Correlates of the joint attention disturbance in autism

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CORRELATES OF
THE JOINT ATTENTION DISTURBANCE
IN AUTISM

A Dissertation
Presented to
The Faculty of the School of Education
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

by
Linda S. Bourdon
May 1999
CORRELATES OF
THE JOINT ATTENTION DISTURBANCE
IN AUTISM

by

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ABSTRACT

Deficits in joint attention, imitation, and pretense are believed to contribute to subsequent difficulty in the development of a theory of mind in children with autism (Baron-Cohen, 1991; Mundy, 1995). Joint attention and other early social skills of children with autism (34 male, 4 female; ages 4 to 18 years) were correlated with measures of nonverbal cognitive ability (Leiter International Performance Scale), receptive and expressive language skills (Peabody Picture Vocabulary Test -Revised and Expressive One-Word Picture Vocabulary Test- Revised), and the severity of autism (Childhood Autism Rating Scale) to gain a better understanding of these developmental relationships. Joint attention and other early social skills were measured with the Social Interest Inventory (SII), a questionnaire developed for this study and completed by Parents and Teachers. Subjects with autism at all levels of cognitive and language ability were found to have deficits in joint attention, imitation, and pretense. Joint attention deficits were not correlated to the acquisition of language or to the cognitive ability of the subjects. This is a deviance from the typical course of development. However, deficits in joint attention, imitation, and pretense showed significant correlations with the overall severity of autism. Students with autism reportedly engage in significantly higher levels of instrumental than social communication and parents tend to rate their children somewhat higher than teachers on several SII measures. Joint attention deficits may have a more profound effect on how language and cognitive skills are used by children with autism than on how they are acquired. Interventions which focus primarily on the cognitive and language abilities of children with autism may overlook more basic social skills such as joint attention which may warrant more direct intervention.

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CORRELATES OF

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IN AUTISM
Correlates of the Joint Attention Disturbance in Autism

Chapter 1

Introduction

A. Justification

Autism is a behaviorally defined disorder characterized by pervasive impairments in several areas of development. The deficits of autism are seen in verbal and nonverbal communication and in reciprocal social interaction skills. Individuals with autism exhibit a restricted range of interests often manifest in unusual sensory responses or preoccupations, stereotypic mannerisms, and rigid adherence to routines. They fail to develop appropriate peer relationships and generally show limited or no imaginative or pretend play (DSM-IV, 1994).

Education is the primary treatment for autism although educational approaches vary widely in their focus and methods. Despite the early emphasis on the social deficits of autism (Kanner, 1943), most educational approaches have focused on the cognitive and linguistic aspects of the disorder while nearly ignoring the social and affective processes (Klinger & Dawson, 1992). The social deficits of autism have generally been addressed as they relate to language difficulties and behavior concerns more than as a primary area of emphasis. Behavioral interventions have focused on direct training of appropriate behavior through the use of operant conditioning and modeling and have generally been more successful for increasing specific cognitive and language skills and reducing maladaptive behaviors (Lovett, 1987; Strain, 1983). Even when successful, these behavioral interventions have not adequately addressed certain core features of autism such as the impairments in reciprocal social interaction skills.
and the pragmatic use of language for communicative purposes (Klinger & Dawson, 1992). In fact, some have argued that the social-communicative profile of children with autism may be inadvertently worsened by traditional behavioral approaches to intervention in that these adult-directed approaches may inhibit the development of certain social skills by teaching the child to follow external cues and prompts without learning to initiate spontaneous interactions (Duchan, 1983; Wetherby, 1986).

