Child and Caregiver Social Behavior and Joint Attention Change following P.L.A.Y. Project Intervention

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by

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ABSTRACT
CHILD AND CAREGIVER SOCIAL BEHAVIOR AND JOINT ATTENTION CHANGE FOLLOWING P.L.A.Y. PROJECT INTERVENTION

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Autism is a complex, developmental disorder affecting approximately one in 110 children in the United States. Children with autism spectrum disorders demonstrate a variety of significant deficits, including social impairment. The limitations in social ability may be in part a product of limited joint attention development at an early age. Joint attention refers to the triadic attention between an individual, another person, and an object or event and has been shown to moderate the effectiveness of certain autism interventions. The P.L.A.Y. Project, developed by Dr. Richard Solomon, aims to train parents of children with autism to be their child's own therapist by following the child's lead and utilizing naturalistic learning opportunities to enhance the reinforcing value of social interaction.

This study investigated whether five months of P.L.A.Y. intervention was effective in improving behaviors germane to joint attention development in caregivers and children with autism in comparison to a community standard control group. The relationship between caregiver and child joint attention behavior change also was explored. Thirty-two caregiver-child dyads were videotaped before and after a five-month period in which 14 received P.L.A.Y. Project intervention and 18 were assigned to a community standard control group. Results indicated that children in the P.L.A.Y. group made improvements in many domains, particularly in their frequency of children initiating and leading play sequences. However, these changes did not differ significantly from those made by children in the control group. Future studies should examine longer periods of P.L.A.Y. intervention for more accurate understanding of its benefits and a more comprehensive understanding of the interactive, dependent nature of the trajectory of joint attention development.

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Child and Caregiver Social Behavior and Joint Attention Change Following P.L.A.Y. Project Intervention

Autism is a complex developmental disorder affecting approximately one out of every 110 children in the United States (CDC, 2010). Deficits in autism are pervasive and vary greatly in severity. Autism spectrum disorders (ASD) affect numerous domains, including social and behavioral functioning and language development, and are also distinguished by the presence of a variety of circumscribed interests and stereotyped, repetitive interests and behaviors. Recent increases in the rate of ASD diagnoses have led to a plethora of new research related to etiology and treatment. The complexity of the disorder has impeded progress, however, and there is extensive controversy regarding both the origins of ASD as well as the domains of impairment which are important targets for early therapeutic intervention. Researchers and clinicians have struggled to identify what deficits appear to be primary and critical, in that they appear early and impede the development of later functional skills. The only predominant consensus amongst researchers in this field is the importance of early and intensive (i.e., 20-40 hours per week) intervention (Mundy & Crowson, 1997). The push for intensive intervention reflects the notion that children will benefit from treatment that occurs as early as possible in a child's developmental progression. It further posits that intervention should be extensive in both time and intensity at an early age in order to provide the best possible developmental trajectory. This paper will review a specific area of deficiency in children with ASD, namely joint attention, and assess how this construct affects the larger deficits in social development seen in these children. The development of joint attention in typically developing children as well as children with autism will be reviewed, as will the importance of joint attention in a larger developmental context. Interventions for children with ASD will be evaluated, both in general and more

specifically in terms of their previously studied and/or theoretical contribution to joint attention development. A special focus will be given to the intervention under review in this study, The P.L.A.Y. (Play and Language for Autistic Youngsters) Project, developed by Dr. Richard Solomon and offered through Easter Seals Disability Services. As this intervention primarily involves training a child's caregiver to be his or her therapist, the role and importance of caregiver involvement in autism interventions will also be reviewed. The effectiveness of The P.L.A.Y. Project in developing joint attention behaviors in children with ASD and their caregivers will be assessed in comparison to a community control group by comparing caregiver-child interactions before and after a five month period, during which approximately half of the subjects will have received P.L.A.Y. intervention. This review of dyadic joint attention development will take place within the context of "joint engagement bouts," or periods where the caregiver and child were mutually engaged in an activity. Finally, relationships between caregiver and child joint attention behaviors will be examined.

One crucial domain of impairment in children with ASD is social competence and social cognition. Van Hecke and colleagues (2007) described three areas of social behavior that are important to this realm of functioning: 1) the development of cognitive and emotional interest in other people, 2) the regulation and integration of one's own behavior into social interaction, and 3) the "ability to regulate attention and emotional reactivity . . . in positive goal-directed activity" (Van Hecke et al., p. 53). The impairments in social behavior of children with ASD are notable in all of these categories. Sullivan, Finelli, Marvin, Garret-Mayer, Bauman, and Landa (2007) noted that there are qualitative differences seen in children with ASD in a variety of social domains, including verbal and non-verbal behaviors, social reciprocity, and sharing of affect. These deficits are thought to distinguish children with autism not only from typically

developing children but also children with other developmental disorders such as Down Syndrome (Dawson et al., 2004; Leekam & Ramsden, 2006). Joint attention, which underlies the ability of a child to engage and interact with another individual, has been identified as an underlying "pivotal skill" (Mundy & Crowson, 1997) crucial for the later development of social functioning (Bakeman & Adamson, 1984). Van Hecke et al. noted that joint attention development is important in the development of all three domains of social competence described earlier, and it appears that deficits in joint attention in infancy may be responsible for later impairments in a broad spectrum of social and communicative domains (Warreyn, Roeyers, Van Westwinkel, & De Groote, 2007).

Joint Attention: Subtypes, Development, & Importance

The definition, conceptualization, and measurement of joint attention vary a great deal across both past and more recent literature. The unifying factor in defining this construct is the engagement in a triadic connection between self, other, and object or event (Bakeman & Adamson, 1984). Joint attention is most commonly understood as a mutual and social phenomenon (Tomasello, 1995), meaning that both individuals involved in the engagement are aware of their attention to a common object or event. Furthermore, Tomasello noted that joint attention is best understood as exclusively a process of social engagement, not a result of attentional redirection or gaze alternation. Schertz and Odom (2007) referred to this distinction as one between "commenting," or proto-declarative behavior and "requesting," or proto-imperative behavior (p. 1562). That is, joint attention is specific to a triadic interaction which is initiated for the sole purpose of sharing an external experience and the resulting shared internal experience(s) with another person. Joint attention behaviors are thus directly distinguished from requesting behaviors, which are by definition aimed at acquiring an object or gaining assistance.

Researchers have developed several distinctions in the form and function of joint attention, the most common of which differentiates between RJA and IJA. This dichotomy refers to whether the individual is using the nonverbal cues of another individual to understand the focus of that person's attention (RJA) or intentionally using gestures and eye gaze to "direct" another person's attention for the purpose of sharing an experience (IJA; Mundy, 1995; Sullivan et al., 2007). The terminology of RJA and IJA evolved from Adamson and Bakeman's (1995) earlier distinction between passive joint engagement from coordinated joint engagement, which was the first examination of infant behavior which demonstrated an awareness of another person's involvement in attentional processes.

Typical joint attention developmental pattern.

Joint attention behaviors tend to follow a predictable developmental progression in typically developing children. Bakeman and Adamson (1984) described the process of RJA development in detail; beginning with the use of gaze to determine what area to look at (typically seen at approximately six months of age) followed by the ability to use the focus of another's gaze or a pointing gesture to locate a target (12-15 months of age). These researchers noted that over time the ability to locate the target of one's gaze becomes more refined, and infants learn to respond to increasingly vague nonverbal cues. Leekam (2005) described this process as being dependent on "the ability to reflexively orient to sensory stimuli [and] the ability to control attention" (Leekam, p. 212), both of which are typically present in a child at three months of age. On the other hand, the development of IJA may be less understood. Murray et al. (2008) found that the initiation of joint attention (IJA) developed soon after children demonstrated response to joint attention (RJA) around 12 to 18 months of age and noted this development was contingent on the recognition of shared attention as an intentional communicative act of others. This research

supports the assertion of Bakeman and Adamson that caregivers must provide feedback and support during episodes of passive joint engagement in order for the infant to initiate and increase amounts of coordinated joint attention. Tomasello (1995) separated levels of joint attention interactions into three distinct periods of development. He described in detail the trajectory most common in children:

> "The first nine months of life when skills of joint attention have yet to fully emerge, the period from nine to 18 months when infants begin to follow and direct the attention and behavior of other persons, and the period from 18 to 24 months when joint attention begins to manifest itself in many complex ways in children's learning and use of language" (Tomasello, 1995, p. 105).

