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Joint Attention and Children with Autism: A Review of the Literature

Yvonne Bruinsma,* Robert L. Koegel, and Lynn Kern Koegel

Special Education, Developmental Disabilities, and Risk Studies, Graduate School of Education, University of California, at Santa Barbara, Santa Barbara, California

Preverbal communication and joint attention have long been of interest to researchers and practitioners. Both attending to social partners and sharing attentional focus between objects or events and others precede the onset of a child's first lexicon. In addition, these prelinguistic acts also appear to have important implications with regard to learning to socialize. The construct of joint attention has been noted as an early developing area prior to the transition to symbolic communication. Thus, the importance of joint attention in typically developing children, and the lack thereof in children with autism, has interested researchers for use in diagnosis and intervention for autism. That is, joint attention has been gaining momentum as an area that not only helps characterize children with autism, but also as a prognostic indicator and a potential intervention goal. In this paper, the status of the literature about initiation of joint attention by young typically developing children and young children with autism was examined. Empirical studies regarding joint attention behaviors, including eye gaze alternation, the use of protodeclaratives and protoimperatives, and studies that investigated joint attention as a predictor of language acquisition were reviewed. Possible areas for future research for children with autism are discussed.
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Key Words: autism; joint attention; intentional communication

Interest in joint attention in children with autism has greatly increased in the recent literature. However, the term "joint attention" can be a confusing construct, because it often refers to not one, but a cluster of behaviors that share the common goal of communicating with another person about a third entity in a nonverbal way, including eye gaze alternation and gesturing. Although the literature contains a number of different definitions of joint attention, these can be divided into one of two classes: 1) response to joint attention (RJA), which can be defined as a child's *response* to the parent's point or shift in eye gaze, or 2) initiation of joint attention (IJA), which can be defined as a child's seeking another's attention. Due to space limitations, this paper will exclusively focus on the different forms (eye gaze alternation, pointing, and showing) and functions (i.e., protoimperatives and protodeclaratives) of IJA by young typical children and by young children with autism. Specifically, this paper will begin by examining the importance of intentional communication and how it relates to the development of IJA. Subsequently, an overview of the development of the initiation of joint attention bids will be provided. Finally, this paper will examine the value of IJA as a prognostic indicator of outcome.

INTENTIONAL COMMUNICATION

In typical children the emergence of joint attention skills is closely intertwined with the development of intentional communication. Intentional communication is most likely the result of the infant beginning to understand that another person can be a means for the achievement of the infant's goal and that the infant can send signals that effect that person's actions [Bates et al., 1975; Prizant and Wetherby, 1987]. This developmental continuum has been charted in considerable detail by Sugarman [1984], who described the transition from the newborn baby's showing little awareness of a goal and instead reacting diffusely with primary emotions to nonspecific situations, to the evolution of understanding of the world; ultimately coordinating behaviors, modifying communicative signals as needed, and directing communication to more than one person if unsuccessful with the first. As the child progresses along this continuum, behaviors become more and more goal directed, conventional, and purposeful. In other words, there is no distinct moment in development where child communication becomes "intentful." Rather, the child slowly learns between 6 and 9 months of age, that behaviors have "consistent and predictable effects" [Wilcox et al., 1996, pp. 373] as a result of parents or other communicative partners attributing meaning to actions. For example, an infant may reach for a desired toy on the table. The nearby parent interprets this behavior as a request for the toy, even though the child never communicated directly in any way to the parent, and hands the toy to the child [Wilcox et al., 1996]. However, some authors [i.e., Trevarthen, 1979] argue that the infant plays a more active role in this process and that the emergence of intentionality is consequently also the result of child behaviors that can be observed as early as 2 to 3 months of age. As Trevarthen puts it, it is not merely the mother who attributes meaning to the infant's actions, the child "*is* speaking to her" [Trevarthen, 1979, pp. 346].