The emphasis is now shifting back to the social-emotional processes in autism as researchers are beginning to understand the language dysfunction of autism as a reflection of the underlying impairments in social-emotional development (Prizant & Wetherby, 1989). Research and intervention programs are beginning to promote the early social abilities that typically emerge in the first two years of life and which are believed to provide the foundation for the later development of social and language skills. It is believed that the earliest interventions, directed at the earliest identified social-emotional deficits associated with autism, may have the most profound impact on the development of children with autism (Simeonsson, Olley, & Rosenthal, 1987). One of the most critical of these early social skills to be identified for its significant impairment in autism is joint attention. The significance of the joint attention deficit in terms of assessment, diagnosis, and ultimately treatment remains to be determined as researchers continue to investigate the relationship of joint attention to other aspects of autistic pathology.

Joint attention, as originally defined by Bruner (1975), is the coordination of attention with another person to an object or topic of shared interest. The disturbance of joint attention development in autism has been identified as perhaps the most fundamental component of the early expression of autism (Mundy, Sigman, & Kasari, 1993) and the scaffold from which other social,
cognitive, and language skills are built (Tomasello, 1995). Recognition of the importance of the joint attention disturbance in autism has contributed to an increased research interest in the earliest social skills and how their impairment might contribute to an autistic pattern of deficits. Joint attention appears to be an important diagnostic and treatment variable but research is still needed to define the relationship of joint attention skill development to other aspects of autistic pathology and development.

The skills included under the general term "joint attention" have varied somewhat according to the focus of the researchers who have published studies, but some general consensus has been apparent in the research. Butterworth (1991) defines joint attention as simply looking where someone else is looking. Most other researchers have included this responsive form of joint attention along with a broader range of skills. Sigman and Kasari (1995) include responsive measures of joint attention such as following another person's gaze in their research but also emphasize the child's spontaneous initiation of joint attention interactions such as holding up something for someone else to see and pointing at something to share an interest. These researchers also studied social referencing behaviors such as checking another person's face while playing with something, when a task has been accomplished, after pointing to something of interest, or in the presence of an ambiguous situation. Baron-Cohen, Allen, and Gillberg (1992) include behaviors such as pointing to "show" (or proto-declarative pointing), bringing an object to another person to share an interest in that object, and monitoring another person's gaze in their operational definition of joint attention. Raver and Leadbeater (1995) describe joint attention as behaviors which represent nonverbal communicative effort and the sharing of experience. These researchers include behaviors such as head orientation and vocalization coupled with one-finger pointing as indications of joint attention. Mundy (1995)
includes behaviors he describes as social-emotional approach behaviors in his studies on joint attention. These behaviors include the use of eye contact and gestures to show objects to others or share an experience of an event with others. Mundy points out the distinction between proto-imperative (requesting) behaviors which are instrumental in nature and are generally not considered to be indicators of joint attention versus proto-declarative (showing/sharing) behaviors which are considered to be indicators of joint attention.

In theory, the concept of joint attention implies a capacity to form representational thought. Baron-Cohen, Allen, and Gillberg (1992) have also studied pretense which, along with joint attention, is usually developed before 18 months of age and is considered to be an important precursor to the later development of what is described as a theory of mind (also see Baron-Cohen, 1989b, 1991b, & 1995). Theory of mind, in its simplest interpretation, is the understanding that other people can have thoughts and beliefs and that other people's beliefs can be different than one's own. This is an awareness that typically emerges at around the age of four years in normal development and is believed to be dependent on the earlier development of prerequisite skills such as joint attention and pretense. The absence of a theory of mind has been hypothesized by Baron-Cohen, Leslie, and Frith (1985) to be the basis for the behavioral manifestations of autism.

Evidence of a theory of mind emerges at about four years of age in typical development, but features of autism are generally apparent before that age. The hypothesis that a failure to develop a theory of mind is at the core of autism has led to increased attention in the research to the study of potential precursor skills such as joint attention and pretense as they relate to autistic pathology and to the later development of a theory of mind (Mundy, 1995). The failure of children with autism to show many of the basic forms of joint attention behaviors has been
documented by numerous researchers (e.g. Baron-Cohen, Allen, and Gillberg, 1992; Osterling and Dawson, 1994). This research has helped to delineate some of the first identifiable and measurable symptoms of autism. The early emergence of these joint attention skills in normally developing children has been said to provide an opportunity to measure the developmental impairment of children who might not otherwise be identified as autistic until much later in their preschool years, when language fails to develop normally, which allows greater opportunities for early identification and intervention (Baron-Cohen, Allen, & Gillberg, 1992).