The relative stability of this pattern allows joint attention to serve as a distinct and extraordinarily early developmental marker for social impairment (Vaughan et al., 2003), though most research on joint attention and ASD has begun at a later age, typically around 3 years of age (Naber et al., 2007). Mundy and Crowson (1997) argued that the quality of RJA and IJA behaviors differ significantly, thus the "level" of IJA behaviors utilized by children must also be assessed. Furthermore, Mundy, Block, Delgado, Pomares, Van Hecke, and Parlade (2007) discovered that IJA and RJA did not necessarily increase in conjunction with each other, and that IJA did not follow a linear pattern of development, but rather IJA appeared to develop in distinct stages. The Early Social Communication Scales (ESCS) developed by Mundy et al. (2003) differentiated between "high-level" and "lower-level" IJA behaviors, while RJA behaviors were conceptualized on one level. This distinction is based on the typical development of IJA behaviors, which seem to occur in two stages, as opposed to the linear model seen in RJA development. Low-level IJA behaviors include eye contact and gaze alternation, which typically

develop around 12- to 18-months, while higher-level IJA behaviors include pointing, pointing with simultaneous eye contact, and showing, which typically developing children tend to begin using between 18- and 24-months. RJA behaviors defined in this coding system included following both the point and line of regard (eye gaze direction) of the researcher. Jones and Carr (2004) noted that the declarative function of joint attention, in comparison to the imperative function of requesting, points to the true reciprocal and social nature of this category of behavior.

Ongoing arguments exist as to whether deficits in joint attention processes are primarily cognitive or interpersonal-affective in nature (Dunham & Moore, 1995; Leekam, 2005). Baron-Cohen (1989) has argued that joint attention deficits are largely a result of cognitive deficiency in which children lack the ability to understand another person's attention and interest. This hypothesis can best be understood in relation to "theory of mind," reflecting an individual's inability to understand the thoughts and behaviors of others and as a result "enable a sense of connectedness" (Schertz & Odom, 2004, p. 44) with another person. Hobson (1993), in contrast, asserted that children with autism are unable to engage in appropriate affective interactions with others and thus are unable to effectively share affective experiences or emotions with others. He argued that these deficits render joint attention as an impairment in both dyadic and triadic social orientation. Hobson's model predominantly emphasizes the lack of reinforcement and incentive for joint attention interactions in children with ASD.

Importance of joint attention development.

The development of early skills related to joint attention are understood to be foundational for a developmentally appropriate social trajectory that eventually leads to a more comprehensive understanding of one's social world (Schertz and Odom, 2004). Recent research also indicates that a variety of pivotal domains are affected by delays in joint attention. Baldwin

(1995) noted that joint attention allows for development of the true triadic relationship between self, other, and object. This relationship provides a child with the ability to gather information about both another person and the object or event he or she is referencing. Tomasello (1995) indicated that children use episodes of joint attention not only to share affective experiences with another individual, but further to build the foundations for an interpersonal relationship. Furthermore, when engaged in joint attention, Murray et al. (2008) noted that the child engages in mutual mental focus on an object or event with another individual. It stands to reason that both the cognitive and interpersonal-affective models described above are crucial to understanding the importance of joint attention. That is, in sharing an experience with another individual, a child eventually builds connections between experiences or behaviors, emotions, and even cognitive factors, based on their ability to read these in another individual.

Joint attention deficits also are associated with significant language delay and impairment, and research has shown that improvements in joint attention behaviors are often closely followed by language gain and increases in spontaneous speech (Bono, Daley, & Sigman, 2004; Colombi et al., 2009; Kasari, Paparella, Freeman, & Jahromi, 2008; Murray et al., 2008; Tomasello & Farrar, 1986; Whalen, Schreibman, & Ingersoll, 2006). Much of this research hypothesizes that social cognitive learning takes place when the child is able to fully engage in both an event as well as another individuals' verbal and nonverbal language behaviors (Mundy, Sigman, & Kasari, 1990). The importance of joint attention development in acquiring and using language further underscores the need for intervention that targets social attention related behaviors at an early age. Furthermore, joint attention development, specifically an increase in the quality of IJA behaviors, is related to the acquisition of adaptive behavioral control, social competence, and self-regulation (Van Hecke et al., 2007), another domain that is negatively affected in children

with ASD. These studies, along with many others, clearly indicated that the development of joint attention is of critical importance for high level social and emotional development (e.g. Bakeman & Adamson, 1984; Morales, Mundy, Crowson, Neal, & Delgado, 2005; Mundy, 1995; Whalen & Schreibman, 2003).

Joint Attention in Autism.

Charman (1998) noted that certain deficits in joint attention in children with autism have been identified since the disorder was first described by Kanner (1943). For example, Curcio (1978) found that children with ASD were more likely to use requesting gestures than declarative gestures, and subsequent studies (e.g. Baron-Cohen, 1995; Mundy & Crowson, 1997; Sigman & Kasari, 1995) have supported the idea that children with autism are able to use protoimperative gestures (requesting) but are either unable or unwilling to produce and understand protodeclarative gestures (socially responding or directing; IJA). Charman hypothesized that this deficit may primarily be a result of a lack of intrinsic interest in social and emotional cues, similar to the theory promoted by Hobson (1993). Specifically, Charman found that attention monitoring and the coordination of attention and affect, specifically within interpersonal interactions, were often significantly impaired in children with autism. Since these initial findings, follow-up research has focused on how the picture of joint attention changes in children with ASD as they develop, by examining whether these skills are absent or simply delayed, and further to what extent these delays impact other areas of functioning. Whalen, Schriebman, and Ingersoll (2006) proposed that deficits in joint attention within ASD meet criteria proposed by Sigman and Capps (1997) for specificity, universality, and primacy in the identification of ASD. Thus, research also continues to explore the use of joint attention skill deficits as a mechanism for ASD evaluation, diagnosis, and treatment planning.

Researchers have demonstrated that children with ASD have impairments in both RJA and IJA (e.g., Sigman, Mundy, Sherman, and Ungerer, 1986). However, it has been suggested that RJA skills do eventually develop in higher functioning children, even when IJA skills remain limited. Further research indicates that most children with ASD are eventually able to respond to joint attention requests (RJA), but do so less frequently than typically developing children. Sullivan and colleagues (2007) found that children with ASD responded to RJA cues, however they found that their performance was irregular and did not markedly improve between the ages of 14 and 24 months when compared to children in a broader autism phenotype (i.e., children with sub-clinical deficits similar to those in autism) group or typically developing children. These researchers also found that delays in RJA cues predicted future communication and social difficulties. Warreyn et al. (2007) found that children with ASD showed fewer RJA behaviors than typically developing children, but also noted that their ability to request was similar to a chronologically age-matched control group. These findings suggest that the deficit in RJA, and likely IJA behaviors, are primarily due to their social nature (i.e., a lack of social interest, not ability). However, it appears that children with ASD have markedly impaired abilities compared to both typically developing children and children with other developmental delays in their ability to initiate joint attention (IJA). Warreyn et al. described the declarative behavior, or IJA, of children with autism as qualitatively and quantitatively different. These children "looked at their mothers' faces less often and for a shorter duration of time" (p. 510) than a control group including during periods of object activation.

Leekam (2005) found that pre-school children with autism were able to both orient to objects as well as shift their attention from one object to another location. However, these same children demonstrated difficulty orienting to a person calling their name. Leekam suggested that this

provided evidence that children with autism have particular difficulty with the social nature of joint attention. In a follow-up study, Leekam and Ramsden (2006) found evidence that children with autism oriented to fewer dyadic bids and that this difficulty was associated with both verbal and non-verbal ability. These findings further the likelihood that children with autism have difficulty orienting to social stimuli at both a reflexive (exogenous) level and at the level of voluntary (endogenous) control. It remains notable that deficits are still present in non-social domains. Dawson et al. (2004) demonstrated that young children with ASD showed significant impairment in orienting to social and non-social stimuli, as well as in attending to signals of distress from others. In line with Charman's (1998) premise that joint attention skills fail to develop in children with ASD from a lack of interest in social cues, Dawson and colleagues proposed that children with ASD fail to find the affective exchange that typically occurs within joint attention exchanges intrinsically rewarding, and thus are not motivated to participate in early social interactions. As a result of this lack of engagement in joint attention and social exchange, children with autism likely miss the opportunity to develop and refine adaptive and appropriate communication techniques. Joint attention has been found to moderate the relationship between intervention and language gain in children with autism (Bono et al., 2004), and active treatment of joint attention skills within therapy were associated with higher levels of language gain over the course of intervention (Kasari et al., 2008). These researchers hypothesized that a child who develops joint attention skills thus becomes more aware of social and emotional reinforcement as a result of increased understanding and use of functional joint attention behaviors and language. The present study aimed to provide a better understanding of how joint attention skills can be developed within the framework of an intervention not specifically designed to target joint attention, but nonetheless based on common principles.

Further, it was hoped that qualitative analysis of intervention effects would shed light on language gains or other secondary skill developments made following an increase in social behavior.

A related area that has received little research at this point is the neurological systems associated with joint attention in typical or atypical development (Mundy & Neal, 2001). Neurological inquiries include questions of whether there are specific areas of the brain responsible for, or at the very least associated with, deficits in joint attention, as well as if increases in joint attention affect the neurodevelopment of typically functioning children or children with ASD. Mundy, Sullivan, and Mastergeorge (2009) proposed a parallel and distributed processing model that demonstrated joint attention as a "primary and cardinal" (Mundy et al., p. 2) feature of autism that has tremendous implications for both social information processing and human learning. Dawson and colleagues (2004) stated that social attention impairments likely create a cyclical feedback loop by limiting the amount of cognitive input a child receives during development. In essence, the lack of social cognition often seen in children with ASD may limit development in numerous spheres of childhood functioning and neurodevelopment. These researchers thus hypothesized that increases in joint attention at an early age could help correct the trajectory which appears to be responsible for many of the social and linguistic neural deficits seen in children with ASD. Mundy and Neal (2001) supported the idea that joint attention development increases the likelihood of normal brain and behavioral development, including social and communicative competence.

