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UNIVERSITY OF CALIFORNIA

Los Angeles

Communication profiles of children with profound visual impairment and their caregivers

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy in Special Education

by

Robyn Rene Herrera

2015

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ABSTRACT OF THE DISSERTATION

Communication profiles of children with profound visual impairment
and their caregivers

by

Robyn Rene Herrera

Doctor of Philosophy in Special Education

University of California, Los Angeles, 2014

Professor Connie Kasari, Chair

This study examined the social communication profiles of 12 dyads which included a young child (18-48 months) with congenital blindness using a semi-structured, play based, manualized protocol: the Communication Play Protocol (CPP) (Adamson & Bakeman, 2012). Children and their caregivers were found to be synchronous in their communication profiles with each member of the dyad equally contributing to the interaction. Caregiver and child characteristics were found to be related to the dyad's social interaction profile and predictive of social communication competence. The results of the exploratory sequential analysis suggest that caregiver recognition of non-prototypical child responses to a bid for joint interaction leads to continued child responsiveness or sustained joint interaction.

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2015

Dedication Page

For Jacqueline, “Brother” and Micah. Before you entered my life, I used to wonder what I might accomplish; you have taught me that with love and hard work all things are possible.

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List of Acronyms

CGBid - Caregiver bid for joint attention

CGBidnV - Caregiver nonverbal bid for joint attention

CGBidV - Caregiver verbal bid for joint attention

CGBidVnV - Caregiver paired verbal and nonverbal bid for joint attention

ChnP: Child non prototypical response to a bid for joint attention

ChP: Child prototypical response to a bid for joint attention

ChnR - Child non response to a bid for joint attention

CPP- Communication Play Protocol

ChR - Child response to a bid for joint attention

JA- Joint attention

O&M-Orientation and mobility

ONH- Optic Nerve Hypoplasia

PVI- Profound visual impairment

MCDI- MacArthur Bate Communicative Development Inventory

VCOPS- Vulnerable children overprotective parents' scale

Acknowledgements

This dissertation would not have been possible without the love, support, and encouragement I received from my children, parents, family, friends, and mentors. Only now am I beginning to realize how much my family has sacrificed so that I could attain my dream. I do not have words to adequately describe my deep gratitude for all they have provided me, though I hope to show them in the years to come.

Additionally, this dissertation would not have possible without the support of the families who participated in this project. I am eternally grateful to them for allowing me into their lives. It is my hope to continue to make a difference in the lives of children with congenital blindness.

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Introduction

Childhood blindness and visual impairment is a low incidence disability. There are approximately 59,355 school aged children, ages birth to 21 who are blind or legally blind, 20/200 in their better eye with correction or a visual field of 20 degrees or less in their better eye (American Printing House for the Blind, n.d). The Office of Special Education's child count project has identified 3,354 young children, ages 3-5, as having the primary disability of visual impairment (Data Accountability Center, n.d.). While the population remains small, children with blindness and visual impairment have atypical development (Ferrell, Shaw, & Dietz, 1998; Hatton, Bailey, Burchinal, & Ferrell, 1999, Warren & Hatton, 2003). The fact that 30%-50% of the population has continued atypical development resulting in lifelong socio-communicative deficits is a cause of concern (Hobson, & Lee, 2010; James & Stojanovik, 2006; Tadic, Pring, & Dale, 2010).

Children with a profound visual impairment (PVI), who have a visual acuity of 20/800 or worse in their better eye with correction, have the most atypical development (Ferrell et al., 1998; Hatton et al., 1999). These children frequently have delays in motor development (Bigelow, 1992; Fraiberg, 1977; Hatton et al., 1999; Ibsen, Troester, & Brambring, 2010; Prechtl, Cioni, Einspieler, Bos, & Ferrari, 2001), language acquisition and use (Andersen, Dunlea, & Kekelis, 1984; Conti-Ramsden & Perez-Pereira; 1999; Dunlea, 1989; James & Stojanovik, 2006; Kekelis & Prinz, 1996; McConahie & Moore, 1994; Tadic et al., 2010), and social personal development (Ferrell et al., 1998; Hatton et al., 1999; Perez-Pereira & Conti-Ramsden, 1999; Preisler, 1993). For some children, these interaction- related delays are transient; they disappear with experience (Hobson & Lee, 2010; Peterson & Peterson, 2000). However, for others these delays persist or intensify, and become a secondary socio-

communicative disability (Hobson, Lee & Brown, 1999; James & Stojanovik, 2007; Tadic et al. 2010).

The proposed study hopes to further our understanding and replicate findings from previous research in the development in children with blindness, and add to the growing research base. The study will investigate the social communicative profiles of young children and their caregivers. The social interactions of caregivers and their children with blindness during semi-structured play based interaction will be coded and analyzed. Relationships between caregiver characteristics and child characteristics and the social communicative profiles will be investigated. Lastly, an exploratory sequential analysis will be conducted to investigate if caregiver recognition of non-prototypical child responses leads to greater child responsiveness.

Literature Review

From infancy, children with PVI and their caregivers differ from both their sighted counterparts and their low vision counterparts in their social interaction styles and abilities (Tadic et al., 2009). These differences emerge as infants with PVI are unable to visually investigate and coordinate themselves with the environment, unable to visually identify another's affect, unable to use vision to coordinate their affect with another, and unable to engage in alternating eye gaze. Furthermore, as infants with PVI mature into toddlerhood, they limit their interaction with their environment (Brambring, 2006), display limited affect (Fraiberg, 1977; Troester & Brambring, 1992) infrequently respond to bids for communication (Brambring, 1987; Troester & Brambring, 1992), infrequently initiate socio-communicative interaction (Anderson, Dunlea, & Kekelis, 1993; Bigelow, 2003), and have significant delays in the emergence of joint attention (Bigelow, 2003).

Joint Attention and related skills in Children with PVI

Joint attention (JA) is a crucial social-communicative milestone that emerges and develops in sighted children between 9 - 14 months of age (Striano & Reid, 2006). During an episode of JA, both the child and caregiver are aware that their focus is on the same object with the mutual goal of sharing the experience, activity, or event (Mundy, Sigman, Ungerer, & Sherman, 1986; Tomasello, 1995). Joint attention is interactionally achieved when one person alerts another to an object or activity by means of eye-gazing, finger-pointing, or other verbal or non-verbal indication.

Children with PVI do not begin to engage in episodes that include JA, until 21- 30 months of age (Preisler, 1993), and only with the co-occurrence of language (Bigelow, 2003). During these episodes caregivers are scaffolding interaction, and children are responding; however, children with PVI are not initiating interaction with their caregivers, nor are they attempting to direct their caregivers' attention.

Role of Motor Development

Using vision, infants gather information about the environment, which allows them to engage with the environment and others. Through interaction and engagement with the environment children receive social feedback, and proprioceptive feedback, which promotes the refinement of motor skills. Social feedback further promotes engagement with others, the practice of motor skills, and the development of more complex motor skills. Children with PVI often have delays in transitional movements (Brambring, 2006; Fraiberg, 1977), and in purposeful independent movement (Brambring, 2006; Celeste, 2002; Ferrell et al., 1998; Hatton et al., 1999, Warren & Hatton, 2003). Without vision to assist with motor development, children can become passive, non-responsive, and hypotonic (Hatton et al., 1999; Scott & Kinnis, 1975). These decreased levels of environmental engagement and delays in motor development seen in

children with PVI (Brown & Bour, 1986; Celeste, 2006; Ferrell et al., 1990; Fraiberg, 1977; Norris, Spaulding, & Brodie, 1957; Troester & Brambring, 1993) have been hypothesized to be due to fear of movement, spatial disorganization, hypotonia, as well as to caregiver fear of harm. These are thought to also lead to subsequent environmental restriction (Brown & Bour, 1986; Jan, Robinson, Scott & Kinnis, 1975; Sonksen, Levitt, & Kitzinger, 1984).

It is theorized that delays in motor development and engagement with the environment impact children with PVI in the area of social interaction. Vision loss affects a child's ability to interact with the world, and to send and receive nonverbal social reinforcement to continue or initiate a motor activity, or stop an activity. It is during these early joint interactions that include eye gaze and sensorimotor play that children and caregivers are learning to respond reciprocally, engage in affect attunement, and motor imitation, all, which promote language and joint interaction (Preisler, 1993).

Role of language ability

Language is used within social contexts. An individual must know when and how to use language within social situations. A child must not only learn phonology, syntax and semantics, they must learn how to put language to its intended use, communication. Children with PVI have little difficulty acquiring the sounds of their native language (Mills, 1993). The first words they acquire are similar to those acquired by children with sight, and these words are acquired close to the norm of children with sight (Brambring, 2007; Fraiberg, 1977; Iverson, Tencer, Lany & Goldin-Meadow, 2000; Moore & McConachie, 1994). The child's restricted visual, environmental, and linguistic input appears to interfere little with the sounds they learn to articulate (Mills, 1993), their ability to combine these sounds into words (Brambring, 2007; Fraiberg, 1977; Iverson, Tencer, Lany & Goldin-Meadow, 2000; McConachie & Moore, 1994),

their ability to assign meaning and reference, even to visually based terms (Landau & Gleitman, 1985), and their ability to combine these utterances following the rules of grammar. The restricted input however does affect how children with PVI use language; their communication competence.

To be competent in communication, one must know and follow the implicit rules of interaction and conversation, cooperation and turn taking (Grice, 1957, 1975), which are learned in early childhood during child-caregiver interactions. It is during these interactions, that children learn these rules of conversation, and that language realizes its function; that of communication. Little research has been done to investigate the communication competence of children with PVI. However, anecdotal evidence and recent research suggests that children with PVI have continued difficulties with language use. Emerging evidence from the field is especially troubling. Studies using the Children's Communication Checklist (Bishop, 2003; James, & Stojanovik, 2007; Tadic et al., 2010) reveal that children with PVI, aged 6-17 years, have a general composite score on the Children's Communication Checklist that is not indicative of a language impairment; however, they have a disproportionate communication profile, with significant strengths in structural language and significant deficits in pragmatic language; the social use of language. These deficits in social communication are significant to the degree that they are indicative of an undiagnosed pragmatic language disorder, or a secondary diagnosis of Autism spectrum disorder (ASD). It is believed that these later pragmatic language difficulties can be traced back to the pre-linguistic and early linguistic period when children first demonstrate difficulties in social communication during caregiver-child interactions.