No standard operational definition exists in the literature for the construct of intentional communication [Prizant and Wetherby, 1987; Calandrella and Wilcox, 2000]. The ground-

*Correspondence to: Yvonne Bruinsma, Componistenlaan 195, 2215 SR Voorhout, Netherlands. E-mail: bruinsma@education.ucsb.edu
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breaking and often cited work by Bates [1979] placed the emergence of intentional communication around 9 months of age and she defined intentional communication in terms of three characteristics. The first characteristic pertained to the emergence of joint attention, specifically the alternation of eye gaze between an object and the communicative partner during a communicative exchange. A second characteristic was the child's persistence in gesturing and/or vocalizing until the communicative goal is met. Similar repair strategies described by Wetherby, Alexander, and Prizant [1998] appear to be evident in verbal children wherein a child will modify their behavior in a persistent effort to be understood. Finally, Bates noted that a child's vocalizations during intentional communication attempts begin to more closely resemble speech patterns and/or conventional sounds. Intentional communication according to Bates [1979] may therefore change as follows: A preferred item such as a bottle is no longer requested by a short one-syllable vocalization ("eeeeh") but by a closer approximation to the actual word ("baabaa"), combined with gaze alternation between the mother and the bottle and persistent efforts that may include reaching or pointing until the bottle is obtained. As a whole, these studies suggest that intentional communication involves a complex array of social interaction, persistence, and environmental feedback.

INITIATION OF JOINT ATTENTION IN TYPICAL CHILDREN

Although researchers vary as to the specific criteria used to define intentional communication, many suggest that the emergence of IJA is critical. It even is often described as a pivotal point in development, both as the culmination of early social development during the first part of infancy and as the foundation for and beginning of true language acquisition [Werner and Kaplan, 1963; Bruner, 1975]. When a child begins to engage in joint attention, his or her communication evolves from an exclusively dyadic interaction between the child and communicative partner to coordinated communication with the child's attention now divided and alternated between the communicative partner and an object [Bakeman and Adamson, 1984; Mundy and Willoughby, 1998].

The progression of the development of gaze alternation in typical children is clearly documented in the seminal study by Bakeman and Adamson [1984]. These authors studied 28 infants playing with their mothers at 3-month intervals between the ages of 6 and 18 months. Six categories of engagement were coded: 1) Unengaged, 2) Onlooking (infant observes without participating), 3) Persons (infant is engaged only with the other person), 4) Objects (infant plays and attends to object only), 5) Passive Joint (infant and other person play together, but infant does not acknowledge other's presence or involvement), and 6) Coordinated Joint (infant divides attention and alternates gaze between object and other person). The authors found that the frequency, duration, and relative amount of time spent in the category of Coordinated Joint increased with age, albeit relatively slowly. For example, in a 10-minute free play session with the mother, a third of the 9-month olds engaged in coordinated joint attention, but on average for only 2% of the total 10-minute play time. Not until 18 months of age was each infant observed in coordinated joint attention at least once during the 10 minutes, for an average of 26.6% of the playtime.

Subsequent research helped to define the different functions eye gaze alternations may serve. Although researchers vary somewhat in their definitions of function, generally a distinction is made between two main functions: protoimperatives and protodeclaratives [cf. Gleason, 2001]. Protoimperatives are defined by the child's request or rejection for social interaction, objects, or actions [Warren and Yoder, 1998]. Requesting can take many forms, for example, whining or reaching while opening and closing the hand [Carpenter et al., 1998]. However, one must determine (as for protodeclaratives) with relative certainty that the child's communication is intentful. For example, whining must therefore be combined with looking toward mother, pointing at the desired object, sustained attempts until the goal is reached, or a combination of such indicators of intent [Warren and Yoder, 1998].

Wetherby et al. [1988] reported that, during a 30-min sample of the behavior of very young typical children (mean age 12;29), requesting of actions or objects occurred twice as much as protesting during the prelinguistic stage. This research suggests that a more specific evaluation of function, even within a category (in this case behavior regulation), may be important for diagnosis and for intervention, particularly in the area of requests for social interaction.