Autism Interventions

As discussed previously, children with ASD show early impairments in joint attention, which appear to be later manifested as delays in both social development and language acquisition

(Bakeman & Adamson, 1984). It thus stands to reason that joint attention skills should be a target, either directly or indirectly, for early intervention. Bono, Daley, and Sigman (2004) proposed that joint attention skills may serve as a necessary precursor for any other component of intervention to be effective. They suggested that therapists providing interventions for children with ASD typically did attempt to initiate joint attention within a variety of therapeutic contexts and that developing RJA was thus necessary to achieve therapeutic goals. Mundy and Crowson (1997) have suggested that assessing the development of nonverbal social communication skills would also further our understanding of the neural growth and development of children with ASD in early intervention programs. These researchers have also discussed the importance of determining associated changes between joint attention gains and increasing neural connectivity and coherence. They hypothesized that earlier targeting of joint attention behaviors in intervention might be essential, as there could be a critical period in which the brain is able to incorporate these skills. However, an inherent limitation to interventions targeting joint intervention and social skills as a whole is that gains made in these domains can be difficult to measure using traditional techniques of developmental assessment (Mundy & Crowson, 1997). Thus, interventions must not only show efficacy in developing joint attention skills, but intricate observational techniques must be employed to measure the resulting changes in social behavior.

Numerous intervention modalities are available for children with ASD, the majority of which fall under the umbrella of either Applied Behavioral Analysis (ABA; Lovaas, 1987) or Developmental, Individualized, and Relationship-oriented (DIR)/Floortime models (Greenspan & Wieder, 1999). ABA techniques generally emphasize discrete trial methodology, typically using techniques of positive reinforcement and in some cases time-out or response cost

techniques to increase the frequency of adaptive behaviors and decrease the occurrence of maladaptive behaviors. While Lovaas claimed that ABA was effective in teaching social and communicative behavior, Mundy and Crowson noted that other researchers (e.g., Seibert & Oller, 1981; Wetherby, 1986) have argued that the discrete trial format does not effectively teach skills which can be generalized to a broader range of social interactions. Buffington, Krantz, McClanahan, and Poulson (1998) could not find clear results in either direction regarding whether traditional ABA techniques were effective in increasing and generalizing joint attention gestural and verbal responses. However, individual components of joint attention (e.g. eye contact, requesting, commenting) are often early targets of discrete trial training, and thus it is possible that these behaviors could be shaped over time or chained together to develop a comprehensive joint attention repertoire. ABA techniques are also the most widely available and well-funded intervention for children with ASD because of their success in both teaching new behaviors and decreasing the frequency of maladaptive behaviors (Jones & Carr, 2004).

In contrast, DIR/Floortime models typically emphasize naturalistic learning opportunities and are often seen as child-directed rather than therapist- or caregiver-directed (Greenspan & Wieder, 1999). The caregiver is instructed to follow the child's lead and respond directly to the child's play initiations. While these strategies often begin with a therapist and child, the emphasis of most DIR/Floortime interventions is on the caregiver-child relationship, and this component is believed to be essential to developing and generalizing joint attention and promoting socio-emotional functioning (Mahoney & Perales, 2003; Schertz & Odom, 2004). Lewy and Dawson (1992) suggested that through this model of providing opportunities for social interaction that was child-focused and thus increasing the likelihood of joint attention, the adult would be better able to elicit joint attention from the child in everyday interactions. These researchers posited

that naturalistic teaching opportunities were essential in creating the motivation necessary for the child to respond to and initiate joint attention, which may not otherwise be reinforcing for the child. The increased emphasis on affect, rather than behavior or cognition, is a central component of DIR techniques.

Jones and Carr (2004) also examined a variety of other intervention techniques, including pre-linguistic milieu teaching (PLMT; Warren et al., 1993, Yoder & Warren, 1999) and general social skills interventions (Baker, 2000; Pierce & Schriebman, 1995), both of which were reported to have a positive impact on joint attention based on behavioral observations and parent report measures. Pre-linguistic milieu teaching focuses on teaching early social interaction skills and has demonstrated some success in teaching IJA, but does not address RJA skills. General social skills interventions typically do not target joint attention directly, but are still able to have a positive impact on JA development through other skills learned (Hwang & Hughes, 2000). There are numerous other interventions, such as Pivotal Response Training (Koegel et al., 1991; Pierce & Schriebman, 1995), and Relationship Development Intervention (RDI; Gutstein, Burgess, & Montfort, 2007) which have demonstrated success in teaching a variety of skills related to social functioning, but have not been specifically assessed in their ability to develop and generalize responding to or initiating joint attention. Finally, interventions have been designed to specifically and primarily target joint attention, through the use of behavioral techniques similar to those used in ABA (Gulsrud, Kasari, Freeman, & Paparella, 2007; Kasari, Freeman, & Paparella, 2006; Rocha, Schriebman, & Stahmer, 2007; Whalen & Schriebman, 2003). These interventions have shown effectiveness in their ability to increase both RJA and IJA behaviors, and Whalen and Schriebman reported seeing sophisticated levels of social interaction develop in children with ASD as a result. Furthermore, these researchers found that

changes in joint attention were not only seen by scientists trained in assessing and coding the data, but also by lay observers. These changes were thus proposed to be both scientifically valid and socially significant. Kasari and colleagues (2006) noted the importance of a child-centered model in a joint attention intervention, but Rocha et al. found that while children maintained increased levels of joint attention at follow up, parents did not maintain their increase in joint attention initiations. It was hypothesized that parent gains in joint attention behaviors would have been more likely to be sustained if intervention took place in a naturalistic environment, allowing for increased parent and child generalization of therapeutic skills (Reamer, Brady, & Hawkins, 1998 as cited in Rocha et al, 2007). It appears important for joint attention focused interventions to provide training for both caregivers of and children with ASD in as naturalistic of a setting as is possible. When gains in joint attention behaviors have been made during the course of intervention, these increases were also followed by increases in other skills, such as play (Kasari et al., 2006) and language (Drew et al., 2002; Kasari, Paparella, Freeman, & Jahromi, 2008). These results support the theory of joint attention as a critical skill that must be addressed early in the autism intervention process, before other deficits are targeted and before higher order skills are taught.

Caregiver involvement in intervention.

As noted earlier, research has shown that caregiver involvement is crucial in the development of joint attention. Recently, Zwaigenbaum et al. (2009) outlined guidelines for autism intervention which included the "pivotal role of the parent-child relationship" (p. 1388). The caregiver-child relationship is contingent on both cultural and affective norms, but is seemingly imperative across developmental variations (Adamson & McArthur, 1995). Kim and Mahoney (2004) examined the interaction style of mothers and implications for child

engagement. These authors found that maternal responsiveness and affect were both positively correlated with children's engagement, and thus asserted that interventions targeting responsive interactions would promote "developmental processes such as attention, persistence, initiation, and joint attention during their daily routines" (Kim & Mahoney, p. 36). However, they also pointed out that positive correlations do not address the issue of directionality. That is, the apparent lack of interest in social interaction and engagement in children with autism may cause parents to be less responsive and interactive, rather than the other way around. Naber et al. (2007) noted that this contingency may be more based on the quality of the infant-parent relationship. Schertz and Odom (2007) found evidence of joint attention development in two of three infants using a family-centered and family-guided model for intervention and recommended that interventions focusing on natural caregiver-child interactions be utilized for this purpose. Specifically, researchers (e.g. Adamson and Bakeman, 1985; Schertz and Odom, 2004; Vaughan et al., 2003) have recommended a "scaffolding" model, in which the caregiver gives assistance to the child in activities involving attention and socio-emotional interaction which allow the child to build increasingly complex social skills. According to these researchers, this development occurs largely as a result of the contingency between the infant's activities and the adult's response. The scaffolding technique has shown success in developing joint attention in children with autism (Siller & Sigman, 2002), as well as language skills in typically developing children (Markus, Mundy, Morales, Delgado, & Grace, 2000). Lastly, Rocha et al. (2007) recommended that the parent training take place in the home to specifically teach how skills could be targeted and learned in the child's natural environment.

Lovaas (1987) and McEachin et al. (1993) hypothesized that early intervention for children with autism may not only lead to improvement in developmental and intellectual functioning, but

actually help children recover from autism. The "recovery hypothesis" is strongly debated, in large part due to disagreement over what constitutes true recovery from autism. Whether or not it is possible for children to recover from autism, Mundy and Crowson (1997) noted that "the inference of recovery with regard to specific social skill deficits cannot be made from either general measures of social development or intelligence in studies of children with autism" (p. 663). They argued that outcome measures should instead focus on effects of intervention that are most sensitive to the social and cognitive domains of impairment in autism. Thus, joint attention development must be considered an important component of assessing interventions, as it appears to be a fundamental deficit both specific to autism and responsible for the development of later developmental and social difficulties.