Various hypotheses have been proposed which describe the joint attention disturbance of autism as a disorder in social-affective development (Mundy, 1995), a specific cognitive deficit (Baron-Cohen, 1989b & 1995; Leslie, 1987), or a disorder of executive function (Hughes & Russell, 1993; Rogers & Pennington, 1991). It is now believed that joint attention deficits are fundamental to the early expression of autism (Mundy, Sigman, & Kasari, 1993) and that these deficits persist over time and appear to be present to some degree in children with autism at all ages and at all developmental levels (Baron-Cohen, 1995).

The importance of joint attention skills for early diagnosis of autism, for planning appropriate interventions, and for estimating prognosis is dependent on research to determine how the joint attention deficit relates to other aspects of the developmental patterns of children with autism. The relationship between joint attention deficits and other developmental characteristics of autism is largely untested. Different developmental outcomes may be associated with individual differences in the acquisition of joint attention skills in individuals with autism (Dunham & Moore, 1995). Of particular interest is the need to determine correlates of joint attention deficits which might give some insight into the influence of these deficits on the language and cognitive development of children.
with autism and on the overall severity of their autism. The relationship of joint
attention disturbance to cognitive ability, language development, and severity of
autism have been investigated with mixed results depending on the specific skills
measured and the nature of the subject pool (Landry & Loveland, 1988;
Loveland & Landry, 1986; Sigman & Kasari, 1995). Studies to date have relied
on relatively small sample sizes with a fairly restricted range of skills measured in
controlled experimental situations and may not fully represent the impact of the
joint attention disturbance on global developmental issues for children with
autism. If the relationship of the joint attention disturbance to other
developmental and behavioral characteristics can be clarified, it may be possible
to improve methods of early diagnosis and design more effective treatment
programs for children with autism.

B. Statement of the problem

Deficits in the development of joint attention skills have been identified as a
fundamental component of the early expression of autism (Mundy, Sigman, &
Kasari, 1993). Joint attention deficits have been found to discriminate young
children with autism from those with developmental delays at ages as young as
18 months and have thus become the first identifiable symptoms of autism in
many cases (Baron-Cohen, Allen, & Gillberg, 1992). Joint attention deficits have
also been described in children with autism at all ages and developmental levels
and appear to persist over time (Baron-Cohen, 1995). Despite the apparent
diagnostic value of these joint attention skill deficits and the possible implications
for a child's prognosis, research has not yet emphasized the relationship of these
skills to other developmental and behavioral features of autism.

It is not clear whether differences in joint attention development are predictive
of individual differences in language development, cognitive ability, and/or the

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severity of autism or if these factors are relatively independent of one another. Despite much speculation about the importance of joint attention deficits in the diagnosis and treatment of autism and as a precursor to the eventual development of a theory of mind (Baron-Cohen, 1995), only a small number of studies have been conducted with a limited range of ages and abilities surveyed, a restricted range of skills measured, and small sample sizes (e.g. Landry & Loveland, 1988; Loveland & Landry, 1986; Sigman & Kasari, 1995).

It is notable that controlled experimental situations unfamiliar to the child have been used for most of the joint attention research on children with autism which may distort the profile of communicative behaviors displayed by the child (Cantwell, Baker, & Rutter, 1978; Wetherby, 1986). The use of more spontaneous gestural and vocal behaviors studied in naturally occurring interactions may offer more insight into how these behaviors function for the child with autism. This purpose of this study is to investigate the relationship of several groupings of joint attention behaviors and early social skills to the severity of autism, the nonverbal IQ, and the receptive and expressive language ages of a group of children with autism in order to help clarify the relationships of these variables to one another.