Children with PVI are not alone in their early social communication difficulties. Children with ASD and intellectual disability (ID) have been found to have diagnosis-specific

difficulties with specific social communicative functions, such as commenting, social interaction, and requesting (Adamson, Bakeman, Deckner & Ronski, 2009). The differences and difficulties children with ASD and ID have in social communication include: initiation and response patterns, language level and use, and their overall patterns of joint engagement during social interaction with a caregiver (Adamson, Bakeman, Deckner & Ronski, 2009). Specifically, young children with ASD have particular difficulty during contexts that afforded commenting, and children with ID found requesting contexts especially challenging. Children with ASD were more often unengaged during commenting than either social interacting or requesting, whereas children with ID were more often unengaged during both requesting and commenting rather than during social interacting. Children with ASD are more engaged during the context of requesting, and children with ID are most engaged during the context of social interaction (Adamson, Bakeman, Deckner & Ronski, 2009). It is unknown if children with PVI have diagnosis-specific difficulties or differences, or if their social communication profile mirrors that of children with ASD, children with ID or typically developing children who perform equally well in each context.

Role of Adaptive Behavior

Adaptive behavior is defined by the extent to which a person is capable of being self-sufficient in real-life situations, including the functional use of communication, socialization, daily living and motor skills (Sparrow, Balla, & Cicchetti, 1984). They are the everyday living skills such as walking, talking, getting dressed, going to school, preparing a meal, cleaning the house, etc. Adaptive behavior encompasses the skills that a person learns in the process of adapting to his/her surroundings. Adaptive behaviors are for the most part developmental, it is possible to describe a person's adaptive behavior as an age-equivalent score or a composite score.

Research shows that students with visual impairments may present considerable difficulties in their total adaptive behavior (Bradway, 1937, Maxfield & Fjeld, 1942; Parsons, 1987) or in each of the sub-domains of Communication (Dodd & Conn, 2000; Douglas, Grimley, Hill, Long, & Tobin, 2002; James & Stojanovik, 2007), Daily Living Skills (Haymes, Johnston, & Heyes, 2002; Lewis and Iselin, 2002), and Socialization (Celeste, 2006, Leyser & Heinze, 2001; Lifshitz, Hen & Weisse, 2007).

Papadopoulos, Metsiou, and Agaliotis (2011) explored the total adaptive behavior of children with visual impairments, as well as their adaptive behavior in each of the domains of Communication, Daily Living Skills, and Socialization. The predictors for overall performance and level of developmental delay in adaptive behavior were also investigated. The results reveal the effect of age on total adaptive behavior and on each of the domains of Communication, Daily Living Skills, and Socialization. Older individuals with visual impairments present better performance but also a higher rate of delay in comparison with younger individuals. Moreover, the ability to engage in independent movement, or O&M skill level, was found to be a predictor of overall performance and developmental delay. The more independent purposeful movement individuals with visual impairments engaged in the better the performance and the lower the level of developmental delay. Additionally, the caregiver characteristic of caregiver educational level was found to be a predictor of performance and developmental delay regarding Communication and Socialization. The higher the educational level of parents the better the performance and the lower the developmental delay.

Caregiver Contribution

Children with PVI are not the sole contributors to social interactions. For the interaction to be successful caregivers must be responsive, make equal contributions to the interaction, and

be competent communicators. When caregivers verbally engage their children they talk twice as much as caregivers of sighted children, yet their talk is less informative, repetitive, directive in nature, and often restricted to action related requests or is object focused (Anderson et al., 1993; Conti-Ramsden & Perez-Pereira, 1999; Perez-Pereira & Conti-Ramsden, 2001).

Caregivers may demonstrate their interaction related difficulties through increased levels of negative affect during interaction, and their unresponsiveness to their child's negative affect during interaction (Preisler, 1993, 1995). Each member of the child-caregiver dyad is misinterpreting the communication signals of the other. Neither member of the communication dyad can identify the other's attentional focus, predict or anticipate the other's actions, or affect, and direct the other's attention. This repeated miscommunication leads to stress, frustration, non-responsiveness and negative affect on both parts of the communication dyad. This pattern of limited interaction with caregiver dominance and directiveness is a sign of caregiver overprotection, and related to caregivers beliefs of limited child ability, or fragility (Thomasgard & Metz, 1993; Wright, Mullen, West, & Wyatt, 1993).

Caregiver Overprotection

Caregiver overprotection is conceptualized for this study following Green and Solnit (1964). Caregivers perceive their children with disability or illness as fragile or incapable, irrespective of the severity of the disability or illness. These beliefs lead caregivers to make insufficient demands for physical, social or intellectual development. These caregiver beliefs and behaviors further put the child's development at risk when caregiver beliefs are reinforced and modeled by the caregiver (Bandura, 1969). Caregiver behaviors found to be related to overprotection are restrictiveness, unsolicited and continued infantile interaction without regard

to the child's abilities, rewarding or reinforcing dependent behavior, domineering, directive behavior, and an over concern that the child is in danger or ill.

Caregivers of children with PVI demonstrate behaviors related to overprotection when they assert their control linguistically through the disproportionate use of directives (Andersen et al., 1993; Conti-Ramsden & Perez-Pereira, 1999; Moore & McConachie, 1994), use a high rate of response eliciting techniques such as the use of 'test' questions, typically the request for the child to label an item or to respond to a question that the caregiver knows the answer to (Kekelis & Prinz, 1996), and through a high request rate for repeated labels and actions (Andersen et al., 1996; Moore & McConachie, 1994). Furthermore, caregivers continue to assert their control by disproportionately initiating topics of communication, restricting topics to the child, rather than others or the outside world. (Andersen et al, 1993), and by restricting interaction with the outside world due to fear of injury. These practices indicate caregiver overprotection and are hypothesized to be what lead children with PVI to be less explorative, less autonomous, less responsive to interaction and affect, and to non-contingently respond to bids for interaction (Andersen et al., 1993). Overprotection is hypothesized to be of particular concern for very young children with PVI, who are known to contribute less to early socio-communicative interactions (Anderson et al., 1993; Bigelow, 2003; Conti-Ramsden, & Perez-Pereira, 1999 Kekelis & Prinz, 1996; Preisler, 1993), and who are less environmentally engaged.

Theoretical implications of vision loss

Children with PVI have difficulties in social interaction due to the role vision plays within social interaction (Bigelow, 2003; Hobson, & Lee, 2010; Neisser, 1994; & Preisler, 1993, 1995). Vision allows an individual to coordinate social interaction between themselves, and another, and an object (Neisser, 1994). Vision, specifically eye gaze, plays an important role in

the acquisition and later refinement of social skills. Eye gaze mediates turn taking, eye gaze promotes conversation when accompanied with gesture, and eye gaze accompanied by facial expressions invites responses and continued interaction from others. School aged children with PVI often have continued difficulty with basic social skills, including social communicative skills such as initiating and maintaining conversations well into adolescents (James, & Stojanovik, 2006 ; Tadic et al., 2010). This is not surprising as eye gaze coordinates social interaction.

In line with Bandura (1977), it is argued that the development and application of social communication related behaviors are equally important for both members of the caregiver-child dyad; the effects are bi-directional. Caregiver initiation and response patterns affect child response and initiation patterns, and child response and initiation patterns affect caregiver initiation and response patterns. It is during these early child-caregiver interactions that children and their caregivers are co-constructing the immediate social, learning environment.

Summary

The foundational skills for learning involve the development and application of communication related skills: appropriate response and initiation patterns, identification of another's attentional focus, the ability to interpret the emotional states and intentions of others, the ability to understand the self and others as intentional beings, the ability to engage with and within the environment, and the ability to direct another's attention, within a variety of contexts (Bandura, 1977). The success of a communication dyad rests on each member's ability to achieve and apply these skills within a variety of contexts.

In the absence of vision, eye contact, facial expression, and gesture children with PVI have a difficult time identifying and interpreting input, responding contingently, and initiating

engagement with the world and others. Adding to the child with PVI's difficulty, caregivers also struggle to identify the ways in which their children with PVI express their emotional states, indicate their attentional focus, and indicate shifts in their attentional focus, their intentions, and ways to encourage independent exploration. Caregivers must be able to interpret their child's emotional states, intentions, responses, and initiations, and respond appropriately, and children must do the same.

Present Study

The proposed study sought to apply methods from typical and atypical development to characterize the communication profiles of dyads which include young children with blindness, and to add to the research base in the field of blindness and visual impairment. To do so, the role of caregiver characteristics and child characteristics on the dyad's social communicative interactions were investigated. The present study had the following research aims and hypotheses:

Research Aim 1: Characterize caregiver and child social communication interactions

Research Aim 2: Investigate the relationship between child specific characteristics and caregiver related characteristics on the CPP and the communication competence of the dyad.

Hypothesis 2.1: It is expected that higher child scores on adaptive behavior, motor ability, and language scores will be associated with higher composite (total) communicative interaction scores of the dyad.

Hypothesis 2.2: Higher parental overprotectiveness is expected to be associated with lower communicative interaction scores.

Hypothesis 2.3: Child characteristics (language age, motor ability, adaptive behavior) and caregiver characteristics (overprotection) contribute to and explain the variance in CPP.

Research Aim 3: Investigate caregiver recognition of non-prototypical child responses to bids for attention in children with congenital blindness.

Hypothesis 3.1: Caregiver recognition of non-prototypical child responses to bids for attention will lead to child response.

It is theorized that the more independently a child with PVI engages with the world, the more they will initiate and respond to bids for engagement with others. Caregivers who respond to the child's subtle and overt communication and independent exploration by scaffolding engagement and language learning will encourage engagement, exploration and independence. The role language ability plays within joint interaction is uncertain. Children with PVI may be using language, instead of gesture and eye gaze, as a social bridge between themselves and their caregivers.

Methods

Design

This study employed a non-experimental approach to investigate the social interaction profiles of children with PVI during semi-structured interactions with their caregivers.

Caregivers completed parent rating scales, and each dyad was observed during a structured observation which was video recorded (Figure 1). The video recorded scenes of the caregiver-children interaction were coded using the manualized coding scheme of the CPP (Adamson & Bakeman, 2012). Secondly, the video recorded scenes were recoded using a novel coding

scheme, developed for this study, to investigate sequences of joint social interaction: caregiver initiation, child response, caregiver recognition of response and continued child interaction.

Participants and Setting

Twelve children with a congenital visual impairment, between the ages of 18 - 48 months, and their caregiver(s) participated in the study. Each child had a diagnosis of a PVI, nil to light perception, verified by observation, and parent report. Child members were excluded if they could not sit unsupported for two minutes, maintain posture while making a directive reach, or if they were nonnative English speakers. One dyad was excluded because the child was an English language learner. The caregiver of each child was over 18 years of age and fluent in English. Each caregiver-child dyad was seen in their home or a familiar environment, at a time determined by the caregiver to minimize stress and disruption, to optimize caregiver participation, and to ensure each child participant was oriented to and familiar with the environment.

