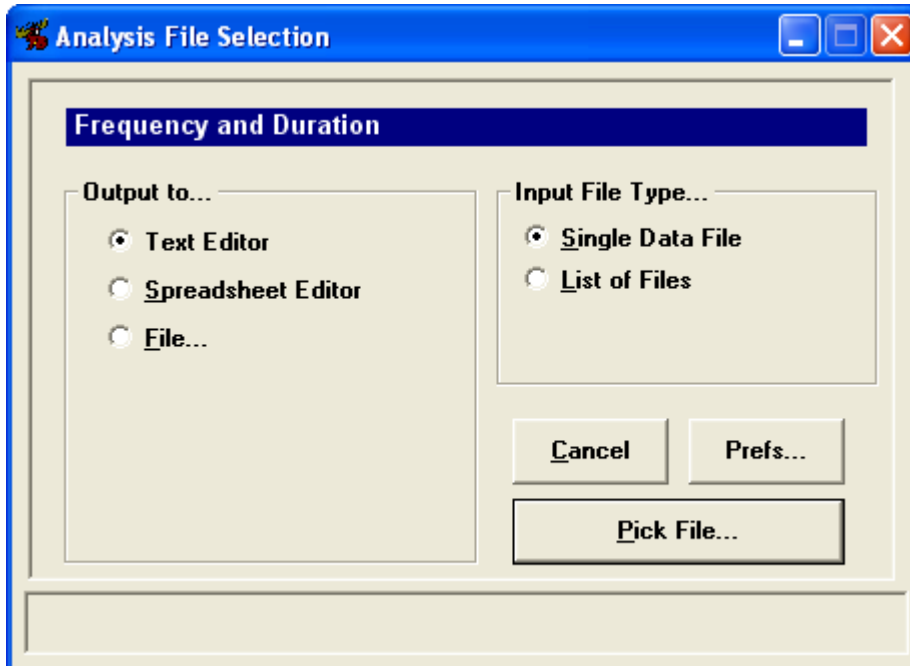
Select procoder settings and make sure like look like below:



Press ok. Under the Helper Files tab, navigate to where the cod file is for the PCFP and press ok.



2. Select analysis, select frequency and duration. Make sure the files are set up as follows:



3. Select Pick File, and navigate to where the observation file is that you created through procoder. Select the appropriate pdv observation file to create a pdv.txt document.
4. Save this text file on the network under analysis files for PCFP data. . The data will be summarized for two different purposes.

For the USS project, enter into the spreadsheet the “frequency” for “c” (codeable intervals), "l" (look leads), "t" (touch leads), "pp (physically plays) and "fu" (follow-in utterances). The excel spreadsheet will compute the needed proportions. These are: (a) $(\# \text{ pp} + \text{fu})/(\# \text{ l} + \# \text{ t})$, (b)

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