Protodeclaratives are also described in the literature as commenting, indicating, referencing, and joint attention [Warren and Yoder, 1998] and can include pointing, showing, giving, etc. [Bates et al., 1975]. Protodeclaratives can be defined in slightly different ways as calling another individual's attention to an object or interest [Wetherby et al., 1988], showing positive affect about an object or interest [Warren and Yoder, 1998], or using an object as the means to obtain adult attention [Bates et al., 1975].

The pattern of emergence and subsequent development for protoimperatives and protodeclaratives is similar to the slow yet steady increase in occurrences by age of coordinated joint attention episodes that Bakeman and Adamson [1984] noted. Infants reach for objects from an early age, but do not begin to alternate their gaze between the desired object and the face of the communicative partner until 11 to 12 months of age [Bates et al., 1975]. Furthermore, requesting and commenting, the two most frequent functions of communication during the prelinguistic stage [Wetherby et al., 1988], become more complex in their topography as a result of the development of increasingly sophisticated and explicit gestures [Iverson and Thal, 1998]. Bates and colleagues [1975] found, for example, that, at approximately 13 months of age, reaching and gaze alternation were first combined with pointing to the desired object. It is not until 15 months, however, that most children engage in these complex requesting and commenting behaviors with greater frequencies [Bakeman and Adamson, 1984; Sugarman, 1984]. For example, Dersochers et al. [1995] followed the production of pointing in 25 typically developing infants every 3 months between the ages of 6 to 18 months and for follow-up at 24 months of age. They distinguished noncommunicative pointing from communicative pointing by including eye contact from infant to mother within 1 s of the produced point for the latter. None of the children pointed at 6 or 9 months of age. At 12 months of age, 67% of children pointed noncommunicatively, but only 13% of children pointed with eye contact. At 18 months of age, all children displayed noncommunicative pointing, and communicative pointing had increased to 79%. At follow up (24 months), all children displayed both forms of pointing.

INITIATION OF JOINT ATTENTION IN CHILDREN WITH AUTISM

A key component of joint attention is the division and alternation of the child's attention between the communicative partner and an object [Bakeman and Adamson, 1984; Mundy and Willoughby, 1998]. This alternation involves one of the most reported deficits of children with autism: eye contact. Evidence for the relative absence or atypical nature of eye contact in children with autism comes from a variety of studies. One of the earliest studies to gather retrospective developmental data was conducted by Ornitz et al. [1977, 1978]. A sample consisting of 74 children with autism and 30 typically developing children was selected and parents were asked to complete a written inventory about their developmental delays in their first and second years of life. Interestingly, although the average age of the children with autism in the sample was 45.2 months, "all but a few of these young children were essentially without speech" [Ornitz et al., 1977, pp 213]. Socially, the children with autism were described as being hard to reach, avoiding eye contact, and as ignoring people [Ornitz et al., 1978].

Even though the parents in the Ornitz et al. study were asked to recall child characteristics from a long time ago after the children had received a diagnosis of autism, similar findings were noted in a study by Wimpory et al. [2000] in which parents were interviewed before they had received a diagnosis. The authors used the Detection of Autism by Infancy Sociability Interview (DAISI), which is a semistructured interview focused on the child's social behaviors between 6 and 24 months of age. The results were striking in that they found a very distinct profile for the children with autism compared to the children with other forms of developmental delay. Specifically, reports from the parents of children in the autism group were clearly distinguishable from those of the parents of children in the developmental delay group. That is, parents of the children with autism noted diminished frequency and referential use of eye contact and of other joint attention behaviors such as giving, showing, pointing at objects, following points, and using fewer preverbal noises communicatively. The clear contrast between the two groups appears to be promising in terms of early identification and diagnosis.