Participants were recruited using flyers, social media (list-serves, websites, groups), and snowballing sampling procedures (Goodman, 1961). Snowball sampling procedures were chosen due to its advantages in recruitment for samples that are rare or unknown, as in the case of children with PVI and their English speaking caregivers. Sampling biases were minimized by relying on a variety of indirect sources to develop an initial participant pool (Blanken, Hendricks, & Adriaans, 1992; Faugier & Sargeant, 1997). A Web search was conducted to locate organizations that provide services to children with PVI, and professional organizations were contacted to build the sample from many diverse sources. Based on the results from the snowball sampling, a diverse group of dyads from urban and suburban areas were recruited.

Final Sample. The participant sample included 12 child-caregiver dyads. The sample was ethnically diverse with equal ethnic distributions; Caucasians ($n=4$), Asians ($n=4$), and Hispanics ($n=4$). The child participant sample included seven males and five females. It is not surprising that the etiology of visual impairment was predominantly Optic Nerve Hypoplasia ($n=10$), as Optic Nerve Hypoplasia (ONH) is the leading cause of infant blindness (Borchert, Garcia-Filion. 2008). All child participants ($n=12$) had light perception at best, verified through caregiver, teacher report and/or direct observation, and no additional identified hearing impairment or developmental disability. All child participants spoke English as their native and primary language. The majority of children attended a center based program at least three days a week ($n=8$), the remainder of the children ($n=4$) participated in early intervention therapies at a clinic, and through home visits (Table 3). Child participant ages ranged from 21 months to 48 months with an average age of 36 months. Caregiver ages ranged from 19 years to 43 years with an average age of 29.75 years.

Measures

Demographic information. Demographic information was collected for each dyad at entry, using a preprinted form/survey. Information gathered included the child's age, child's gender, the etiology of the visual impairment, the presence of additional disabilities, caregiver's age, mother's level of education, and type of early intervention services.

Language Ability. The MacArthur-Bates Communicative Development Inventory (MCDI) (Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, and Reilly, 2007) a nationally recognized, validated parent report instrument was used to assess the early language development of each child member of the dyad. The MCDI has been used to identify children at risk for a language delay, identify specific communicative skills for intervention, monitor results

of treatment, screen and select children at different levels of language development for participation in research studies, and to examine the influence of other variables on language development (Fenson et al., 2007).

The MCDI consists of two separate inventories: the MCDI/Words and Gestures (MCDI/WG) for children 8 to 16 months and the MCDI/Words and Sentences (MCDI/WS) for children 16 to 30 months. Both of the versions allow parents to report on their child's ability in several components of language development and yield raw scores and percentile rankings for each of the test components. The MCDI/WG for 8 to 16-month-old children has two major parts. Part I contains a series of questions followed by a comprehensive vocabulary checklist. Part II of the MCDI/WG focuses on the child's use of actions and gestures in order to provide a comprehensive evaluation of early communicative skills. The MCDI/WS for 16 to 30-month-old children also contains two parts. Part I is a 680 word vocabulary production checklist which is divided into 22 semantic categories. Part II of the MCDI/WS assesses morphological and syntactic development using 125 items organized into five sections.

The MCDI was chosen as the appropriate measure for language ability in this study because it has been used in research studies that have examined the language ability of children who are typically developing and who have disabilities (Dale, 1991; Dale, Bates, Reznick, & Morriset, 1989; Heilmann, Weismer, Evans, & Hollar, 2005; Miller, Sedey, & Miolo, 1995; Thal, O'Hanlon, Clemmons, & Fralin, 1999). Furthermore, it is cost-effective, and easy to complete. Raw scores from the MCDI were used to categorize each child's language age. Specifically, following the MCDI manual, scores for the children were interpreted normatively-relative to other children, as the scores were at or below the median age for the oldest group in

the norming sample. Age equivalent scores for the MCDI, were used as the language age variable.

Motor Ability. The O&M Assessment: Early Years of Birth through Three Years Revised 2004 (Anthony, 2004) is a comprehensive O&M assessment for children with visual impairments. The O&M Assessment: Early Years of Birth through Three Years Revised 2004 measures a child's O&M related skill development in the domains of visual, auditory, tactile, body image (self), body image (other's), object permanence, spatial relationships, cause and effect, imitation, properties of objects and the environment, social emotional, receptive language, expressive communication, self-initiation, tone, stability, rotation, fine motor, and gross motor. The gross motor domain is further divided into skills related to reflexes, balance, static posture, and dynamic posture. The assessment contains behaviorally based statements for each domain that are rated as observed or unobserved. It is administered by an O&M specialist with the assistance of the child's caregiver. The O&M Assessment: Early Years of Birth through Three Years Revised 2004 was administered to each child participant upon entry. Sub-scale scores in the areas of fine motor, gross motor and self-initiation from The O&M Assessment: Early Years of Birth through Three Years Revised 2004 were averaged and used as the measure of motor ability, as specifically related to visual impairment and abilities related to independent locomotion. Specifically, for each subdomain, age equivalent scores were determined by the three highest, consecutive, scores. Each subdomain score was then tallied and an average was computed and used as the final variable.

Adaptive Behavior. The Vineland Adaptive Behavior (VABS) Parents Rating Scale was used in this study to investigate each child's adaptive behavior skill level. The VABS-II Parent/Caregiver Rating Form assesses adaptive behaviors of individuals from birth through 90

years, 11 months. For the age range covered by this study, the VABS-II yields eleven subdomain scores: including Expressive, Receptive, Written, Personal, Domestic, Community, Interpersonal, Play and Leisure, and Coping, Gross motor, Fine motor; four domain scores; Communication, Socialization, Motor Skills and Daily Living Skills; and an overall Adaptive Behavior Composite score. Items are arranged in a developmental sequence within each subdomain, with each item rated on a 3-point scale (i.e., 0 = Behavior Never Performed, 1 = Behavior Sometimes or Partially Performed, or 2 = Behavior Usually or Habitually Performed).

The VABS-II Adaptive Behavior Composite and domains yield age-based standard scores with a normative $M=100$ and $SD=15$, and the subdomains yield standard scores with $M=15$ and a $SD=3$. Reliability and validity estimates reported in the test manual are based on pooled data from both the interview and parent/caregiver rating forms. For the age range covered in this study, internal consistency reliability estimates range from .61 to .91 for the Adaptive Behavior Composite, .87 for the Communication domain, .61 for the Daily Living Skills domain, .80 for the Socialization domain, and .83 for the Motor domain. Concurrent validity of the VABS-II is supported by moderate correlations with other scales assessing adaptive performance. Adjusted correlations, reported in the VABS-II manual for participants age 0 to 5 years, between the VABS-II domains/composite and equivalent VABS-II domains/composite, were moderate to high (i.e., to .78 for the domain scores and .81 for the overall adaptive composites).

Caregiver Overprotection. The Vulnerable Child/Overprotective Parent Scale (VCOPS) is a 28-item weighted scale designed to identify overprotective tendencies in caregivers of young children who are physically vulnerable, or who have a disability or illness (Wright et al, 1993). The 28-items on the VCOPS are based upon their maximum predictive power of overprotection. The

resulting correlations between professional's and medical doctor's ratings of caregiver overprotection and the 28-items statements are high (.94). Coefficient alphas for the 28 item VCOP are .84, and test-retest coefficients are .74, and .77.

The VCOPS is a caregiver self-report measure. Each caregiver rates themselves and their beliefs about their child on a 1-6 Likert scale. A rating of: 1 = the statement is extremely true, 2 = the statement is moderately true, 3 = the statement is slightly true, 4 = the statement is slightly true, 5 = the statement is moderately untrue, and a 6 = the statement is extremely untrue. The VCOPS was chosen for this study because it is designed for use with caregivers of children with disabilities and illness. Additionally, as it is designed as a caregiver belief report, it can be used during early childhood. Lastly, the measure is short, easy to use, easy to code, yet valid and reliable. Caregivers were asked to complete the VCOPS upon entry. Upon completion of the VCOPS, a total weighted score was calculated and used as the measure of overprotection with higher scores reflecting greater degrees of overprotection.

Communication Play Protocol

The Communication Play Protocol (CPP) is a semi-structured observational protocol that has been well validated with typically developing infants and caregivers (Adamson & Bakeman, 2012). The CPP has been used to characterize the joint engagement skills of typically developing children, children with intellectual disability, and children with autism. The purpose of the CPP is to provide a comprehensive view of what transpires during joint engagement episodes in different contexts (see Table1). The CPP consists of six 5- minute scenes. During each scene, caregivers were given the role of the supporting actress/actors. They were asked to perform in a communication based play with their child, and the child was to be the star. The six scenes probed three communication contexts: social interacting, requesting and commenting. Social

interaction was encouraged by the caregiver in two scenes. During the turn taking scene props included a ball or stacking toy, and in the music scene musical toys were provided. During each scene caregivers were encouraged to engage with their child with the ‘plot’ of social interaction in mind, such as turn taking or dancing. Requesting was encouraged by the caregiver in two scenes. During the “I want” scene a novel toy or the child’s favorite toy was put just out of reach, and in the “Help me” scene toys such as a balloon, and a wind-up toy which were too difficult for the child to use independently. Commenting was encouraged by the caregiver in two scenes, one of which was omitted for this study. For this study there were two container based scenes, and the props included both familiar and unfamiliar items. The caregiver asked the child “what is it” and engaged the child in commenting, or description. An art gallery scene that encourages the caregiver and child to engage about pictures was omitted, due to the visual nature of the activity. However, a texture based activity was substituted, due to the child’s blindness. Additionally, the CPP was conducted in the child’s home to ensure the child was oriented to the environment, and the caregiver also provided toys to use during the scenes if the child did not respond to the provided props. These modifications to the CPP were made to ensure that the child was comfortable, and familiar with the environment and objects.

Upon completion of the CPP, the 6 videotaped scenes for each dyad were reviewed and coded using the manualized CPP codebook and anchor descriptors. Coders made judgments about the child-caregiver interaction using the 17 items, and a 1-7 anchored scale. Following the manualized protocol the set of 17 items were divided into 4 clusters: child joint engagement items (1–4), child behavior items (5–9), caregiver items (10–13), and shared topic items (14–17). The set of 17 items were applied to each scene of the CPP, until all were characterized. For

example, each item was rated once within a Communication Play scene; for a total of 6 ratings per item. The 17 items coded were:

Child Engagement State Items

1. Total joint engagement
2. Supported joint engagement
3. Coordinated joint engagement
4. Symbol-infused joint engagement

Caregiver Items

10. Scaffolding
11. Symbol highlighting
12. Following in on child's focus
13. Affect

Child Behavior Items

5. Initiation of communication
6. Responsiveness to partner's communication
7. Expressive language level and use
8. Quality of behavior patterns
9. Affect

Shared Topic Items

14. Elaboration of shared topic
15. Sustainability of shared topic
16. Scope of shared topic
17. Fluency and connectedness of conversation

A composite score of the four areas, 17 items, was totaled for each dyad, and used as the measure for overall communication scores on the CPP.