The P.L.A.Y. Project.

The P.L.A.Y. Project intervention currently under investigation in this study is based on the DIR model (Solomon, Necheles, Ferch, & Bruckman, 2007). Specifically, The P.L.A.Y. Project intervention uses home based consultation, community based trainings, parent support and advocacy services, and medical consultation in an effort to provide families with a cost-effective and naturalistic intervention for children with ASD that are between the ages of two- and six-years-old. The Home Consultation program, which is the component of The P.L.A.Y. Project assessed in this study, consists of monthly home visits from trained home consultants and uses videotaping of both therapist/child and parent/child interaction to teach parents basic interactional skills as well as more advanced DIR/Floortime techniques. The Home Consultation program consists of 10-12 visits per year, which generally consists of one hour of therapist modeling, one hour of coaching the caregiver while he or she interacts with the child, and one hour of feedback. Parents are then encouraged to deliver approximately 15 hours per week of

one on one interaction with their child (Solomon et al., 2007). The format of the home consultation program is flexible, highly individualized, and based on the needs of the child at the time of each session. Videotaped play interactions are presented along with written evaluations and feedback, and progress is documented throughout the intervention by both the consultant and family. The sessions are not formatted in a specific order, but are tailored to the needs of each child and family. Parents are first taught P.L.A.Y. Project principles, including the emphasis on affect, following the child's lead, and utilizing their child's interest to encourage play and are then led to apply these to the specific needs of their child. The parents then work with the home consultants to develop a repertoire of activities which are likely to engage their child. This stage is generally followed by parents learning to follow their child's lead in play and read their child's intentions in order to increase reciprocal social interaction (Solomon et al., 2007). Parents are also instructed to utilize basic daily living activities (such as bath-time, meals, and outdoor play) as opportunities to meaningfully interact with their child and continue to develop their relationship. The intervention manual for the P.L.A.Y. Project notes that some children will benefit from ABA intervention at a later time to strengthen specific skills, but suggests that DIR/Floortime techniques better facilitate social and communication skills for both the caregiver and child at early, important stages of development.

Dr. Solomon and his colleagues have conducted two previous analyses of P.L.A.Y. Project outcomes. The initial study consisted of 68 children diagnosed with an ASD who completed the program through the University of Michigan Developmental and Behavioral Pediatrics clinic (Solomon et al., 2007). The Functional Emotional Assessment Scale (FEAS; Greenspan, DiGangi & Wieder, 2001) ratings, provided by blind video tape reviewers, were used as a measure of both caregiver and child progress in this initial study. This analysis indicated that

almost half (45.5%) of children enrolled in P.L.A.Y. made "good to very good functional developmental gains" (Solomon et al., p. 219) and indicated a 90% satisfaction rate with the Home Consultation program. However, the lack of any control group was a significant limitation in this study, and improvements made were also correlated with greater amounts of parent-child interaction, suggesting that effects may have simply been due to increased interaction not contingent on specific skills learned through P.LA.Y. Secondly, a four-site, National Institute of Mental Health (NIMH) SBIR Grant Phase I study was conducted in order to assess feasibility for a long term (Phase II, currently underway) assessment of P.L.A.Y. This study used four Easter Seals Disability Services sites, including two comparison sites (Youngstown, OH and Joliet, IL) and two intervention sites (Peoria, IL and Saginaw, MI) in conjunction with the Ann Arbor Center for Developmental and Behavioral Pediatrics. This study utilized a brief (five month) P.L.A.Y. trial in order to gain pre- and post-data regarding caregiver and child behavior. The final sample for this study included 38 children, 20 enrolled in P.L.A.Y. and 18 in the comparison group. In regards to parent behaviors, no significant outcomes were detected on the FEAS, which was expected due to the short duration of the study. However, parent behaviors coded on the FEAS did show a trend in the positive direction in a variety of outcome measures including self-regulation, two-way communication, complex behavior organization, and symbolic representation. Child outcomes were not found to be statistically significant, but similarly showed positive trends in self-regulation, two-way communication, and total score on the FEAS. Children enrolled in The P.L.A.Y. Project did show a significant increase in expressive language skills compared to the control group, as determined by the Mullen Scales of Early Learning, and demonstrated both a significant increase in their personal living skills and decrease in maladaptive behavior as measured by the Vineland Adaptive

Behavior Scales. In summary, joint attention can be defined as the triadic relationship between the self, other, and an object or event of interest (Naber et al., 2007). Joint attention behaviors are an important developmental phenomenon which serve as an early foundation for the development of social and communicative skills in children (Van Hecke et al., 2007). Children with autism spectrum disorders show significant deficits in their ability to respond to and initiate joint attention, deficits which have been conceptualized as either cognitive (Baron-Cohen, 1989) or affective (Hobson, 1993) in nature. A variety of early, intensive interventions for children with ASD are available, but to determine the relative effectiveness of these interventions it is necessary to better understand the success of each in targeting skills such as joint attention which appear to play a large part in a child's overall developmental trajectory. The P.L.A.Y. Project (Solomon, 2007) is based on the DIR model of intervention and emphasizes the child's ability to direct play along with the caregiver serving as the child's therapist. These components are believed to be germane to joint attention development.

Hypotheses

The specific aims of this study were to gain a better understanding of the phenomenon of joint attention's developmental trajectory in children with ASD and to determine if and how caregiver and child participation in a DIR-based caregiver intervention (The P.L.A.Y. Project) affected this process. Furthermore, this study attempted to explore whether improvement in specific caregiver social behaviors germane to the development of joint attention would be associated with, and even predictive of, child gains made following five months of P.L.A.Y. Project intervention. It was hypothesized that: 1) Episodes of joint engagement between caregivers and children would increase in frequency and/or duration following five months of P.L.A.Y. Project intervention. 2) Caregivers would demonstrate an increase in their overall

allowance of their child's "directedness," as measured by the percentage in which the caregiver followed their child's lead in initiating and ending joint engagement interactions, after five months of P.L.A.Y. intervention. 3) Caregivers would demonstrate an increase in the frequency of scaffolding joint attention behaviors such as showing, pointing, and demonstrating, as determined by an aggregate measure of overall caregiver joint attention, a summary of these components, after five months of P.L.A.Y. 4) Children with ASD would increase their frequency of alternating gaze, making eye contact, pointing, and showing, as determine by an aggregate measure of overall child joint attention, a summary of these components, following five months of P.L.A.Y. 5) An increase in caregiver joint attention behavior frequency (as determined by the change in "Caregiver Joint Attention" summary variable described earlier) from T1 to T2 would be predictive of greater positive change in child joint attention behaviors from T1 to T2 (in aggregate). All of these hypotheses were also examined in light of whether changes exhibited by children and caregivers in P.L.A.Y. differed significantly from a comparison group of children and caregivers.

Method

Participants

To allow for analysis of study hypotheses, Dr. Solomon allowed the current investigator access to video tapes used for his four-site, Phase I study of The P.L.A.Y. Project. This included participants from two sites where families were enrolled in five months of P.L.A.Y. intervention (Peoria, Illinois and Saginaw, MI), and two sites where families were enrolled in a variety of community services (Joliet, IL and Youngstown, OH). The time frames are referred to throughout this paper as "Time 1," before intervention began, and "Time 2", after the five-month period had been completed. It is important to note that the "Time 2" assessment referred to in

this study thus refers to only a five-month period of P.L.A.Y. Project intervention, less than half than the minimum of one year that is recommended by P.L.A.Y. Project developers.

The final sample meeting inclusion criteria for statistical analysis in this study consisted of 32 child-caregiver dyads, 14 of whom were enrolled in the P.L.A.Y. Project and 18 in the community standard control group. Six children (all from the P.L.A.Y. sample) were excluded from analysis due to not meeting criteria for joint engagement bouts, three of whom were not engaged in five-minute period of interaction within both the pre- or post- session and three of whom did not have a pre- and/or post- video available for analysis. The children meeting criteria for inclusion in this study included 26 males and six females ranging from 26-months to 68-months of age, with a mean intake age of 47.90 months (*SD* = 13.51). The average age at the time of initial diagnosis for these children was 31.75 months (*SD* = 7.81), and the majority had reported receiving this diagnosis from a pediatrician (N = 12), neurologist (N = 8), or psychologist (N = 5; See Table 1). The child's biological mother was identified as the primary caregiver (and thus coded in the interactions) in 29 of the 32 cases included in analysis, with two biological fathers and one adoptive mother also included. Caregiver age was acquired at three of four sites included in the study, from which the mean maternal age was 34.82 (*SD = 6.08*) and the mean paternal age was 38.10 (*SD* = 7.91). The families enrolled in this study were predominantly Caucasian and had significant variance in household income (See Table 2).

P.L.A.Y. Project and control participants did not differ significantly on categorical demographic characteristics such as gender, race, or income. A significant difference in maternal age between the P.L.A.Y. (M = 37.29 years, *SD* = 5.50) and control group (M = 30.25, *SD* = 4.60), $t(20) = 3.198$, $p = .005$, existed, though this analysis was limited by the lack of age data from one of the comparison control sites. The P.L.A.Y. group also had a moderately significant

higher mean diagnosis age (M = 34.71, *SD* = 8.32*)* than the control group (M = 29.44, *SD* = 6.74), t (30) = 1.981, *p* = .057. No demographic differences were included as covariates in further analysis (See Table 3).