Many of the retrospective studies of home films or videotapes also compare the behaviors of the children later diagnosed with autism with a control group. Adrien et al. [1993] compared child behaviors from home films and reported abnormal eye contact for the children later diagnosed with autism. Eye contact was rated as most deviant during the first year of life, with a slight improvement during the second year of life. Osterling and Dawson [1994] conducted a study comparing first birthday home videotapes of children with autism and typically developing children. The authors found that the frequency and duration of looking at other persons was the single best predictor of a later diagnosis of autism. A further study of first birthday home videotapes indicated that the amount of time spent looking at people was a significant marker for children with autism compared to typically developing children and compared to children with other developmental delays [Osterling et al., 2002]. In her review of the literature, Stone [1998] pointed out, for differential diagnosis, it may be helpful if future research focused on distinguishing between symptoms of autism and symptoms of cognitive and language delays independent of autism.

Baranek [1999] compared 10-minute home videos recorded between 9 and 12 months of age for children later diagnosed with autism, typically developing children, and a group of children with a developmental disability or mental retardation, including Down syndrome, Williams syndrome, and nonspecific mental retardation. She found that orientation/attention to (nonsocial) novel visual stimuli, response to name, mouthing of objects, and social touch aversions constituted the profile that distinguished the group with autism from the group with retardation. Osterling et al. [2002] pointed out, however, that the children in the mental retardation sample included children with Down and Williams syndrome, who would be relatively easily recognized in the videotapes, thus compromising the extent to which coders were blind to the infant's diagnosis.

As a whole, these studies indicate that young children with autism have severe difficulties with the use of eye contact, both referentially and in looking at other people. Empirical studies investigating the use of joint attention behaviors, including gestural behaviors, by children with autism have been completed using the Early Social Communication Scales (ESCS) [Seibert et al., 1982]. This assessment instrument was designed to measure social development from birth to 30 months of age by providing the child with a variety of high to low structured contexts designed to elicit social communication. The instrument provides detailed information about all joint attention behaviors, including not only the form, but also the function (e.g., eye gaze alternation to share enjoyment versus eye gaze alternation to request). One important and often-cited study by Mundy et al. [1986] compared child behaviors on the ESCS between samples of typical children, children with autism, and children with mental retardation of various etiologies other than autism. Nonverbal and verbal children were included, with ages ranging from 38 to 75 months. The results suggested that the behaviors of the children with autism were most atypical in the category of initiation of joint attention behaviors. Specifically, in comparison with both the typical children and the children with mental retardation, the children with autism engaged significantly less in eye contact to share enjoyment with the examiner during toy play, both when the examiner was holding a wind up toy and when the toy was active, a finding consistent with other studies [i.e., Charman et al., 1997]. Interestingly, eye contact after tickle play was not significantly different between the three groups, suggesting that physical social play may be an activity in which the children with autism show a relatively higher level of eye contact and social engagement. Furthermore, the children may have more difficulty with eye contact with the addition of a third item or action (such as the wind-up toys). This may possibly relate to difficulties with "overselective attention" in children with autism that have been described in the literature [Koegel and Wilhelm, 1973; Lovaas et al., 1979; Rosenblatt et al., 1995].

The functions of joint attention behaviors are also taken into account in studies of pointing. Several studies suggest that, although children with autism do engage in some forms of pointing, these do not reach levels seen in typical development. Baron-Cohen [1989] and Goodhart and Baron-Cohen [1993] examined children with autism who had at least single words in their vocabulary and provided further support for the selective pointing deficits described earlier by Curcio [1978]. That is, children with autism appear to produce and understand protoimperative pointing to some extent so that this is a relative strength, but protodeclarative pointing is severely impaired, and often completely absent. A third form of pointing, referential pointing (nonsocial pointing to an object in a book) appears to be relatively intact in

children with autism compared to more socially oriented pointing. Thus, the primary function of these gestures does not appear to be social in the child with autism. Perhaps more importantly, these studies demonstrate that simple, nonsocial use of pointing is preserved in autism, but even when a child is capable of pointing, this gesture is unlikely to be used for social reference.