The videotaped CPP scenes were then recoded for use in the sequential analysis. Specifically, the coding of prototypical and non-prototypical child behaviors and parent initiations and responses: First caregiver bids for joint attention were coded by type: (1) a verbal only bid, (2) a physical bid in which the caregiver did not speak but made a noise or engaged the child through an action, or (3) a combination of a verbal bid with a physical bid. Next, children's verbal bids with-responses to the caregivers' bid were coded by type: (1) child non-response, (2) child prototypical response in which the child turned their face towards the caregiver, gave the

caregiver something, showed the caregiver something, pointed, took a turn, or responded verbally, and (3) child non-prototypical response in which the child responded by leaning towards the caregiver or object, the child became quiet or still, or the child engaged in rhythmic hand and foot movements (Preisler, 1993, 1995).

Caregiver recognition of the child response was then coded. Caregiver recognition was coded as occurring if the caregiver continued and added to the interaction by taking an additional turn, elaborating on the topic, offering a direction, etc. Caregiver non-recognition was coded if the caregiver discontinued the interaction, or continued using the same line of interaction without change, as if the child did not hear them. Lastly, child response was again coded. Thus a cycle of interaction was dyadic and included two turns. Continued child interaction or sustained interaction was coded if the child sustained the interaction by responding throughout two additional cycles resulting in three completed cycles of dyadic interaction.

Procedures

Recruitment. Upon inquiry into the study, caregivers were contacted via telephone and briefed. All caregivers who expressed interest in the study received a copy of study related materials: recruitment flyer, a written consent document, and caregiver measures to complete. After caregiver document review, a follow-up telephone interview was conducted to answer any study related questions, and verbal consent was obtained. At this time, the caregiver was asked to return the signed consent form and statement of functional visual acuity statement in the postage paid envelope. Upon receipt of the parental consent a session with the caregiver and child was scheduled at the caregivers' convenience. Additionally, a schedule of CPP scene order, and prop usage was randomly generated by the researcher and randomly assigned to each proposed dyad. Following the CPP procedures, prior to the beginning of the Play the researcher

produced a set of individualized ‘cue cards’ for each caregiver. The Cue cards (directorial instructions) were printed on the 5” x 8”, colored index cards and contained the names of the individual dyad members, the plot of each scene, props for the scene, and directorial suggestions. The cue cards were numbered in the top right corner (See Appendix A).

Assessment. Upon entry, each caregiver met with the researcher in their home, to review the completed parent report measures: the MCDI, VCOPS, and the O&M assessment. Any parent report assessment not completed during or prior to the first meeting, was returned to the researcher via a postage paid envelope. After review of the measures, the CPP began. The CPP assessment took place in the caregivers’ home or a familiar setting. This was a modification to the original protocol. This modification was made to ensure that the child was well oriented to the environment. The caregiver was told that the researcher was interested in observing how he/she and his/her child communicated during a series of scenes. It was explained that “Play” was being used metaphorically and that the caregiver was to act in a supporting role to his/her child; the star.

The Play was introduced by explaining to the caregiver that the goal of the Play was to gain a picture of how they and their child communicate, while doing different things. It was explained that all forms of communication are of interest: gesture, facial expression, affect, vocalizations and language. Before each scene, the caregiver was given a cue card that specified the scene’s plot, and prop suggestions. Directorial suggestions were provided on each cue card, such as suggesting an activity; however, a script was not given. Directorial suggestions were reviewed with the caregiver prior to the start of each scene. Lastly, caregivers were reminded that they or their child could take a break at any time, that each scene was exactly 5 minutes in length, that a 2 minute break would take place between each scene, and that the ‘director’ would

keep time. Child assent was received at the beginning of each scene and throughout as evidenced by continued child participation

The initial scene for each dyad was a free play scene in which the caregiver was instructed to play with the child as they normally would, while the ‘director’ prepared for the play. The order of the following scenes, and props used within each scene, were randomly assigned with the constraint that one scene from each of the communication contexts occurred within the first four scenes of the Play. The CPP was videotaped by the researcher using two tripod mounted Kodak Share video cameras. The video cameras were positioned and angled to capture the interactions of the dyad from two opposing angles. The time function was enabled on each video camera to record the elapsed time by second during recording. Video recording began immediately after the initial greeting and upon set up, but after the researcher indicated “Action”.

The recording continued continuously for the entire CPP. The beginning of each of scene was indicated by “Action” and ended after 5 minutes. A two-minute break occurred between scenes while the next scene was set up, and the new scene immediately followed until all scenes were completed. Immediately following the CPP the video recordings were downloaded to a computer without internet connection, and copied to a flash drive. The flash drive was used for coding, and stored in a separate location, in a locked cabinet, behind a locked door; accessible to the researcher and a second graduate student who assisted with coding and inter-observer agreement.

Inter-observer Agreement

An additional observer observed 33% of all videotaped sessions (2 scenes per participant) and coded the child and caregivers behaviors. Agreement was reached when each coder rated the item within +1, -1. Disagreement was settled by consensus. Agreement was determined using

Cohen's Kappa. Kappa provides an estimate of agreement between raters that is corrected for chance. A value of kappa equal to +1 implies perfect agreement between the two raters; a value of -1 implies perfect disagreement. If kappa assumes the value 0, then this implies that there is no relationship between the ratings of the two raters, and any agreement or disagreement is due to chance alone. A value of Kappa = 0.60, indicates moderate agreement between the raters. Kappa for the CPP in this study was .72, which indicates there was substantial agreement between raters (Landis & Koch, 1977). Kappa for the recoded scenes from the CPP in this study was .79, which indicates there was substantial agreement between the raters.

Analytic Plan

Demographic information was collected and included child gender, child age, the child's placement in early intervention, mother's level of education, and caregiver age. Descriptive statistics, means, standard deviations, variance, range, minimums and maximums for each of the following variables (a) child's language ability, (b) child's motor ability, and (c) caregiver overprotection were calculated using SPSS 22.

After calculating descriptive statistics, the data was transformed for use in correlational statistical analysis. Specifically, based upon the literature (Brambring, 2006; Hatton et al., 1999) motor ability scores are reported as an average age equivalence based on the composite score of the subscales. The CPP is scored as a Likert scale; therefore a composite score was compiled based on the anchored 7-item Likert-Scale. This transformation allowed the composite score to be treated as an interval variable (Clason & Dormondy, 1994). These transformations were necessary for the data to be analyzed using correlational procedures and multiple linear regression.

Upon completion of data transformation procedures correlations between the variables were investigated by plotting the variables on a scatterplot. Visual inspection was used to verify a linear relationship existed between the variables. Next the relationships between the variables were investigated using a Pearson's two-tailed product-moment correlation; r . For this study the significance level of $\alpha = .05$ was used; the odds that the correlation is a chance occurrence is no more than 5 out of 100.

Following correlations, a multiple linear regression was conducted in order to better understand the relative, unique contribution of each independent variable towards the total CPP composite score while controlling for child age and caregiver education. Specially, the amount of the variation in the CPP composite scores that can be explained by each predictor variable: (a) child's motor ability, (b) child's language ability, (c) child's adaptive behavior, and (d) caregiver overprotection, and the relative contribution of each predictor to the explanation of variance, or the model as a whole. Child age was controlled for in the study as the child measures used in the study are developmental in nature; therefore they are inherently related to child age.

Additionally, caregiver education has been found to be high correlated to the adaptive behavior and independent motor skills of children with PVI (Papadopoulos et al., 2011). The assumptions of multiple regression analysis were investigated, and identified as met: linearity, independence of errors, homoscedasticity, unusual points and normality of residuals prior to the analysis.

After all assumptions were identified as met, the multiple regression model was built and tested for goodness of fit using the all possible models procedure in which all possible models were fitted to the data using the selection criterion of R^2 , R^2_{adj} , C_p , AIC and BIC in order to find the model that is preferable. All variables were entered into the model one at a time, while controlling for child age and caregiver education, and checked for selected significance R^2 , R^2_a ,

C_p , AIC and BIC. Specifically, the search for the best subset of predictors proceeded by calculating all possible regression equations, beginning with an equation in which only the intercept was used, followed by all the one-predictor equations, two predictor equations, and lastly followed by the equation with all three predictors. Each model was then tested using the selection criterion: significance R^2 , R^{2a} , C_p , AIC, and BIC.

Data collected for the sequential observational analysis was transformed so that it met the sequential data interchange standard (SDIS). SDIS is language for describing sequential data as obtained thru direct observation of individuals, interacting dyads, or groups. SDIS is the required format for use with the data analytic software the Generalized Sequential Querier (GSEQ). GSEQ is a computer program for analyzing sequential observational data. First, GSEQ converts the SDIS files into MDS files (modified SDS files). GSEQ then uses the MDIS files to compute a variety of simple and contingency table statistics. Simple statistics include frequencies, rates, durations, and proportions (percentages). Statistics can be computed for various lags, and separately for each session or pooled over sessions, levels of a factor, or both. The data for this study was coded as event data; therefore the summary statistics of frequency and relative frequency were computed for each variable. A lag +1 chi square statistic was computed to investigate the relationship between the sequence of caregiver bids, child responses, caregiver recognition of responses and continued child response.

Results

Research Aim 1: Characterize caregiver and child social communication interactions

Dyadic scores on the CPP.

The first aim of the study was to describe the dyads' performance during the CPP.

Means and standard deviations were calculated for the six scenes of the CPP: Help, Want, Turns,

Music, Hidden and Texture (Table 5). The dyads scored lowest on the context of Requesting which included the scenes Help ($M=47.58$) and Want ($M=55.12$). The dyads had higher scores on the social interactions context which included the scenes Music ($M=55.08$) and Turns ($M=61.50$). The dyads scored the highest within the context of commenting which included Texture ($M=61.08$) and Hidden ($M=64.42$). A paired-samples t-test was conducted to compare the dyads performance in each context: social interaction, requesting and commenting. Performance data were significantly different between requesting ($M=103.92$, $SD=31.097$) and commenting ($M=125.50$, $SD=39.778$); $t(11) = -3.266, p = .008$.