C. Theoretical rationale

In 1985, a paper was published by Baron-Cohen, Leslie, and Frith entitled "Does the autistic child have a theory of mind?" They put forth the hypothesis that an impaired ability to use a theory of mind underlies the specific behavioral impairments of autism. Theory of mind is described as the ability to impute mental states to oneself and others and to understand that others may not share the same thoughts and beliefs as oneself.
Theory of mind is a term which was initially coined by Premack and Woodruff (1978) in reference to their work with chimpanzees. Their paper, "Does the chimpanzee have a theory of mind?" looked at whether chimpanzees could behave in a manner which showed an awareness of the mental states of others. Baron-Cohen and his associates have extended the work of Premack and Woodruff to the study of children with autism in numerous studies exploring the capacity of children with autism to correctly attribute mental states to others (Baron-Cohen, 1989c, 1991c, 1993, & 1995). It has been documented repeatedly that children with autism exhibit deficits in theory of mind tasks relative to the performance of normally developing subjects and those with mental retardation when matched for mental age and language ability.

The importance of recognizing mental states is that it allows one to make inferences about what others believe in a given situation which subsequently allows one to predict what they will do. Baron-Cohen (1995) points out that this capacity, which he refers to as "mindreading," is not only useful for making sense of behavior, but it is essential to communication in that it allows the speaker to monitor the informational needs of the listener. The pragmatics of conversation require that one hypothesize about the speaker's mental states or intentions. This applies to nonverbal forms of communication as well as speech. Sperber and Wilson (1986) refer to this capacity as the search for relevance. The listener will assume that the speaker's communication is relevant to their intentions.

Baron-Cohen (1995) makes a case that mindreading is a universal human behavior which can be thought of as an instinct. He believes there is a strong likelihood that the phenomenon is biological, innate, and a product of natural selection. Baron-Cohen, Leslie, and Frith (1985) perceive of the theory of mind deficit of autism as a case of specific developmental delay. It allows one to explain the specific impairments of childhood autism by considering the
underlying cognitive mechanisms separate from considerations of IQ (Frith, 1982; Rutter, 1983). Theory of mind is believed to be a mechanism which underlies a crucial aspect of social skills. Being able to conceive of mental states allows one to know that other people know, want, feel, and believe things and allows one to respond accordingly.

Numerous researchers have theorized as to the basis for the theory of mind deficit in autism. Much of the interest has been directed toward lower level skills believed to be essential precursors to the development of a theory of mind. For example, DeGelder (1987) argues that it is more likely that lower-order biological functions are impaired in autism rather than some single more advanced cognitive mechanism such as theory of mind. DeGelder notes that autism originates in early childhood, long before there could be evidence of an impaired theory of mind which typically emerges in development at around the age of four years. Boucher (1989) believes that the impaired metarepresentational ability in autism is secondary to some impairment in lower level and much earlier developing capacities, most likely involving inner language and symbolic functions. Frith (1989) suggests that there is a point in the process responsible for forming and using second-order representations in which there is a fault in autism. This fault can be seen in the delayed or disordered use of imitation, symbolic play, and pretense in subjects with autism at a much earlier stage of development than that required for theory of mind.

Baron-Cohen (1995), Leslie (1994), and Premack (1993) have each proposed modular systems to explain the development of a theory of mind and account for the emergence of lower level skills leading eventually to an understanding of a theory of mind. Baron-Cohen (1989b, 1993) has identified joint attention behaviors and pretend play as important early precursors in the development of a theory of mind. Holroyd and Baron-Cohen (1993) report that
many autistic children fail to show pretend play or joint attention behavior equivalent to a one to two-year-old level. The interest in pretense and especially in joint attention behavior has been growing as researchers have investigated precursor skills or building blocks to a theory of mind, especially as these skills might be impaired or absent in children with autism (Baron-Cohen, 1989b, 1991b, & 1995; Meltzoff & Gopnik, 1993; Mundy, Sigman & Kasari, 1993; Tantum, 1992; Wellman, 1993).