A broader study of the different strategies children with autism and typically developing children employ to make requests used an adaptation of the Muni test [Philips et al., 1995]. This test consists of putting desired items out of reach but in view of the child by the experimenter while the child is watching. The child's reactions are subsequently scored from videotape as being part of one of four strategies: 1) object centered (i.e., climb on furniture, move object to toy), 2) person as object (i.e., climb on adult, push adult, throw adult's hand), 3) person as self-propelling agent divided into contact (touching, pushing adult's hand toward toy) and no contact (i.e., point, verbal request), and 4) person as perceiving subject (any of the strategies under person as self-propelling agent but combined with eye contact). The participating children in the sample were children with autism, children with mental retardation who were not diagnosed with autism, and typically developing children. Although the range of language levels of the children in the study was relatively broad, the results of this study concur with previously discussed studies because the children with autism differed from the other two groups by using significantly more "object centered" approaches and significantly fewer "person as perceiving subject" approaches. As expected, the children with autism also displayed fewer gestures, for example, pointing to request, in comparison to the other two groups. These findings suggest that the children with autism did not engage in significantly more "person as object" strategies than the children in the other two groups, nor did they make use of more contact gestures, such as the "autistic leading" compared to the typically developing children. Rather, the difficulties appeared to be more in the lack of distal gestures (pointing, reaching for toy, reaching to be picked up, and verbal request). The authors theorized that the relative lack of distal behaviors makes the use of contact gestures more salient to clinicians, resulting in the reputation, but perhaps misleading trait of "autistic leading" as a marker of autism.

As described previously, requesting (protoimperatives) and commenting (protodeclaratives), are the two most frequent functions of communication by typical children during the prelinguistic stage, although these children also engage in protesting, greeting, and showing off, but with lower frequency [Wetherby et al., 1988]. A study by Wetherby and Prutting [1984] compared communicative functions of four typical children and four children with autism during a free play and a structured communication condition in familiar environments. This study assessed the differences in functions of communicative behavior for children with autism. The children were matched on language stage, ranging from the prelinguistic to the three-word stage. Although the children differed substantially in age (the average age of the autistic sample was 9.6 years, the mean age for the typical sample was 1.7 years), one of the interesting general findings of the study was that, although the children with autism did not differ in the number of communicative acts, there was a difference in the quality of communicative acts. In particular, the communicative acts produced by the children with autism primarily served the function of behavior regulation (requesting, protesting). In comparison, the typical children readily used all three functions of communicative acts: behavior regulation, social interaction, and joint attention. Again, these results suggest that children with autism, independent of age and functioning level, do not tend to use communication for social purposes, as do typical children.

Stone and colleagues [1997] have also studied the communicative profile of children with autism, comparing nonverbal communication in 14 two- and three-year olds with autism with a closely matched group of developmentally delayed children without autism. These authors also found that the children with autism requested more and commented less than matched controls. In addition, they were less likely to engage in joint attention behaviors, such as pointing, showing, or eye gaze alternation, and more likely to manipulate the examiner's hand.

INITIATION OF JOINT ATTENTION AS A PREDICTOR

The emergence of joint attention behaviors, such as eye-gaze alternation, nonverbal requesting, and commenting that make up intentional communication is of considerable interest in light of their roles as precursors to the acquisition of first words. A substantial body of literature suggests that a relationship exists between aspects of intentional communication and later lexical acquisition for typical children. Tomasello and Todd [1983] studied the effects of joint attention and maternal interaction style on expressive vocabulary growth in six mother–child dyads. They videotaped these dyads in their homes with a set of novel toys at monthly intervals for 6 months, beginning at the child's first birthday. The authors found that the amount of time dyads spent in joint attentional episodes was positively related to the child's vocabulary size at the end of the period. This finding was later replicated by Tomasello et al. [1986],Smith et al. [1988] , and Markus et al. [2000], who also found positive correlations between the amount of time in joint attention episodes and size of expressive vocabulary at later ages.