Individual scores on the CPP. Means and standard deviations were next calculated for the individual items for the CPP (see Table 6). The maximum possible for each item is 42 points: 7 points maximum for each item, in each of the six contexts per participant, and the minimum score possible for each item is 0. Child total joint engagement ranged from 11 to 37, with an average score of 21. There was high variability in child total joint engagement scores, with a range of 26 points. Child supported joint engagement ranged from 11 to 36, with an average score of 21. The scores had a 25 point range. Child coordinated joint engagement ranged from 6 to 23, with an average of 12. The scores had a range of 17 points. These scores indicate that young children with PVI engage more frequently in episodes of supported joint engagement, than coordinated joint engagement irrespective of child age.

Association of caregiver and child scores. The relationship between the CPP composite score of child related social communication behaviors (total time in joint engagement, initiation of communication, responsiveness to bids for communication, expressive language use, quality of behavior patterns, child affect) and the composite score of caregiver related social communication behaviors (scaffolding, symbol highlighting, following the child's lead, caregiver

affect, caregiver elaboration of topics, caregiver sustainability of topics, caregiver scope of topic, and the fluency and connectedness) was investigated. All preliminary analyses showed the relationships to be linear with both variables normally distributed, as assessed by Shapiro-Wilk test ($p > .05$). There were no outliers. Results indicated a strong positive correlation between child related social communication behaviors and caregiver related social communication behaviors, $r(10) = .981, p < .01$.

A Pearson's product-moment correlation was conducted to assess the relationship between the composite score of child related social communication behaviors (total time in joint engagement, initiation of communication, responsiveness to bids for communication, expressive language use, quality of behavior patterns, child affect) and the composite score of the caregiver-child dyad which include a child aged 18-48 months with PVI. There was a strong positive correlation between the child related social communication behaviors and the dyads composite score of related social communication behaviors, $r(10) = .982, p < .01$.

The relationship between the composite score of caregiver related social communication behaviors (scaffolding, symbol highlighting, following the child's lead, caregiver affect, caregiver elaboration of topics, caregiver sustainability of topics, caregiver scope of topic, and the fluency and connectedness) and the composite score of the caregiver-child dyad was investigated. There was a strong positive correlation between the child related social communication behaviors and the dyads composite score of related social communication behaviors, $r(10) = .974, p < .01$. Children ($M=181.75$) and caregivers ($M=182.17$) contributed equally to the composite score of the CPP. The CPP composite score ($M=362.50$) was not driven solely by one member of the dyad. While each member of the dyad contributed differently, each member was found to contribute equally to the interaction. However, because the behavior of the

children and the caregivers were affected by the child's visual ability, qualitative observations also inform the first research aim of describing dyadic performance on the CPP.

Qualitative observations. During the context of commenting, the child was typically positioned in the caregivers lap with both the caregiver and child facing the same direction. This positioning allowed for the caregiver to use hand under hand to guide the child's hands as they were investigating, and discussing each item. This positioning worked well for this type of interaction, and this positioning seemed familiar and comfortable for each member. Each member seemed to be familiar with this type of informational or instructional social interaction. Dyads had more difficulty when the context of the social interaction was purely social.

During the social interaction contexts the positioning of the child and caregiver changed to that of face to face. During this context, children often appeared uncertain of what their caregiver was expecting of them. For instance, caregivers were unable to engage more than half of the children ($n=7$) in a simple back and forth game involving rolling a ball back and forth between the two. Caregivers would make several repeated attempts, with balls of various size, shapes and sounds; however the children often held onto the ball and did not reciprocate by rolling or throwing the ball back to the caregiver. In the music context, when caregivers attempted to engage the child with a musical toy, if the child responded they almost always ($n=9$), took the musical toy from the caregiver and disengaged which led to child solitary play. Children continued to isolate themselves and would not re-engage with their caregivers. If children began to play with a musical toy first, and caregivers then attempted to break into the child's play ($n=3$), the child either brought the toy up to their ear to drown out the caregiver, turned their back to the caregiver, or turned the toy volume up to also drown out the caregiver. It is well known that children with PVI enjoy musical toys; however it has not been reported that

while they prefer these types of toys they can lead to solitary play. These toys appear to be similar to a restricted interest that the children do not want to share.

The requesting context was least successful for both members of the dyad. During the context in which the children needed to ask for assistance, none of the children ($n=12$) did so. The children attempted to get the toy to work by hitting it, dropping it, or shaking it. Even when the caregivers commented on the children's struggles the children did not ask for help ($n=6$), instead the children would lose interest and disengage. Caregivers attempted to direct the children verbally, if the child resisted hands-on help. This verbal only method was not successful. During the context in which a desired toy is put out of the child's reach, two children verbally indicated to their caregivers what they wanted, the remainder ($n=10$) did not attempt to solicit assistance nor direct their caregivers. Instead the children would cry, or sit down and fuss and often they would begin playing with another toy.

Research Aim 2: Investigate the relationship between child specific characteristics and caregiver related characteristics on the CPP and the communication competence of the dyad.

The first hypothesis was that higher child scores on adaptive behavior, motor ability, and language scores would be associated with higher composite (total) communicative interaction scores of the dyad. Both motor ability and language age were significantly positively associated with the social communication composite score of the CPP whereas child adaptive behavior was not (see Table 4). Therefore the hypothesis was only partially supported.

The second hypothesis was that higher parental overprotectiveness was expected to be associated with lower communicative interaction scores. There was a non-significant negative correlation between caregiver overprotection and the dyads composite score of related social communication behaviors. While there was a non-significant negative relationship between

parental overprotection and the social communication composite scores of the dyad the relationship was in the predicted direction.

The third hypothesis was that child characteristics (language age, motor ability, adaptive behavior) and caregiver characteristics (overprotection) would both contribute to and explain the variance in CPP. To investigate the unique contribution of child based characteristics and caregiver based characteristics to the communication competence of a child-caregiver dyad a multiple regression analysis was conducted using all possible subsets. The best model was determined based on the prior identified selection criteria of R^2 , R^2_{adj} , Cp, AIC and BIC, and not merely by the significance of each predictor. The predictors which best explained the variation in CPP composite score for the dyads included child language age and caregiver overprotection (Table 7).

The model (table 8) chosen explains 71.7% of the variation in the composite score of the CPP. According to the model, a one month increase in child language age is associated with a 12.405 point increase in the composite CPP score for the dyad, and a 0.1 increase in caregiver overprotection is associated with a 5.931 point decrease in the composite CPP score for the dyad. A 1 year increase in caregiver age is associated with a 2.792 decrease in the composite CPP score for the dyad, and a 10 month increase in child's age is associated with a 6.37 increase in the composite CPP score for the dyad.

$$\hat{y} = 161.225 - 2.792 (\text{caregiver age}) + .637 (\text{child age}) + 12.405 (\text{language age}) - 59.311 (\text{overprotection})$$

Research Aim 3: Investigate caregiver recognition of non-prototypical child responses to bids for attention in children with congenital blindness.

Caregiver recognition of non-prototypical child responses to bids for attention was hypothesized to lead to child response to the caregiver. Variables initially coded for use in the

sequential analysis included types of caregiver bids: verbal (CGV), nonverbal (CGnV) and paired verbal and nonverbal bids (CGVnV), how children responded to the bid: prototypically (ChP), non-prototypically (ChnP), or child nonresponse (ChnR), if caregivers recognized the response (CGRec) or did not recognize the response (CGnR), and lastly if the children then closed the loop and responded (ChR) or did not respond (ChNR). Summary statistics, frequency and relative frequency, were computed for each variable (Table 9). Paired caregiver bids incorporating both nonverbal and verbal occurred most often ($n=603$). Children responded to the caregivers' initial bid prototypically: using language, or engaging in the activity ($n=460$) more often than non-prototypically bid by leaning, quieting, stilling, or opening and closing their hands ($n=118$). Caregivers recognized their child's responses 79% of the time, as demonstrated by the caregiver continuing and adding to the interaction through language or activity.

After the initial summary statistics were computed for the individual variables, variables were then combined or chained and new codes were established. The new codes included chained sequences of social interaction related behavior. These chained variables included: the initial caregiver bid minus the form, how the child responded to the bid, and if the caregiver recognized the bid. For example: (1) caregiver bid (CGBid) prototypical child response (P), and caregiver recognition (R) became the chained code CGBidPR ($f=394$, $rf=.26$), (2) caregiver bid (CGBid) non prototypical child response (nP), and caregiver recognition (R) became the chained code CGBidnPR ($f=46$, $rf=.03$), (3) caregiver bid (CGBid), prototypical child response (P), and child nonresponse (nR) became the chained code CGBidPnR ($f=53$, $rf=.03$), and (4) caregiver bid (CGBid), non-prototypical child response (nP) and non-caregiver recognition (nR) became CGBidnPnR ($f=72$, $rf=.05$).

Prototypical versus non-prototypical child behaviors: All children (n=12) with PVI responded to a bid for attention made by their caregivers prototypically using language (n=460). All children (n=12) used non-prototypical responses (n=118). All children (n=12) responded non-prototypically by quieting or becoming still immediately after the bid. Quieting and stilling was the predominant method children with PVI in this study used to indicate interest non-prototypically (n=97; 82%). Some children (n=4) identified their interest or attempted to direct another's attention by leaning towards the caregiver or activity (n=19; 16%), and one child used rhythmic hand and foot patterns (n=2; 1.7%) as a method of response to a bid for attention (Table 11). The two youngest children in the study accounted for 40% of the non-prototypical responses. While these two children were the youngest they did not have the lowest language age. Children used non-prototypical responses mostly during the social interaction context, which includes turn taking and music (Table 12).

A chi-square test for association was conducted to assess the sequential relationship between the chained sequences of social communicative behavior and child response; consecutive positive child response: lag +1. Continued child response or sustained interaction was coded if the child sustained the interaction by responding throughout two additional cycles of interaction, resulting in three completed cycles of dyadic interaction (see Figure 2). All expected cell frequencies were five or greater. There was a statistically significant association between caregiver recognition of non-prototypical child responses and continued child response, $\chi^2(1) = 58.86, p = <.01$ (Table 10).

Discussion

The findings of this study indicate that the children and their caregivers were responsive to one another's bids for social interaction, and that during these episodes the effect of the

children and caregivers was high and positive. Children with PVI who had adequate language skills primarily indicated their interest, and directed their caregiver's attention, verbally. These methods were overt and caregivers had little difficulty recognizing these as responses. Children with PVI who were delayed in language primarily utilized non prototypical methods to indicate their interest. These children indicated their interest by quieting, stilling, leaning towards the object or activity, and rhythmically moving their hands and feet. Caregivers had more difficulty recognizing these non-prototypical responses as responses. It should be noted that positioning here too could play a role. As it is difficult to determine if caregivers did not recognize these non-prototypical responses as responses, or if due to positioning their child in their lap, they were not aware of their child's position or movements as responses. However, caregiver recognition of child responses was found to be related to the sustained and continued responses of the children. Caregiver recognition was especially important for children who indicated their attention or interest using non prototypical methods. When caregivers did not recognize the child's non prototypical response, the interaction did not continue and the child often isolated themselves or ignored the caregiver.