Procedure

Videos were viewed in a locked, secured office in short increments to ensure accurate coding, and data was tracked real time while viewing the caregiver-child interaction. Five minute segments from each pre- and post- therapy video were selected by viewing the video and selecting the first five minutes in which the caregiver and child were continuously in the same room and presented with activities to engage in. Following the selection of this five-minute segment, the videos were viewed and coded according to the Caregiver-Child Joint Engagement Interaction system described below (CCJEI; Vaughan et al., 2003). Selection of the five minute clip was recorded by time to ensure accuracy for inter-rater reliability coding, and tapes were excluded from analysis if a) there was more than one caregiver present, b) there was more than one child present, or c) there was not a period of five-minute continuous interaction available throughout the recorded portion of the caregiver-child interaction. The primary investigator viewed and coded all of the videos provided from Dr. Solomon's Phase I study. An undergraduate assistant was trained in the CCJEI coding system to assess inter-rater reliability and assure that the primary investigator's ratings were consistent with operational definitions provided within the CCJEI coding scheme. Due to time constraints regarding the length of time these videos could be held at Marquette University, the undergraduate assistant viewed two videos from each "site" included in the study for both the pre- and post-intervention trials, for a total of 16 videos viewed (eight from the P.L.A.Y. sample and eight from the control group). Inter-rater reliability for continuous variables of interest was then assessed through intra-class

correlation coefficient (ICC values). These reliability values allow for an evaluation of agreement, rather than simply consistency, of ratings between raters, and thus best provided an accurate assessment of overall rating reliability. Absolute agreement Intraclass Correlation Coefficient (ICC) values for the sum joint attention variables were very good (Child JA ICC = .911; Caregiver JA ICC = .898). Component joint attention variable ICC values were more varied and ranged from .561 to .928. See Table 4 for complete a complete list of ICC values for joint attention component and summary variables.

Measures

Caregiver-Child Joint Engagement Interaction.

Caregiver and child interactions were coded using a system developed by Dr. Peter Mundy and cited in Vaughan et al. (2003) based on the schemes of Bakeman and Adamson (1984) and Tomasello and Farrar (1986). The Caregiver-Child Joint Engagement Interaction system (CCJEI) codes periods of time in which the caregiver and child are visually focused on the same object or activity for a minimum of three seconds and in which the faces of both are at least partly visible throughout the interaction. The interactions are assessed for both frequency and duration, and the end of the episode is also assessed qualitatively to gain an understanding of what the child or caregiver does following the period of joint engagement. The child's behavior is then coded with Active Child Bouts representing the percentage of bouts in which the child is physically engaged in the activity with the caregiver. These interactions include child IJA variables including child alternates (child alternates looking between an active object spectacle and the caregiver's eyes, with at least one full alternation made, e.g. object-caregiver-object), child makes eye contact (child makes eye contact while manipulating or touching a toy or object), child shows (child moves an object to orient it towards caregiver's face), child points

(child uses index finger to direct caregiver's attention to object or event), and child gives (child gives a toy or object to a caregiver for purposes of "sharing" rather than requesting). These child variables were summed to create a summary variable denoted as "Child Joint Attention." Joint engagement episodes also were coded for caregiver variables, including caregiver shows (caregiver moves an object to orient it toward the child's face), caregiver points (caregiver uses his or her index finger to direct child's attention to an object or event), and caregiver demonstrates (caregiver using a toy in conventional fashion or combining toys). Similarly, caregiver joint attention variables were summed to create an overall measure of "Caregiver Joint Attention." Caregivers were rated on the number of verbalizations made in each bout. The caregiver showing, pointing, and demonstrating variables sometimes occurred simultaneously within some episodes of joint engagement and were coded concurrently if this occured. Caregivers also were coded on whether they initiated the play sequence (caregiver directs) or followed the child's lead and line of attention (caregiver following), which were coded as mutually exclusive variables for each joint engagement bout. The interaction was also coded based on whether the caregiver or child directed the end of the play sequence. These two variables (initiation and ending of the play sequence) were averaged to create an overall assessment of child "directedness." Directedness was contingent on the number of joint engagement bouts in each five-minute selection, and thus is a proportion of all bouts where the child initiated and/or ended the interaction. The CCJEI is based upon the strong conceptual underpinnings of joint attention (i.e. Bakeman & Adamson, 1984; Mundy, Hogan, and Doehring, 1996) that are the most widely cited in early and more recent literature related to this construct. Thus, the CCJEI was seen as the best instrument to evaluate this study's hypotheses in a specific and parsimonious manner.

Results

A total of 32 caregiver-child dyads met inclusion criteria for both Time 1/Time 2 analyses (14 in the P.L.A.Y. group and 18 in the comparison control group.) Data were analyzed using SPSS version 17.0.

Bout Frequency, Duration, and Directedness

To test hypothesis 1, two mixed between-within 2 (P.L.A.Y./control) x 2 (Time 1/Time 2) subjects analyses of variance (ANOVA) were conducted to determine whether episodes of joint engagement between caregivers and children increased in frequency and/or duration following five months of P.L.A.Y. Project intervention in comparison to a control group (Hypothesis 1). Dependent variables included in these analyses included bout frequency and duration (See Table 5 for a review of joint engagement bout statistics across time and group). There was no significant interaction between groups (P.L.A.Y. and control) and time (Time 1 and Time 2) for bout frequency, Wilks Lambda = .98, F (1, 30) = .53, p = .47, partial eta squared = .02. There also was not a significant main effect found regarding bout frequency for time (Wilks Lambda = .98, F (1, 30) = .53, p = .47, partial eta squared = .02). The main effect comparing the P.L.A.Y. Project and control group also was not significant, F (1, 30) = .86, p = .36, partial eta squared = .03. There was no significant interaction between groups and time for bout duration, Wilks Lambda = .95, F (1, 30) = 1.57, p = .22, partial eta squared = .05. There also was not a significant main effect found regarding bout duration between Time 1 and Time 2 (Wilks Lambda = 1.00, F (1, 30) = .12, p = .73, partial eta squared < .01). The main effect comparing the P.L.A.Y. Project and control group also was not significant, F (1, 30) = 2.73, p = .11, partial eta squared = .08.

In order to test hypothesis 2, a mixed between-within 2 (P.L.A.Y./control) x 2 (Time

1/Time 2) subjects ANOVA was conducted to determine whether caregivers more frequently followed their child's lead in initiating and ending joint engagement interactions following 5 months of P.L.A.Y. Project intervention in comparison to a control group. The dependent variable in this analysis was a summary variable created to assess the child both initiating and ending the play sequence, termed "directedness." There was no significant interaction between groups and time for child directedness, Wilks Lambda = .96, F (1, 30) = 1.13, p = .30, partial eta squared = .04. There was a significant main effect found for time, Wilks Lambda = .709, F (1, 30) = 12.31, p = .001, partial eta squared = .29. This indicated that there was a significant increase in Directedness from T1 to T2, collapsing across groups (Time 1 M = 48%, Time 2 M = 70%). The main effect comparing the P.L.A.Y. Project and control group was not significant, F (1, 30) = 3.46, p = .07, partial eta squared = .10 (See Table 6).

Caregiver Joint Attention

To test hypothesis 3, a mixed between-within 2 (P.L.A.Y./control) x 2 (Time 1/Time 2) subjects analysis of variance was conducted to assess whether caregivers increased their frequency of joint attention behaviors following five months of P.L.A.Y. Project intervention in comparison to a control group (See Table 7 for descriptive statistics). The dependent variable in this analysis was a summary variable of caregiver joint attention created by summing caregiver frequency of pointing, showing, and demonstrating. There was no significant interaction between groups and time for caregiver joint attention, Wilks Lambda = .92, F (1,30) = 2.78, p =.11, partial eta squared = 09. There also was not a significant main effect for time, Wilks Lambda = 1.00, F (1, 30) = .19, p = .67, partial eta squared > .01. The main effect comparing the P.L.A.Y. Project and control group also was not significant, F (1, 30) = .90, p = .35, partial eta squared = .03 (See Table 8).

Child Joint Attention

To test hypothesis 4, a mixed between-within 2 (P.L.A.Y./control) x 2 (Time 1/Time 2) subjects analysis of variance was conducted to assess whether children increased their frequency of joint attention behaviors following five months of P.L.A.Y. Project intervention in comparison to a control group. The dependent variable in this analysis was a summary variable of child joint attention created by summing child gaze alternating, eye contact, pointing, showing, and giving. There was no significant interaction between groups and time for child joint attention, Wilks Lambda = 1.00, F (1, 30) = .10, p = .76, partial eta squared > .01. There was a significant main effect for time, Wilks Lambda = .80, F (1, 30) = 7.57, p = .01, partial eta squared = .20. This finding indicated that, collapsing across groups, children increased their frequency of joint attention behaviors from Time 1 to Time 2 (Time 1 M = 3.65, Time 2 M = 6.39). The main effect comparing the P.L.A.Y. Project and control group also was significant, F (1, 30) = 4.92, p = .03, partial eta squared = .14. This finding indicated that, collapsing across time, children in the P.L.A.Y. group showed significantly greater levels of joint attention (M = 6.23) behaviors than children in the control group (M = 3.75; See Table 8).