Some developmental psychologists (Bretherton, McNew & Beeghly-Smith, 1981; Leslie, 1987) have argued that a theory of mind has its origins in normal children at the end of their first year of life when joint attention skills become apparent. Joint attention may be a precursor to the development of a theory of mind by demonstrating a beginning awareness that another person has feelings and thoughts that may be useful to consider (Landry, 1995). At its most sophisticated level, Bruner (1983) sees joint attention as a "meeting of the minds." Bretherton (1991) notes that from about nine months of age, infants seem to operate with an implicit theory of mind which becomes more apparent as language begins to emerge. Evidence for this awareness is said to come from infants' emerging ability to engage in intentional communication, their ability to reverse roles in social games (Ratner & Bruner, 1978) and their ability to engage in deliberate imitation of another person's facial movements (Piaget, 1962).

The importance of joint attention and its relationship to normal child development has been studied since the 1970s (Bruner, 1975). Bruner originally defined joint attention as the ability to coordinate attention with another person to an object or topic of shared interest. As infants approach their first birthday, they begin to display an increased interest in external objects and events during interactions with their caregivers (Dunham & Moore, 1995). Previously established dyadic (infant-other) interactional structures are transformed into
triadic (infant-object-other) social systems. Butterworth (1995) describes joint visual attention, or what he calls deitic gaze, as simply "looking where someone else is looking," which he further defines as an intentional search for the goal of the partner's gaze. The alternation of gaze between the adult and the object and back to the adult again is often a key descriptive feature of joint attention which is interpreted as a coordination of the attention between interactive social partners to share an awareness of an object or event (Landry, 1995; Mundy, Sigman, & Kasari, 1990).

Dunham and Moore (1995) note that it seems likely that episodes of joint attention during infant-caregiver interactions are functionally significant "social hot spots" influencing many different dimensions of early development. Bruner (1995) believes that joint attention interactions contribute to early problem solving and affective skills (Bruner, 1977) and to social cognition in general (Bruner, 1993 & 1995). Adamson and Bakeman (1991) argue that episodes of shared attention are used for mutual regulation of affect, problem solving, negotiation of communicative intentions, and for the sharing of cultural meanings (p. 9). Landry (1995) has described the development of joint attention skills and the relationship of these skills to the emergence of language, toy exploration, and social competence. Joint attention is believed to involve an integration of information processing and emotional responsiveness (Harris, 1989; Sigman & Kasari, 1995).

Tomasello (1995) believes that early joint attention is more than just a precursor to the child's theory of mind. He believes it is more fruitful to conceive of joint attention as a foundation or "scaffold" for later forms of theory of mind. The ability to see others as intentional agents is foundational. It describes what is uniquely human. Tomasello argues that only humans can enter joint-attentional
states to interact with others as intentional beings and learn to use symbols without special training.

Bruner (1995) feels that this active engagement or sharing with others is essential to the infant's understanding of others as agents with intentions that might be different from their own. He describes joint attention as a mandatory condition for the sharing of social realities and notes that humans are the only species that seems driven by the need to share the objects of our attention with others (1995). Dunham and Moore (1995) point out that Bruner's original work "provoked a strong and persisting interest in the developmental role of these early social experiences at a time when Chomsky's deep innate structure and Piagetian egocentricism constituted a formidable opposing Zeitgeist among researchers concerned with early language and social cognition," (p. 16).