A consistent pattern of strengths and weaknesses emerged on the CPP based upon the context of the interaction: requesting, social interaction, and commenting. Children with PVI and their caregivers performed least optimally during the context of requesting, similar to children with ID. During the requesting context children often pushed the caregiver away when the caregiver attempted to assist. It is uncertain whether the children misunderstood the caregivers' intentions, or if the children were attempting to assert their autonomy. If the caregiver persisted, the child often lost interest in the object. Additionally, it is during the requesting context that caregivers and children assumed their most distal positioning. Children and caregivers often

positioned themselves so that they were not touching, or in direct contact during this context; therefore children may not have known the caregiver was waiting for the child to initiate an the interaction. However; it is during this context that children with PVI engaged in coordinated JE most frequently. It is believed that during the requesting context the attentional focus of both the child and the caregiver is determined, and the caregiver is not guessing what the intention of the child might be; therefore, more fleeting moments of coordinated JE occur.

Results were mixed for the dyads during the context of social interaction: music and turn taking. During the music context, children often isolated themselves and engaged in solitary play. Children would find a musical toy they liked, and when the caregiver attempted to join in, the child would bring the toy up to their ear in an attempt to block the caregiver out. This is interesting as children with PVI are traditionally known to love music and music related games and interaction. While children with PVI in this study preferred to play with musical toys, they did not want to engage with others while playing with the musical toys. It was as if the music was a restricted interest that they did not want to share. When children shut out the caregiver, caregivers often continued to bid for the child's attention using the same line of interaction, instead of attempting to break in- or follow the child's lead. Children and their caregivers performed better during the social interaction scene which included turn taking. Caregivers often implemented a familiar turn taking play based routine during this context. It is believed that the improvement is because the context is familiar to both caregiver and child, with each member of the dyad understanding their roles and the routine.

Secondly, the context often resulted in a change in caregiver and child positioning. During the turn taking context the caregiver repositioned themselves so that they sat across from the child. This face to face positioning, allowed for a more naturalistic sharing, and interaction

and appeared to discourage caregiver directiveness. This is an interesting finding, as caregivers of children with PVI are often instructed to place their child in their lap and to use hand-under-hand to engage with their child. It is possible that this in the lap positioning promotes instructional type interaction; however it may actually discourage social interaction which normally takes place using face to face positioning. Caregivers may benefit from an intervention which targets caregiver and child positioning based on the function of the interaction.

Children with PVI and their caregivers performed best during the commenting context. During the commenting context the child was often positioned in the caregiver's lap, as they 'looked' at, and played with each item. It is during these scenes that the caregiver was most directive, informative, and most sensitive to the child's response. Caregivers tended to know which items their children would like as well as not like and they respected the child's choice. Children were more apt to engage with their caregiver when caregiver language was directive, informative, and sensitive. As with the prior contexts, caregivers and children were more mutually engaged when the play scene was specific and routine based. This suggests that caregivers are unsure of how to interact or engage with their children, and that they would benefit from targeted, specific, interventions in the area of play skills and joint interaction.

Caregivers performed well during the structured social interactions in the areas of scaffolding and symbol highlighting (labeling and directing). Caregivers often scaffold during the interaction through verbal direction. This strategy appeared to work well with novel items, as caregivers provided information and verbal directives more about "how to play" with the item, rather than actually engaging the child with the item. For example, caregivers would show or tell the child what the item was, what buttons to push etc., but did not make a game out of it, or play with the child with the toy.

Once children responded to their caregivers bid, caregivers often had difficulty maintaining the interaction. This difficulty is not surprising as caregivers rarely expanded on the play topic, or elaborated on the play activity. The caregivers often repeated the same activity with the same toy during the scene even when the child's interest waned. Additionally, caregivers rarely moved the topic of conversation beyond the here and now; restricting the conversation to labeling or directing the child's behavior. Caregivers and children equally struggled to maintain or sustain the interactions. Interactions typically lasted one or two turns, and at no time did a child or caregiver want to continue the interaction past the five minutes. Caregivers appeared to struggle to identify how to increase their child's play based skills, or to connect during play based social situations. These data suggest that specific play and engagement interventions may prove helpful.

Children who engaged their environment through exploration and independent purposeful movement did better during caregiver-child joint interactions. Children who performed better in the measure of independent purposeful movement performed better in all the areas of JE – total, supported and coordinated – on the CPP. While a causal relationship is not supported, a strong positive relationship existed between child independent purposeful movement and the child's social interaction ability on the CPP. This should not be surprising as the more opportunity a child has to explore and investigate the world around them the more they learn about the world, and their role within that world. It is thought that independent exploration leads to more autonomous child, and children who are more autonomous are viewed as more capable.

Furthermore, the idea that independent exploration leads to a more autonomous child, a child who is viewed as more capable can explain the positive relationship between independent purposeful movement and the child's adaptive behavior. Caregivers who promote independent

exploration view their children as capable and independent and are thus more likely to promote independence.

Historically, children with PVI do well on measures of expressive language, often outperforming their counterparts with sight. Yet, paradoxically, they do poorly on measures of JE, even though JE is closely linked with expressive language. While children with PVI, in this study, were delayed in their language skills; they used language as a bridge between themselves, their caregivers, and the outside world, similar to gesture. Children used language as a method of responding to their caregivers' bids for interaction, for sustaining the interactions, and for directing their caregivers' attention and behavior. Children with the poorest language skills used other non-prototypical methods to indicate their response; however, they rarely initiated engagement.

Interestingly, in this study child language ability was positively related to both child characteristics and caregiver characteristics. Children who had better language ability also engaged in more independent and purposeful movement, and performed better on a measure of adaptive behavior. Children with caregivers who were more overprotective demonstrated better language ability. A possible explanation to this seemingly confounding results is that while, overprotective caregivers keep their children from engaging in the outside world and with others, they may keep them close by where they are exposed to greater adult interaction and complex language. Therefore the child's vocabulary maybe greater, due to exposure or echolalia yet their social interaction skills may be poor.

Caregivers who were overprotective limited their child's interaction with the outside world by limiting the scope of conversation during interaction, and by being repetitive and directive during interactions. These caregivers often repeated the same phrase over and over until

the child complied. Their play lacked spontaneity and children did not attempt to initiate interaction. Children with overprotective caregivers surprising did best in measures of language ability, despite the high levels of overprotectiveness. It is thought that the children with PVI in this study benefitted linguistically from the caregivers' directive and informative language style, and again that these children may be exposed to greater adult interaction and complex language. Therefore the child's vocabulary maybe greater, yet their social interaction skills may be poor. This may explain the negative relationship found between caregiver overprotection and the social communication composite scores of the dyad.

While it was not the aim or intention of this study to raise questions regarding assessment and evaluation of students with PVI, a concern must be raised. All the participants in this study were identified as a potential participant for this study by early intervention specialists in the area of blindness and visual impairment. In order to participate in this study children with PVI could be delayed, but not have a known developmental or intellectual disability. It was thought that each of the child participants were performing within the normal limits for a child with PVI. The range of abilities and assessment scores is troubling (Table 11). At what point do professionals in the area of blindness and visual impairment, such as myself, identify a child as being outside the norm? What is the norm? How is this established? It is critical that children with PVI with suspected additional disabilities be identified early, so that they may have the opportunity to benefit from early interventions, which target the suspected secondary disability.

Limitations and Future Directions

While the study has significant findings, there are limitations. First, the current study had a relatively small sample size, with considerable variability. Due to the small sample size the findings of this study should be considered exploratory, or preliminary, and generalizability

should not be assumed. A larger sample would help to better identify the relationships between caregiver characteristics and child characteristics related to the development of social interaction skills in children with PVI. Secondly, while cue cards were used to assist caregivers during the CPP to facilitate interaction and investigate specific contexts, caregivers may have felt compelled to act out each scene explicitly instead of interpreting each cue card as a suggestion. Researchers must ensure that caregivers understand that the cue cards are suggestive and not step by step directions. A third limitation to the study was the one time point assessments. More assessment time points with all measures may have allowed for greater understanding of the relationships between caregiver characteristics and child characteristics. Additionally, the majority of measures used in this study were parent report, and the findings of these assessments or completing these assessments could have affected the outcome, as the parents were not unbiased. Future studies should consider using independent assessments, or observations to combat this limitation. Furthermore, future studies should consider using a measure of language ability which focuses equally on communication, and spoken language, as children with PVI have historically done well on measures of spoken language. Lastly, the sequential analysis was exploratory in nature and as such, the interactions were coded as events and not as timed events. A more fine-grained detailed analysis which coded the data as timed events would have provided more detail on the rate of communication.

Future studies should investigate child initiation of joint interaction, caregiver responding, and caregiver language in greater detail. In the current study, children infrequently, if ever, initiated interaction. It was not clear whether caregivers are over directive, thus limiting the child's opportunity to initiate interaction, or if children are not initiating social interaction. Caregiver responding appeared to be related to sustained child social interaction. Additionally,

the form of caregiver language should be further investigated to determine if certain forms of caregiver language promote or inhibit social interaction and child initiation. Finally, it is suggested that a more fine grained sequential analysis, which codes child-caregiver interactions as timed events be conducted to further investigate the relationship between social communication and interaction and children with PVI and their caregivers.

Following from this study, young children with PVI and their caregivers would benefit from early, intensive, targeted intervention focusing on play based skills incorporating sensory motor activities and social communication. Interventions should incorporate both members of the dyad, because both members of the dyad contribute to the success of the interaction. Intervention should include play based routines, sensory motor activities, and instruction for caregivers on the importance of parent positioning based on the function of the play, and how to expand the play routine beyond the current scope. Targets for intervention should be tailored to each dyad, based upon characteristics of the dyad. These interventions should be implemented early to combat growing delays.