Child and Caregiver Joint Attention Development

Finally, the relationship between child and caregiver joint attention change was examined to determine whether either greater change in the frequency of caregiver joint attention behaviors from T1 to T2 was associated with positive increases in the frequency of overall child joint attention behaviors. No significant relationships were found at $p < .05$ between change in caregiver joint attention behavior frequency and child joint attention behavior frequency. There was a significant relationship found at $p < .05$ between an increase in caregiver verbalization and child verbalization from T1 to T2 and an increase in child joint attention. However, due to a

lack of correlations found among change in component caregiver and child joint attention variables, it was not feasible to conduct a multiple regression analysis in order to further explore the relationships among these variables (See Table 9).

Discussion

The aims of this study were to gain a better understanding of the phenomenon of the developmental trajectory of joint attention in children with ASD and to determine if and how participation in The P.L.A.Y. Project affected this process. Videos of children with autism and their caregiver before and after a five-month period of P.L.A.Y. intervention were coded with the CCJEI (Vaughan et al., 2003) and compared with a community standard group of children with autism and their caregivers not receiving P.L.AY. The importance of joint attention development has received increased emphasis in the past few years, as research begins to outline the primary nature of joint attention and its role in other skill deficits seen in autism (Mundy et al., 2009). As estimates of the incidence of autism continue to rise, it is important not only to understand deficits in areas such as joint attention, but also to develop comprehensive interventions that target primary deficits at a young age. Furthermore, as diagnoses increase, it becomes imperative to utilize all available resources to provide effective early, intensive interventions. Kim and Mahoney (2004) and Schertz and Odom (2007) noted that caregivers have shown success in learning the skills necessary to promote joint attention development, but emphasized that this is best accomplished through naturalistic forms of joint engagement intervention rather than through discrete trial methods. It is therefore important to understand a parent-mediated intervention's success not only by the long-term development of the child but also by the more immediate changes brought about in the caregiver's responsiveness and scaffolding of the child's skills. Research suggests that these aforementioned caregiver qualities

are associated with increased levels of response to, and later initiation of, joint attention in children with autism (Siller & Sigman, 2002).

The P.L.A.Y. Project builds off of the Developmental, Individualized, and Relationship-oriented (DIR) model (Greenspan & Weider, 1999) that closely corresponds to the suggested framework for developing joint attention (Kim & Mahoney, 2004). Through the Home Consultation program, P.L.A.Y. aims to teach parents practical, naturalistic ways to interact with their children with ASD's in a way which benefits both the caregiver-child relationship as well as the child's overall social-emotional abilities. The P.L.A.Y. Project emphasizes following the child's lead in play, utilizing high levels of parental affect, and maintaining flexibility to deliver intensive, caregiver-directed intervention. Through guiding children in a strategic yet naturalistic manner, P.L.A.Y. strives to increase generalization of social, emotional, relational, and language skills. This study sought to determine how effective The P.L.A.Y. Project was within the more narrow domain of joint attention, which appears to be an important early skill necessary for broader and more complex abilities (Leekam, 2005; Naber et al., 2007).

It was hypothesized that caregivers and children receiving five months of P.L.A.Y. intervention would increase the frequency and/or duration of joint engagement bouts in comparison to a community standard control group. Results indicated that a significant interaction effect did not exist between group and time for bout frequency or duration. Significant main effects were not found for group or time with regards to frequency or duration, though the group difference in duration showed a small trend toward significance. The likelihood of finding significant differences in this domain was likely limited by the brief (five-minute) period of interaction that was coded for this investigation. According to Dr. Solomon's original pilot data, caregivers spent approximately 14.1 *(SD = 4.9)* hours per week engaged in

P.L.A.Y.-based interactions with their children, and a more comprehensive analysis would be needed to understand if these frequency and/or duration of play, along with joint engagement, changed over time However, it appears that The P.L.A.Y. Project was not significantly different from the control group in terms of joint engagement bout frequency and duration in the context of this study.

It also was hypothesized that dyads receiving P.L.A.Y. Project intervention would increase their frequency of child directedness between T1 and T2. Results suggested that there was not a significant interaction between group and time in directedness, nor was there a significant main effect found for time. However, a significant main effect was found for group, with caregivers in the P.L.A.Y. group allowing greater child directedness than those in the control group. This significant finding is extraordinarily important, not only because child directedness is a central tenant of P.L.A.Y. (Solomon, 2007), but also because it appears to be a crucial factor in developing child joint attention. Lewy and Dawson (1992) suggested that children who were allowed to play with preferred items and engage in varied activities would be significantly more motivated to engage in joint attention behaviors with their caregiver. The natural consequences, both behavioral and affective, should be more reinforcing to a child who is able to exert more direction over their interaction with their caregiver (Jones & Carr, 2004). An increase in positive reinforcement to the child should facilitate extended greater emotional connectedness between the child and caregiver, which, in line with Hobson's (1993) model, would lead to an increase in joint attention.

The next hypotheses were that caregiver and child joint attention behaviors would increase in frequency after five months of P.L.A.Y. intervention in comparison to a control group. Results suggested that there was not a significant interaction between group and time for caregiver joint

attention, nor was there a significant main effect found for either time or group. Also, a significant interaction was not found for child joint attention behaviors. However, there were significant main effects for both group and time, suggesting a significantly higher frequency of joint attention behaviors by children in the P.L.A.Y. group and a significant increase in joint attention across groups over time. The direction of the difference between groups was unexpected, as Dr. Solomon had indicated that the control group was "higher functioning." However, this result may have been explained by exclusion of three P.L.A.Y. participants who appeared lower functioning and whose behavior was not sufficient to meet criteria for CCJEI coding. The significant effect over time suggests that while children with autism may not demonstrate joint attention behaviors as early and/or as frequently as typically developing children, these behaviors still develop over time. Charman (1998) suggested that differences in joint attention may be most obvious during the first five years of life, which should have included almost all of the children involved in this analysis, which had a mean age of just under four years. However, even if these children eventually "catch up" with regards to joint attention development, it is possible that early deficits can still lead to significant social delays (Sullivan et al., 2007). It is important to note that P.L.A.Y. did not appear to be singularly crucial to the development of joint attention in this study.

Finally, it was hypothesized that increases in caregiver joint attention would correlate with and significantly contribute to gains in child joint attention. Correlational analyses did not report any significant correlations between changes in caregiver joint attention frequency and child joint attention frequency, likely due in part to small sample size and the short duration of the intervention. The relationship between specific caregiver and child joint attention variables remains an area to be further explored in future studies. As noted earlier, Mundy's ESCS (2003)

joint attention denotes both low- and high-level child joint attention behaviors, and this distinction may hold true for caregivers, as well. It seems important to understand if certain caregiver behaviors are most effective in the scaffolding of child behavior and more likely to lead to gains in child joint attention behavior. A significant relationship was found between an increase in both child and caregiver verbalizations and an increase in child joint attention. A relationship between child increase in verbalizations and child joint attention reflects both an overall increase in adaptive functioning, as well as the relationship between joint attention development and improvement in spontaneous speech and verbal abilities that has been documented in several previous studies (Bono et al., 2004; Colombi et al., 2009; Kasari et al., 2008; Murray et al., 2008; Tomasello & Farrar, 1986; Whalen et al., 2006). The association between change in caregiver verbalizations and change in child joint attention may be related to parental increase in responsiveness within the dyadic interactions, which is suggested to be a necessary component of building joint attention (Kim & Mahoney, 2004). Future studies could focus more specifically on the quality and quantity of caregiver verbalization as a scaffolding behavior.

Despite limitations in intervention duration and sample size, this analysis also allowed for an extensive concurrent qualitative analysis of joint attention and its nature within autism spectrum disorders. Furthermore, the investigation shed light on important factors to be considered for future coding and analysis of joint engagement and joint attention. One noticeable difference evident in viewing children with autism interacting with their caregivers was the subtle but significant difference between deficits in joint attention and the inattention characteristic in Attention-Deficit/Hyperactivity Disorder (ADHD), a disorder commonly comorbid with ASD. There were numerous instances of sustained child attention to an activity with their caregiver,

which in this study met criteria for joint engagement, and these interactions were notably free of distractibility or outside interference. In fact, many children sustained bouts of attention to an object of interest for the entire five minute period of analysis. To an untrained observer, these interactions may have seemed completely typical in nature, but specific assessment of joint attention demonstrated the lack of reciprocal play behavior and overall social enjoyment and social engagement within the framework of the activity. Among a multitude of factors that seemed to affect this dynamic was the caregiver's physical orientation in relation to their child. Several caregivers played with their child seated on their lap and facing the object or activity of interest, which allowed for shared observation of the event or object but diminished the chance of eye contact, affect sharing, and nonverbal cues that provide social reinforcement within play-based interactions (Whalen & Schreibman, 2003). This setup also likely diminished the opportunity for the child to respond to joint attention, which Van Hecke et al. (2007) noted is an important precursor to learning the behavioral skills necessary for proper initiation of joint attention. A decrease in response from the child throughout the interaction also noticeably affected feedback from caregivers, many of whom spoke, demonstrated, or pointed during play without first assessing and then obtaining their child's attention. The result was play that reflected young children's "parallel play," in which persons are involved with the same overt activity but in which the interactions are devoid of sufficient social orienting (Dawson et al., 2004). The lack of caregiver coordination of joint attention behaviors may have been due in part to the contrived play situation in the research setting, but seemed representative of the negative effect that disengaged child behavior can have on caregiver engagement, affect, and responsiveness (Kim & Mahoney, 2004; Zwaigenbaum et al., 2005), especially when this is continually problematic throughout development.