These studies suggest a strong relationship between the child's developing lexicon and the amount of time spent in joint attention episodes and Markus et al. [2000] provided an important addition to these findings. In a replication and extension of the Tomasello and Todd [1983] study, these authors found that individual child differences in language skills at 12 months of age were related to the number and length of joint attention episodes within the free play period at 18 months. Specifically, receptive language at 12 months predicted duration of joint attention episodes at 18 months and expressive language skills at 12 months predicted the number of episodes of joint attention *initiated* by the child. Studies such as these provide evidence for a transactional perspective [Yoder and Warren, 1993], where the communicative partners influence each other on an ongoing basis.

Further evidence of predictors of language was presented by Mundy et al. [1995]. The ESCS [Seibert et al., 1982] was used to identify a broader set of joint attention behaviors that may predict later language development. The results suggested that the rate of requesting (reaching with and without eye contact, giving, and pointing to out-of-reach toys) as well as the rate of social interactions (initiation of turn-taking sequence, teasing, reacting to pause in social game with gesture and eye contact, etc.) and responding to joint attention (following a point and gaze shift) were positively related to both expressive and receptive vocabulary on the Reynell Expressive Language Scale [Reynell, 1977] 1 year later for 22 children (mean age 16.6 months) with typical development.

Much of the research that aims to predict the rate of lexicon acquisition in typical children has focused on the relationship with joint attention behaviors. As evident from the previous sections, these behaviors are generally absent or delayed in children with autism. Mundy et al. [1990] focused specifically on a group of children with autism with minimal language (5 words or less) and examined the relationship between joint attention and later language development. These authors used the ECSC and found again that the children with autism (mean age of 44.9 months with fewer than 5 words) displayed a deficit in nonverbal joint attention skills and that this deficit distinguished the children with autism from the matched sample of children with mental retardation without autism. An equally important finding was that the child variations in gestural joint attention skills predicted language development (both expressive and receptive language as measured on the Reynell Development Language Scales [Reynell, 1977]) at follow up (13 months later) for the children with autism. In this study, the gestural joint attention appeared to be more predictive than other types of social behavior, requesting, language level, mental age, chronological age, and intelligence quotient (IQ), for the children with autism's development of language 13 months later; however, language level and mental age were significant predictors for the children with mental retardation.

At this time, relatively few empirical studies have been published that predict language outcomes based on joint attention behaviors in prelinguistic children with autism, however, the predictive relationship between joint attention behaviors and language acquisition has been tested in greater detail for young prelinguistic children with developmental delays other than autism [McCathren et al., 1999a; Calandrella and Wilcox, 2000]. Results from these studies suggest similar relationships as those found for typically developing children. McCathren et al. [1999a] tested 58 children with developmental delays of varied etiologies, but excluded autism, using the Communication and Symbolic Behavior Scales [CSBS; Wetherby and Prizant, 1993]. The authors found that the rate of joint attention (defined as acts used to direct the experimenter's attention) and the rate of communication (any vocalization or gesture toward the experimenter) were statistically significant predictors of expressive vocabulary during the follow-up CSBS session 12 months later. A second study by these authors with the same sample of children [McCathren et al., 1999b] showed that the rate of prelinguistic vocalizations, rate of prelinguistic vocalizations with consonants, and rate of prelinguistic vocalizations used interactively were all strongly correlated with expressive vocabulary 12 months later. Further, Calandrella and Wilcox [2000] studied 25 developmentally delayed children for the relationship between prelinguistic communication behaviors and later lexicon. Intentional nonverbal communicative acts that included eye contact predicted expressive vocabulary at follow up. The number of gestural indicating acts (defined as pointing, reaching, or giving without eye contact) was predictive of receptive vocabulary.

Finally, Koegel et al. [1999] demonstrated that the number of child-initiations at program entry (child ages ranged between 2 years 9 months and 3 years 11 months) predicted highly favorable treatment outcomes at follow up when the children ranged in age from 10 years, 9 months to 15 years, 4 months. Child initiations were broadly defined as any verbal or nonverbal action by the child to begin a new interaction or to change the direction of an interaction. It is important to note that it is likely that many of the behaviors scored under this definition as initiations could also be defined as joint attention behaviors, including pointing, showing, and giving.