Table 1. *CPP Contexts, Scenes and Props*

Context	Scene	“Prop”
	Free play	Legos, blocks, animals, doll house or farm, school bus with people
Social Interaction	Turns	ball with bell inside, bead ball, stacking toy, shape sorter
	Music	keyboard, toy radio, book with music, bongo drum
Requesting	“Help me”	bubbles, balloons, music box, 2 wind-up toys
	“I want”	favorite toy from CPP or child’s
Commenting	Texture	6 textures- pokey, squishy, sticky, smooth, rough, furry
	Container	nail file, bead necklace, truck, rubber wheel, paint brush

Table 2. *Participant Characteristics*

Participants	Child Age (months)	Child Gender	Early Intervention	Etiology	Caregiver Age (yrs.)	Caregiver Education
P1	21	Male	Home	ONH	24	High School
P2	26	Male	Center	ONH	24	College
P3	48	Male	Center	ONH	26	College
P4	48	Male	Center	ONH	32	College
P5	48	Male	Center	Microphthalmia	40	College
P6	25	Male	Home	Anophthalmia	36	College
P7	46	Male	Center	ONH	39	College
P8	30	Female	Center	ONH	19	High School
P9	26	Female	Home	ONH	23	High School
P10	40	Female	Center	ONH	43	College
P11	48	Female	Center	ONH	19	High School
P12	30	Female	Home	ONH	32	College

Table 3. *Summary Statistics for Child and Caregiver Characteristics*

Member	Measure	Summary Statistics			
		Mean(SD)	Minimum	Maximum	Range
Child	Language (months)	22(7.8)	10	35	25
	Motor (months)	15.58(7.7)	6	33	27
	Adaptive behavior (Standard score)	73(14.2)	47	95	48
Caregiver	Overprotection (weighted score)	0.1942	-0.87	1.2	2.07

Table 4. Correlation Matrix

	CPP	Child Age	Caregiver Age	Caregiver Education	Language Age	Over protection	Spatial	Adaptive Behavior
CPP	1	0.256	0.342	0.358	.740**	-0.217	.618*	0.192
Child Age	0.256	1	0.348	0.326	0.326	0.172	-0.014	-.774**
Caregiver Age	0.342	0.348	1	.633*	.722**	0.401	0.481	0.027
Caregiver Education	0.358	0.326	.633*	1	0.539	0.071	.712**	0.133
Language Age	.740**	0.326	.722**	0.539	1	0.203	.685*	0.206
Over protection	-0.217	0.172	0.401	0.071	0.203	1	-0.036	-0.211
Spatial	.618*	-0.014	0.481	.712**	.685*	-0.036	1	0.512
Adaptive Behavior	0.192	-.774**	0.027	0.133	0.206	-0.211	0.572	1

** Correlation is significant at the 0.01 level (two-tailed).

* Correlation is significant at the 0.05 level (two-tailed).

Table 5. CPP Contexts

Context	CPP Scene	Composite scores by CPP scene			
		Mean (<i>SD</i>)	Minimum	Maximum	Range
Requesting	Help	47.58 (15.32)	31	81	50
	Want	55.02 (21.88)	23	89	66
Social interaction	Music	55.08 (12.85)	32	76	44
	Turns	61.50 (19.54)	31	100	69
Commenting	Texture	61.08 (18.98)	37	101	64
	Hidden	64.42 (21.60)	40	105	65

(*SD*) = Standard deviation

Table 6. CPP Composite Scores by Item

Item	CPP Composite score by items				
	CPP Composite Mean (SD)	Mean item	Minimum	Maximum	Range
Child total JE	20.50 (7.78)	3.4	11	37	26
Child supported JE	20.50 (7.43)	3.4	11	36	25
Child coord JE	12.25 (5.69)	2.0	6	23	17
Child symbols	14.42 (7.20)	2.40	6	29	23
Child initiation	18.67 (9.40)	3.11	7	35	28
Child response	23.42 (5.96)	3.9	14	35	21
Child language	22 (12.44)	3.7	7	40	33
Child behavior	22.08 (8.30)	3.7	12	38	26
Child affect	27.58 (4.60)	4.6	22	36	14
Caregiver scaffolding	28.08 (7.98)	4.7	18	40	22
Caregiver symbols	27.75 (8.10)	4.6	16	39	23
Caregiver follows child	26.25 (7.31)	4.4	17	40	23
Caregiver affect	30.75 (5.15)	5.1	18	37	19
Caregiver elaborates	16.42 (5.13)	2.7	8	25	17
Caregiver sustains	23.58 (6.32)	3.9	12	36	24

Table 6. Cont'd *CPP Composite Score by Item*

Item	CPP Composite scores by item				
	Composite Mean (<i>SD</i>)	Item Mean	Minimum	Maximum	Range
Caregiver scope of topic	10.17 (5.17)	1.7	6	22	16
Fluency and Connection	19.83 (5.70)	3.3	12	32	20

(*SD*) = Standard deviation

JE = joint engagement

Table 7. Regression Selection Table

Predictors	Model Statistics					
	R^2	R^2_{adj}	R^2_{Ch}	C_p	AIC	BIC
Mac	0.629	0.490	0.629	4	106.018	107.958
VCOPS	0.292	0.027	0.292	4	113.781	115.721
Spatial	0.456	0.252	0.456	4	110.614	112.553
Vineland	0.448	0.241	0.448	4	110.802	112.742
Mac VCOPS**	0.717	0.556	0.717	5	104.739	107.184
Mac Spatial	0.661	0.468	0.661	5	106.929	109.353
Mac Vineland	0.643	0.439	0.643	5	107.557	109.981
Spatial VCOPS	0.515	0.238	0.515	5	111.241	113.666
VCOPS Vineland	0.485	0.191	0.485	5	111.962	114.306
Spatial Vineland	0.478	0.180	0.478	5	112.118	114.543
Mac Spatial VCOPS *	0.729	0.503	0.729	6	106.252	109.161
Mac VCOPS Vineland	0.717	0.482	0.717	6	106.759	109.669
Spatial VCOPS Vineland	0.522	0.124	0.522	6	113.069	115.979
Mac Spatial Vineland	0.662	0.380	0.662	6	108.908	111.818
Mac Spatial VCOPS Vineland*	0.742	0.433	0.742	7	107.655	111.059

** Model chosen based on selection criteria

*Model investigated based on selection criteria

Table 8. *Regression Summary*

	<i>b</i>	SE <i>b</i>	β	Sig.
Constant	161.225	99.800		0.112
Age of child	0.637	2.101	0.070	0.699
Caregiver age	-2.792	3.825	-0.230	0.457
Language age	12.405	3.868	0.957	0.014
Overprotection	-59.311	40.745	-0.351	0.183

Table 9. *Sequential Analysis Variables*

Codes	Frequency	Relative Frequency
CGV	187	0.06
CGNv	192	0.06
CGVNv	603	0.20
ChP	460	0.15
ChNP	118	0.04
CGRec	439	0.14
CGNRec	124	0.04
ChR	404	0.13
ChNR	563	0.18
Totals:	3090	1.00

CGV=caregiver verbal bid, CGNv= caregiver nonverbal bid, CGVNv= caregiver verbal bid and nonverbal, ChP= child prototypical response, ChNP= child non prototypical response, CGRec= caregiver recognition of child response, CGNRec= caregiver non-recognition of response, ChR= child response, and ChNR= child non response.

Table 10. *Sequential Observational Analysis Frequency Statistics*

Chained codes	Targets:		
	ChR	ChNR	Totals
Given:			
CGBidnPR	38	7	45
CGBidnPnR	9	62	71
Totals	47	69	116
$X^2(1) = 58.86, p < .01$			

CGBidnPR= caregiver bid for attention, child non prototypical response, caregiver recognition of child response. CGBidnPnR= caregiver bid for attention, child non prototypical response, caregiver non-recognition of child response.

Table 11. *Type and frequency of child non-prototypical response*

Participant	Non—prototypical response types		
	Quieting/Stilling	Leaning towards	Hand/foot movements
P1	0	4	0
P2	12	7	0
P3	6	0	0
P4	5	0	0
P5	6	0	0
P6	6	0	0
P7	4	0	0
P8	23	5	2
P9	9	0	0
P10	14	3	0
P11	6	0	0
P12	9	0	0

Table 12. *Non-prototypical child response by context*

Participant	Context					
	Help	Want	Hidden	Texture	Turns	Music
P1	1	2	0	0	3	0
P2	8	0	5	1	0	3
P3	1	0	0	2	1	2
P4	1	0	2	0	0	2
P5	2	0	0	0	1	3
P6	1	0	1	0	2	2
P7	0	0	3	0	0	1
P8	1	1	2	0	11	9
P9	0	2	2	0	3	2
P10	2	3	2	1	3	3
P11	2	0	0	1	0	3
P12	5	0	2	1	0	1

Table 13. *Discrepancy score table*

Participant	Chronological age	Language difference	Motor difference	Adaptive difference
P1	21	-18	-11	-5
P2	26	-20	-17	-12
P3	48	-38	-21	-37
P4	48	-25	-27	-13
P5	48	-13	-26	-20
P6	25	-1	-13	-7
P7	46	-12	-25	-26
P8	30	-2	-7	-19
P9	26	-8	-11	-9
P10	40	-17	-22	-19
P11	48	-28	-38	-33
P12	30	0	+3	+7