The importance of caregivers coordinating simultaneous joint attention behaviors became evident when observing the interactions and was a limitation of the coding scheme employed in this study. Learning theory dictates that spatial and temporal factors are necessary for associative learning, and these features appear to hold importance in social learning. A caregiver who points to an object while the child is not making eye contact or otherwise attending, for example, could be coded as utilizing a behavior consistent with joint attention development, though it may have not been noticed by the child. Joint attention behaviors are interdependent, and intrinsically require behavioral (and often cognitive and/or affective) involvement from the caregiver and child. Thus, a temporal coding scheme that allowed for assessment of joint attention behaviors as they occurred over time would provide enhanced perspective on what combinations of caregiver and child behaviors best promote development of joint attention. A variety of child behavior assessment instruments use time increment based behavior sampling that could be adapted into a coding scheme to capture and analyze the integration of caregiver and child joint attention behavior in real time. Furthermore, the inclusion of affect-related variables would provide better understand of emotional factors which likely mediate the relationship between caregiver and child joint attention behavior (Schertz & Odom, 2004). The P.L.A.Y. Project's emphasis on affective involvement would also benefit from assessment that was not purely behavioral, such that highly structured and non-social activities would not be considered as beneficial in terms of joint attention development. Finally, a coding scheme that included more child RJA behaviors may have better captured the interactive and interdependent nature of joint attention.

In line with P.L.A.Y. Project principles, it would also be beneficial to develop a more comprehensive assessment of "child-directedness" that is present in a caregiver/child interaction.

This study utilized start and end codes by determining who began each joint engagement activity and who was responsible for the end of the play activity. More direct comparison to typically developing populations would have been necessary to determine if there were optimal lengths of time for joint engagement bouts that would be maximally beneficial for development of joint attention. Furthermore, the extent to which choosing an activity (or choosing to end it) truly represents child directedness is debatable and may be more dependent on a child's age, developmental level, and overall adaptive functioning. It may be more important for caregivers to utilize scaffolding techniques originally described by Adamson and Bakeman (1985) as a means to incorporate productive learning opportunities into an activity that is not only chosen but also predominantly directed by the child. For a lower functioning child, this now may even necessitate the caregiver selecting the toy and beginning a play sequence that he or she believes to be preferable and reinforcing to the child, before giving way and allowing the child to lead. More elaborate coding schemes could be utilized to capture this crucial component of The P.L.A.Y. Project and other child-directed therapy modalities that are gaining in popularity (Jones & Carr, 2004). Another limitation of this analysis concerning child directedness was the use of a standard set of toys between three of the four sites' caregiver-child dyads. While this allowed for some degree of standardization across subjects within each Easter Seals site, it also resulted in children being presented with unfamiliar toys within an unfamiliar context, which may have inhibited their ability and/or interest in directing play, as children with autism typically demonstrate an initial aversion to "unfamiliar" people or objects (Adamson, Decker, & Bakeman, 2010; Van Hecke et al., 2007).

Limitations of this study imposed by the original project's design included the lack of a non-autism control group and limited information about each child's diagnosis, both in terms of

severity as well as comorbidity. A typically developing control group would have provided a more comprehensive view of joint attention development in early childhood and would have also allowed for a greater understanding of how caregivers who received positive social feedback from their children differed in play behavior. Future studies may even assess how caregivers of typically developing children interact with children with autism, and inversely how caregivers of children with autism play with typically developing children. More simply, it would be beneficial to understand how birth order, sibling diagnoses, and number of typically developing siblings or siblings with autism affect parenting sense of competency and effective play behavior. A better understanding of each child's autism diagnosis (e.g. categorical criteria ratings on the Autism Diagnostic Observation Schedule) could provide more insight into the strengths and limitations of P.L.A.Y. for children with different abilities and difficulties. Increased knowledge of categorical rating (e.g., social and communicative deficits vs. restricted, repetitive, or stereotyped interests and behaviors) could have allowed for inclusion of pronounced social deficits as a covariate if found to significantly impede a child's proclivity for developing joint attention skills. Furthermore, the lack of data concerning comorbid diagnoses or other health issues somewhat limits the generalizability of this analysis within the autism population.

Strengths of this study include the use of the CCJEI coding scheme that allowed for a thorough and focused attention of joint attention that captured individual components of joint attention for both children and caregivers. The parsimony of the coding also allowed for exceptional inter-rater reliability for the sum variables, as coding was limited to a few, clearly defined behaviors. However, the CCJEI also has not previously been used in the ASD population, and therefore the appropriateness of this measure has not been established. It could

be that the sensitivity of a joint attention measure for children with ASD may need to be greater in order to measure even subtle attempts at joint attention, which could be less important when studying typically developing children. The distinction made in this study between "joint engagement" and "joint attention" was also important, as it allowed for a distinction between times when the caregiver and child were attending to the same activity or event (joint engagement) and when there was a cognitive and/or affective acknowledgment between the two reflected in mutual understanding and enjoyment (joint attention). The community standard control group offered a reasonable comparison for The P.L.A.Y. Project, assuring that children were receiving some sort of intervention but allowing for the different principles of P.L.A.Y. to take effect over time. Also, through each family's voluntary involvement with an Easter Seals organization, there was limited concern that motivation for improvement or effort invested in therapy was an intervening variable. Finally, the limited number and strong experience of home consultants used in the study allowed for consistency in therapeutic delivery and ensured that P.L.A.Y. principles were adequately presented to families receiving intervention, with sufficient fidelity.

In summation, this investigation provided insight into the benefits of The P.L.A.Y. Project and analysis of previous literature provides strong support for this intervention's ability to improve social and communicative skills in children with autism spectrum disorders. However, as P.L.A.Y. did not distinguish itself from the control group with regards to the hypotheses in this study, it could be that any services are beneficial to children – that the importance lies primarily in receiving some sort of intervention. This investigation also provided insight into the nature of joint attention development and highlighted the complexity of developing joint attention, which is intrinsically dependent on both caregiver and child behavior. While the brief

intervention time frame and small sample size limited statistical power as well as external validity, the thorough analysis of joint attention development allowed for enhanced understanding of this complex phenomena and the need for precise, temporally moderated techniques in order to better understand how joint attention deficits affect individuals with autism spectrum disorders and the way in which their caregivers interact with them. As diagnostic rates of autism spectrum disorders continue to increase, and funding for intervention becomes increasingly limited, it is imperative to identify primary deficits that can be targeted early and with intensive intervention. This investigation lends credence to joint attention as such a foundational skill, as well as to the suitability of individualized, child-directed, relationship oriented approaches such as The P.L.A.Y. Project in targeting deficits in this domain.

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Index

Table 1. Child Demographic Statistics

	Mean	SD	Range	N	%
Gender					
Male				26	81.2
Female				6	18.8
Age at Diagnosis (months)	31.75	7.80	18.00 – 48.00		
Age at Intake (months)	47.90	13.51	26.50 – 68.70		
Diagnosis Source					
Pediatrician				10	31.2
Neurologist				7	21.9
Psychologist				4	12.5
Enrollment GARS				4	12.5
Early Intervention Program				3	9.4
Psychiatrist				2	6.2
School				2	6.2
Primary Caregiver					
Biological Mother				29	90.6
Biological Father				2	6.2
Adoptive Mother				1	3.1

Table 2. Caregiver and Family Demographic Characteristics

	Mean	SD	Range	N	%
Maternal Age (years)	34.82	6.08	25 – 50		
Paternal Age (years)	38.10	7.91	25 – 58		
Number of Siblings	1.09	.89	0 - 3		
Maternal Race					
Caucasian				24	75.0
Black/African American				1	3.1
Asian				1	3.1
Not Provided				6	18.8
Paternal Race					
Caucasian				22	68.8
Black/African American				1	3.1
Not Provided				9	28.1
Maternal Hispanic Ethnicity					
Yes				3	9.4
No				28	87.5
Not Provided				1	3.1
Paternal Hispanic Ethnicity					
Yes				2	6.2
No				26	81.2
Not Provided				4	12.5
Income					
Less than $20k/year				4	12.5
$20k to $40k/year				6	18.8
$40k to $60k/year				6	18.8
$60k to $100k/year				11	34.4
More than $100k/year				5	15.6