Further investigation into the importance of precursors to language acquisition would be highly desirable [Koegel, 2000], especially because some early intervention studies specifically teach joint attention behaviors prior to teaching verbal expressive language (e.g., Dallaire et al., 2003; Whalen and Schreibman, 2003].

SUMMARY

Intentional communication in typically developing children has been studied for many years. The review of the existing literature suggests that, for children with autism, especially for those who are under age 3 and are prelinguistic, additional research is warranted. The nature of the disability is such that many of the joint attention behaviors that usually precede and develop in the context of intentional communication are delayed or missing altogether. Some scholars [e.g., Mundy et al., 1990] suggest that these joint attention skills may be a prerequisite to the acquisition of intentional communication and functional speech. This notion of prerequisite skills is one that should be examined in much greater detail, because, if true, research may influence early intervention programs significantly.

For example, controlled studies comparing the onset of communication and other social behaviors between children with autism who are taught joint attention skills and those who are taught first words should be helpful in determining more effective and efficient intervention programs. Similarly, it would be interesting to assess whether children with autism who are taught verbal communication improve in areas of joint attention. In other words, does a "top down" model [cf., Brown et al., 1976] produce improved joint attention or is joint attention truly a prerequisite for more sophisticated linguistic and social development? Empirical studies that address these areas with children with autism functioning at levels under 3 years of age, would greatly add to the current knowledge.

In addition, studies that take into account the heterogeneity of children diagnosed with autism may help guide us to individualized intervention plans that address the specific unique needs of children. For example, children who are completely nonverbal versus those that have a few words may differ in their types of representational ability and symbolic understanding and therefore may have different intervention needs. Also, it would be interesting to directly compare joint attention in those children who have a few words to those who are completely nonverbal.

Another issue worth consideration relates to the definition and standardization of measured behaviors across studies. That is, more standardized measures and psychometrically reliable measures may help researchers to coordinate their efforts to provide more generalized recommendations based on differential subtypes of joint attention. Although we recognize that measuring prelinguistic skills in toddlers and in children with disabilities functioning at the earliest stages of communication development is inherently challenging, progress in the areas of diagnosis, prognosis, and intervention rest squarely on the psychometric character of the measures of joint attention.

Finally, it is important that studies continue to assess child behaviors in multiple settings and under different conditions, as it is likely that behaviors vary as a result of variables such as contingencies, setting events, the skills of the communicative partner, and other environmental variables. The importance of including measures collected in the child's

natural setting has been pointed out by Wolery and Garfinkle [2002], and this area certainly would merit further research.

As a whole, the literature on intentional communication and IJA for both typically developing children and children with autism supports the transactional model of development. In other words, the data suggest complex and multidirectional relationships between the child and his or her environment. As this review reveals, much research is still needed to determine the exact nature of these relationships, especially for very young children with autism. The acquisition of intentional communication may be a necessary step on the road to verbal expressive language and it is clear that these skills are strongly related to and predictive of later verbal language development. It would be difficult to overestimate the importance of both this first step and of the acquisition of verbal expressive language by children with autism in general. The vast majority of children with autism develop language late and at slower rates [Lord and Paul, 1997]. Their lack of communicative competence is a diagnostic characteristic of autism [Lord and Paul, 1997; Wetherby and Prizant, 1999], and families often view this deficit as one of their greatest sources of stress [Bristol, 1984]. In addition, deficits or delays in verbal expressive communication have also been hypothesized to be the underlying cause of secondary maladaptive behaviors that create even more stress for families [Koegel et al., 1994]. Finally, the presence of functional speech before age 5 is thought to be a characteristic associated with more favorable outcomes [e.g., McEachin et al., 1993] for autism. In conclusion, the importance of intentional verbal communication, joint attention, and attention to multiple cues as developmental milestones cannot be underestimated. Further studies of the strategies that improve a child's ability to effectively use communication and the relationship to joint attention and attention to multiple cues should provide us with an increased understanding of children with autism. ■

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