Scores reported in months

Figure 1. *Study Design*

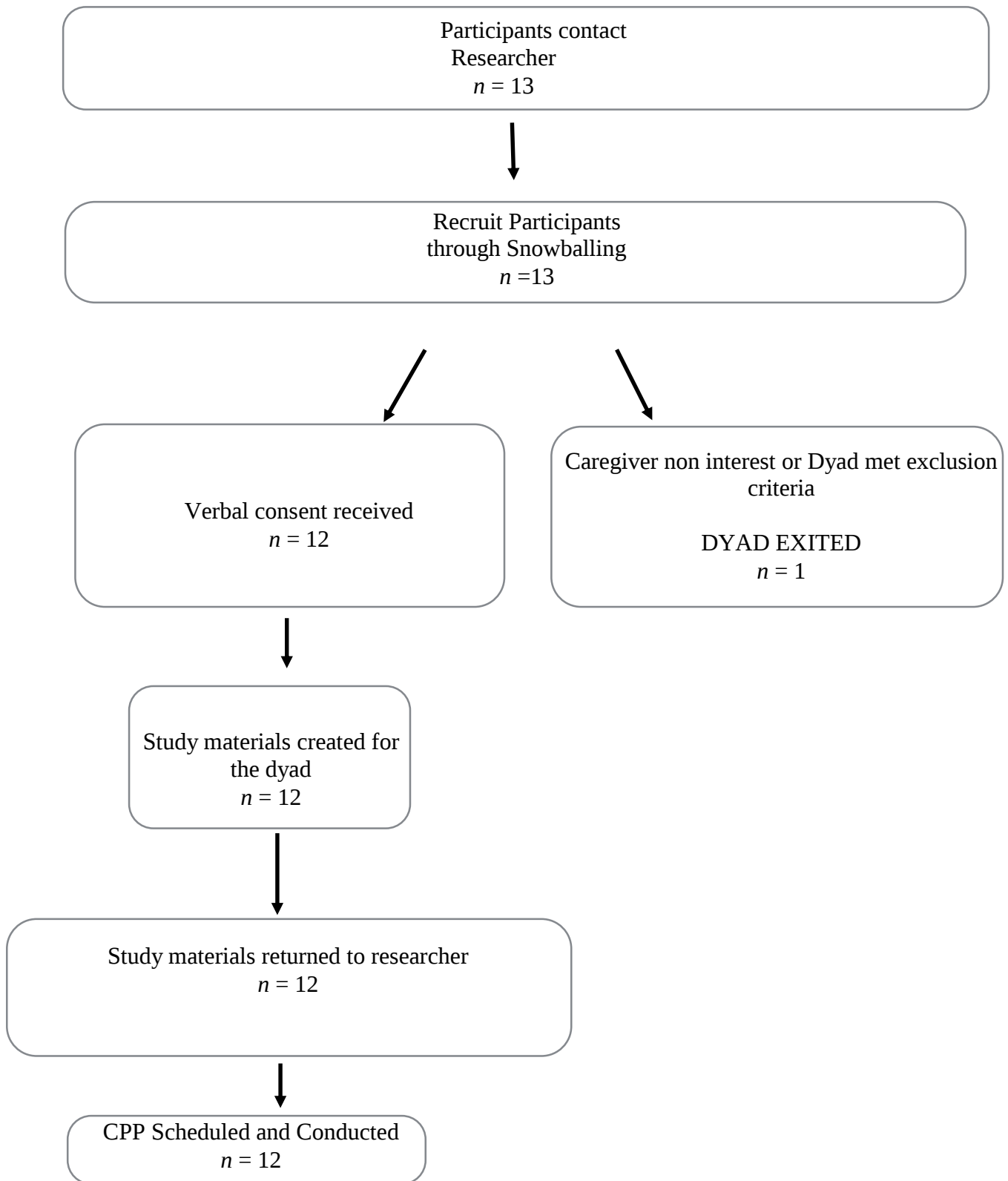
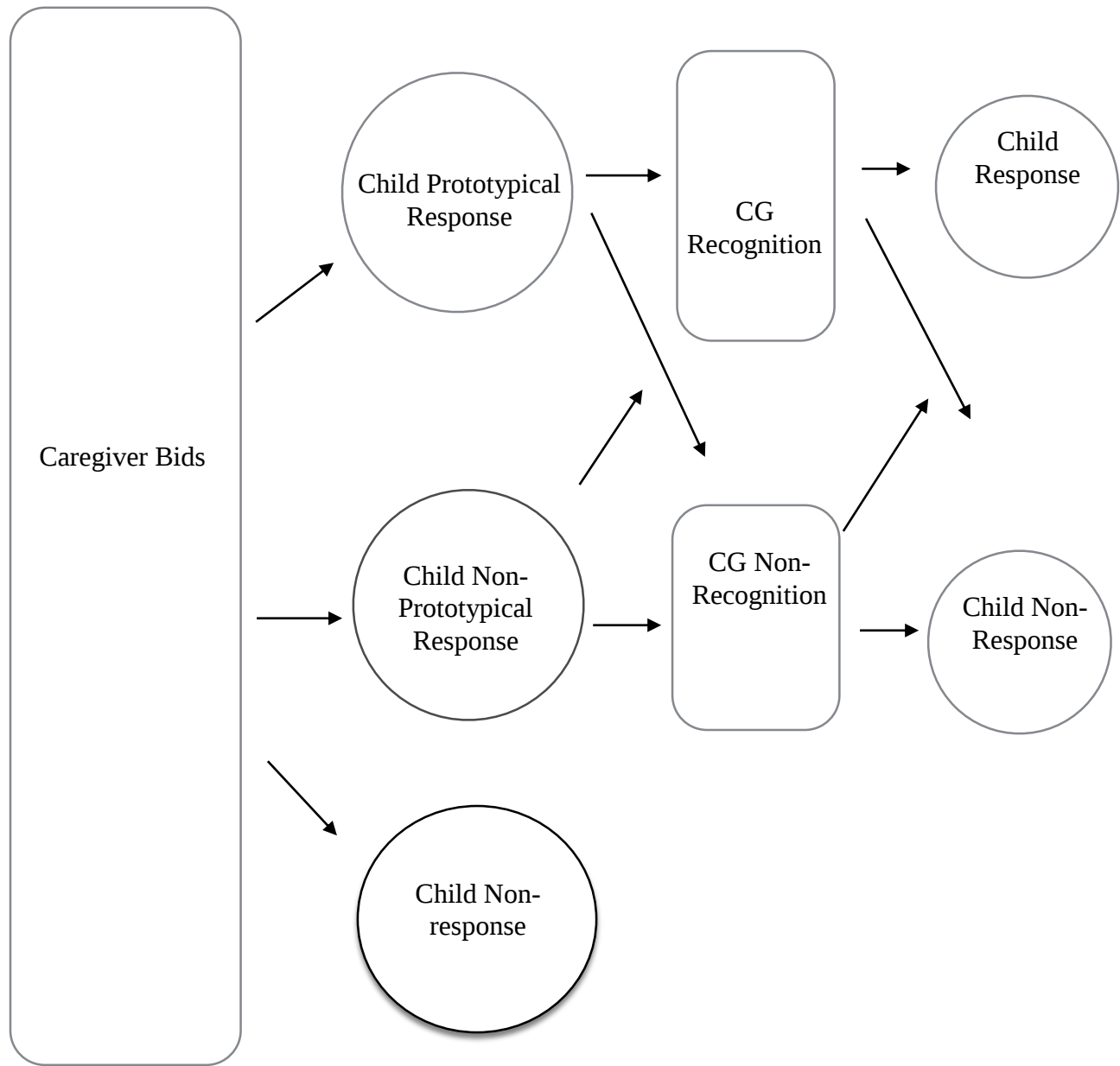


Figure 2. *Dyadic interaction cycle*



CG= Caregiver

Appendix A

Director's Instructions/Cue Cards

THE COMMUNICATION PLAY

I want to watch _____ communicate with facial expressions, sounds, and gestures.

To encourage her/him to show us some of the ways she/he communicates with you, I would like you and her/him to be actors in a communication play.

This play has six scenes. Each lasts about 5 minutes. We will take a brief break between scenes.

Before each scene, I will provide you with a cue card that lists the scene's basic PLOT and some SUGGESTIONS about how you might act to entice _____ to play her/his role.

During the break between scenes, I will bring in new PROPS and take out extra toys. Please let me know if there are toys you want me to remove from the room. And, please feel free to use any objects in the room during any of the scenes,!

Scene 1: “HELP ME!”!

PLOT: _____ needs your help doing something with a toy.

SUGGESTIONS: Although you know what _____ wants, you wait for her/him to ask.

For example, you might blow up a balloon and then, when you have _____ ‘s attention, let the air suddenly come out. Then wait and see if _____ will ask you to repeat this show. If she/he doesn’t do so after several seconds, repeat the blow-up and release once more.

Or while you are blowing bubbles, you might put the cap back on the bottle, or put the wand down and place it down in front of _____. Wait a moment to see how she/he reacts.

Scene 2: THE MUSIC FESTIVAL

PLOT: _____ and you enjoy music together.

SUGGESTIONS: Sing _____’s favorite song with her/him/

Play a musical instrument and encourage _____ to sing and dance along.

Scene 3: TEXTURE GALLERY

PLOT: _____ and you enjoy ‘looking’ at pictures together.

PROPS: Several “pictures” (textures) all around the room.

SUGGESTIONS: Try to attract _____’s attention to each of the ‘pictures’. After ‘looking’ at all of the pictures, return to _____’s favorite picture and to the picture that she/he seemed to like the least.

Scene 4: HIDDEN OBJECTS

PLOT: _____ and you empty the contents of the container object by object. There are five hidden objects. As each object is taken out, you share it for a while before getting another one.

SUGGESTIONS: Try to name each object and play with it for a while before taking out a new object.

Imitate what _____ does with the object. Try to get _____ to imitate you.

Scene 5: TAKE TURNS

PLOT: _____ and you engage in a back and forth game of turn taking.

SUGGESTIONS: To encourage _____ to communicate, tease her a bit by pausing before you take some of your turns.

Scene 6: "I WANT"!

PLOT: _____ notices toys located on a shelf too high to reach. You help her/him get what she wants but only after you pretend to misunderstand her/his desires.

PROPS: Three toys on a bookshelf, two that are provided and one of _____'s favorites.

SUGGESTIONS: Readily agree to help. But initially act puzzled about which toy. Then make a mistake, offering her/him another toy. Finally, go ahead and give her/him the toy.

If _____ doesn't pay much heed to the toys, try to direct her/his attention to them without indicating a specific one. If she/he still pays no heed, let her/him play with one of the toys for a minute and then "put it away" on the shelf and see if she/he asks for help getting it, or one of the other toys down.

Appendix B
CPP coding sheet example

CPP Line Item	Music	Help	I want	Texture	Hidden	Turns	
Total joint engagement							
Supported joint engagement							
Coordinated joint engagement							
Symbol-infused joint engagement							
Initiation of communication							
Responsiveness to partner's							
Expressive language level and use							
Quality of behavior patterns							
Affect							
Scaffolding							
Symbol highlighting							
Following in on child's focus							
Affect							
Elaboration of shared topic							
Sustainability of shared topic							
Scope of shared topic							
Fluency and connectedness							
Composite							

Appendix C
Sequential analysis coding sheet

Caregiver initiated Bid Verbal															
Caregiver initiated Bid Nonverbal															
Caregiver initiated bid verbally and nonverbally															
Child Prototypical response															
Child Non- Prototypical response															
Child does not respond															
Caregiver recognition of response															
Caregiver non- recognition of response															
Child responds															
Child does not respond															
CODED BY															

Sequential Analysis Coding Key

Caregiver initiates verbal bid

1. Caregiver initiates interaction with language

Caregiver initiates nonverbal bid

1. Caregiver initiates interaction through activity

Caregiver initiates bid verbally and nonverbally

1. Caregiver initiated bid with a combination of language and activity

Child prototypical response

1. Child reaches for item
2. Child gives toy to caregiver
3. Child turns and faces the caregiver
4. Child uses language to direct or respond
5. Child follows attention getting attempt by action

Child non prototypical response

1. Child quiets upon interaction
2. Child becomes still
3. Child's hands and/or feet circle
4. Child leans towards activity

Child does not respond

Caregiver recognition of response

1. Caregiver responds contingently to child's response by continuing activity

Caregiver non-recognition of response

1. Caregiver does not respond or continues same line of direction or bid

Child responses

1. Child's affect synchronizes with caregiver
2. Child follows direction or suggestion
3. Child adds to play
4. Child repeats language or activity

Child does not respond

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