Table 3. Selected P.L.A.Y. & Control Demographic Comparison

	Mean	SD	N
Gender			
P.L.A.Y.			
Male			10
Female			4
Control			
Male			16
Female			2
Age at Intake (months)			
P.L.A.Y.	48.96	12.95	
Control	47.02	14.29	
Age at Diagnosis (months)			
P.L.A.Y.	34.71	8.32	
Control	29.44	6.74	
Maternal Age (years)*			
P.L.A.Y.	37.43	5.31	
Control	30.25	4.56	
Paternal Age (years)			
P.L.A.Y.	38.64	7.69	
Control	37.00	8.85	
Income			
P.L.A.Y.			
Less than $20k/year			1
$20k to $40k/year			2
$40k to $60k/year			4
$60k to $100k/year			5
More than $100k/year			2
Control			
Less than $20k/year			3
$20k to $40k/year			4
$40k to $60k/year			2
$60k to $100k/year			6
More than $100k/year			3

* = *Significant difference between groups at $p < .05$*

Table 4. Intraclass Correlation Coefficients (ICC) among Joint Attention Variables (Absolute Agreement, Average Measures) among randomly selected sample (N = 16)

Variable	ICC
Child JA	.911
Child Alternating Gaze	.581
Child Eye Contact	.928
Child Pointing	.879
Child Showing	.615
Child Giving	.561
Child Verbalization	.868
Caregiver JA	.898
Caregiver Showing	.847
Caregiver Pointing	.865
Caregiver Demonstrating	.685
Caregiver Verbalization	.814

Table 5. Means and Standard Deviations of Joint Engagement Bouts (N = 32)

	P.L.A.Y. (N = 14)		Control (N = 18)	
	Time 1	Time 2	Time 1	Time 2
Total Bouts	3.71 *(2.55*)	3.71 *(2.05)*	4.00 *(1.68)*	4.61 *(2.25)*
Total Time (sec)	257.64 *(34.77)*	247.36 *(37.94)*	229.44 *(63.92)*	221.00 *(63.74)*
Avg. Duration (sec)	132.21 *(114.62)*	104.16 *(86.40)*	68.05 *(38.22)*	83.86 *(97.40)*
% Engaged	85.88 *(11.58)*	82.45 *(12.65)*	76.48 *(21.31)*	73.67 *(21.25)*
% Child Start	40.28 (36.99)	73.42 *(29.70)*	32.18 *(30.99)*	52.31 *(39.31)*
% Child End	62.76 *(34.16)*	85.29 *(24.05)*	57.86 *(27.20)*	67.53 *(33.74)*
Directedness	51.52 *(30.38)*	79.35 *(15.57)*	45.02 *(23.03)*	59.92 *(30.96)*
% Child Active	95.16 *(8.19)*	90.94 *(14.12)*	86.92 *(17.12)*	81.87 *(24.71)*
% Caregiver Active	91.59 (*19.95)*	85.87 *(16.26)*	89.17 *(21.42)*	81.71 *(27.11)*

Table 6. Mixed 2x2 between-within subjects ANOVA for Joint Engagement Bouts

Source	df	F	η	p
Bout Frequency				
	Between Subjects			
Intervention (PLAY/Comp)	1	.86	.03	.36
Intervention Within Group Error	30	(6.40)		
	Within Subjects			
Time (Time 1/Time 2)	1	.54	.02	.47
Intervention*Time	1	.54	.02	.47
Intervention*Time Within Group Error	30	(2.74)		
Bout Duration				
	Between Subjects			
Intervention (PLAY/Comp)	1	2.73	.08	.11
Intervention Within Group Error	30	(10305.73)		
	Within Subjects			
Time (Time 1/Time 2)	1	.12	.004	.73
Intervention*Time	1	1.57	.05	.22
Intervention*Time Within Group Error	30	(4825.74)		
Directedness				
	Between Subjects			
Intervention (PLAY/Comp)	1	3.46	.10	.07
Intervention Within Group Error	30	(.08)		
	Within Subjects			
Time (Time 1/Time 2)	1	12.31	.29	.001**
Intervention*Time	1	1.13	.04	.30
Intervention*Time Within Group Error	30	(.06)		

Note. Values enclosed in parentheses represent mean square errors.
*p < .05. **p < .01.

Table 7. Means and Standard Deviations of Joint Attention Behaviors (N = 32)

	P.L.A.Y. (N=14)		Control (N = 18)	
	Time 1	Time 2	Time 1	Time 2
Child Alternating Gaze	.50 (*.94)*	1.29 *(1.27)*	.11 *(.32)*	.39 *(.77)*
Child Eye Contact	2.93 *(3.47)*	2.93 *(3.75)*	1.50 *(1.82)*	1.83 *(1.69)*
Child Pointing	.64 (*1.08)*	.71 (*.82)*	.05 *(.24)*	.44 *(.92)*
Child Showing	.57 *(.85)*	1.86 *(2.03)*	.33 *(.69)*	1.61 *(1.91)*
Child Giving	.43 *(.85)*	.71 *(.91)*	.22 *(.55)*	1.00 *(1.37)*
(Child Verbalization)	7.14 *(2.80)*	6.36 *(3.48)*	4.28 (*3.37)*	5.67 *(4.13)*
Child Joint Attention	**5.07** ***(5.54)***	**7.50** ***(4.65)***	**2.22** ***(2.18)***	**5.28** ***(4.38)***
Caregiver Showing	4.14 *(2.07)*	3.00 *(2.07)*	5.50 (*3.20)*	4.06 *(2.86)*
Caregiver Pointing	1.00 *(1.66)*	1.86 (*2.14)*	2.28 *(1.78)*	1.83 *(2.20)*
Caregiver Demonstrating	3.29 (2.70)	4.71 *(1.68)*	3.39 *(2.52)*	3.33 *(2.35)*
(Caregiver Verbalization)	11.50 *(2.98)*	9.21 *(3.14)*	9.82 *(3.86)*	8.39 *(3.15)*
Caregiver Joint Attention	**8.43** ***(2.71)***	**9.57** ***(3.88)***	**11.16 (*5.43)***	**9.22** ***(4.62)***

Note. Bold type indicates summary variable

Note. Parentheses indicate component variable not calculated as part of summary variable

Table 8. Mixed 2x2 between-within subjects ANOVA for Joint Attention Behaviors

Source	df	F	η	p
Caregiver Joint Attention				
	Between Subjects			
Intervention (PLAY/Comp)	1	.90	.03	.35
Intervention Within Group Error	30	(24.97)		
	Within Subjects			
Time (Time 1/Time 2)	1	.19	.006	.67
Intervention*Time	1	2.78	.09	.11
Intervention*Time Within Group Error	30	(13.51)		
Child Joint Attention				
	Between Subjects			
Intervention (PLAY/Comp)	1	4.92*	.14	.03
Intervention Within Group Error	30	(20.60)		
	Within Subjects			
Time (Time 1/Time 2)	1	7.57**	.20	.01
Intervention*Time	1	1.00	.003	.76
Intervention*Time Within Group Error	30	(15.64)		

Note. Values enclosed in parentheses represent mean square errors.
*p < .05. **p < .01.

Table 9. Pearson's Correlations among Individual and Summary Joint Attention and Bout Variable Change from Time 1 to Time 2

	Child Joint Attention	Caregiver Joint Attention
Child Joint Attention	--	.04
Bouts	.36*	.26
Average Duration	-.12	-.04
Directedness	.26	.04
Child Alternating Gaze	.36*	-.11
Child Eye Contact	.85**	-.05
Child Points	.53**	.11
Child Shows	.33	.19
Child Gives	.63**	.01
Child Verbalization	.55**	-.06
Caregiver Shows	-.14	.72**
Caregiver Points	-.10	.48**
Caregiver Demonstrates	.28	.63**
Caregiver Verbalization	.35*	.21

* Significant at $p < .05$

** Significant at $p < .01$

Note.

Child Joint Attention = Change in Child Joint Attention from Time 1 to Time 2

Caregiver Joint Attention = Change in Caregiver Joint Attention from Time 1 to Time 2

Bouts = Change in joint engagement bout frequency from Time 1 to Time 2

Average Duration = Change in average joint engagement bout duration from Time 1 to Time 2

Directedness = Change in child directedness percentage from Time 1 to Time 2

Child Alternating Gaze = Change in child alternating frequency from Time 1 to Time 2

Child Eye Contact = Change in child eye contact frequency from Time 1 to Time 2

Child Points = Change in child pointing frequency from Time 1 to Time 2

Child Shows = Change in child showing frequency from Time 1 to Time 2

Child Gives = Change in child giving frequency from Time 1 to Time 2

Child Verbalization = Change in child verbalization frequency from Time 1 to Time 2

Caregiver Shows = Change in caregiver showing frequency from Time 1 to Time 2

Caregiver Points = Change in caregiver pointing frequency from Time 1 to Time 2

Caregiver Demonstrates = Change in caregiver demonstrating frequency from Time 1 to Time 2

Caregiver Verbalization = Change in caregiver verbalization frequency from Time 1 to Time 2