Dunham and Moore (1995) note that an expanded list of joint attention behaviors has been added to the early gaze-following behaviors studied by Bruner. For example, Mundy, Sigman, and Kasari (1990) have looked at gestural joint attention, which they define as a child's use and comprehension of conventional gestures such as pointing to objects and showing objects to other people. These social skills involve the use of eye contact in conjunction with gestures. Other joint attention behaviors include more varied uses of social referencing, imitation skills, gestural communication, and eventually shared verbal exchanges and the emergence of predictive, reciprocal conversation (Dunham & Moore, 1995). Levelt (1989) notes that joint visual attention in infancy leads to more ideational joint attention skills once language becomes established. The ability to share a topic of conversation eventually evolves into shared presuppositions based on cultural and community experiences and norms. The broader definition of joint attention includes responsive joint attention, initiating behaviors, as well as the checking of another person's face that occurs in
reaction to ambiguous situations, finishing a task, or after pointing to something. Joint attention is what Adamson and McArthur (1995) refer to as opening and maintaining a communicative channel with the partner.

The early coordinated episodes of joint attention appear to be functionally significant across several dimensions of development (Dunham & Moore, 1995). These authors note that the functional significance of joint attention becomes apparent when individual differences are associated with different developmental outcomes. Children vary in their ability to regulate attention, their level of social understanding, and their interest in the reactions of other people (Sigman & Kasari, 1995). A major theme in joint attention research has been the study of the consequences of individual differences in joint attention on various aspects of social, emotional, and motivational development (Dunham & Moore, 1995).

Mundy (1995) and his colleagues (e.g. Kasari, Sigman, Mundy, & Yirmiya, 1990) have noted that joint attention skill deficits appear to be a fundamental component of the early expression of the social disturbance of autism. He argues that measures of joint attention skill development, in the 12 to 30 month developmental period, may provide a sensitive index of social-emotional approach behavior and executive function in young children with autism (Mundy, 1995). Mundy suggests that it is joint attention that is initially disrupted in autism. He notes a connection between deficits in early social-emotional approach behaviors, such as joint attention bids, and the subsequent social-cognitive disturbances that typify children with autism. The social-emotional approach function of joint attention bids is believed to contribute to the developing capacity of the child to engage in states of intersubjectivity with others (Mundy & Hogan, 1994; Stern, 1985; Trevarthen, 1980). It allows infants to compare their affective experiences with their partner's. Mundy views the joint attention deficit
as a fundamental marker of the social developmental pathology of children with autism.

Baron-Cohen (1995) reports that children with autism do not show any of the main forms of joint-attention behavior and also notes that joint attention deficits are likely to be the earliest deficits of autism yet identified (Baron-Cohen, 1991b). Baron-Cohen, Tager-Flusberg, and Cohen (1993) note that without a ready ability for joint attention, human beings fall into a "grievous state of pathology." The appreciation that objects may or may not be of interest to others may be the drive behind all communication. This may help to explain why even in those autistic children for whom syntax and semantics are intact, spontaneous communication in terms of two-way sharing is seldom seen (Baron-Cohen, 1988). Faulty joint attention is believed to be prognostic of later difficulty in figuring out what might reasonably be on someone's mind when they do or say something. This leads to difficulty in sharing presuppositions about thoughts and feelings. Baron-Cohen (1989, 1991) notes that both pretend play and joint-attention behaviors are thought to be early precursors in the development of a theory of mind. Thus, children with autism might initially manifest delay at a very early stage in the development of a theory of mind by failing to show pretend play or joint-attention behaviors (Baron-Cohen, 1987; Sigman, Mundy, Sherman, & Ungerer, 1986).

Frith (1989) also notes that one of the first signs of autism is a lack of shared interest and attention with others. Even developmentally delayed children usually have this by the age of two or three which is when the diagnosis of autism usually becomes easier. Evidence of problems in joint attention are in evidence well before the emergence of the symbolic play deficit in autism - which has been previously described as an early marker of autism and of the types of cognition involved in theory of mind processes (Leslie, 1987 & 1988).
Children with autism display considerable variation in symptoms (Wing & Gould, 1979). Nevertheless a specific disturbance of social behaviors has been identified as a common feature of all children with this syndrome (Fein, Pennington, & Waterhouse, 1987; Kanner, 1943; Wing & Gould, 1979). Joint attention disturbance reportedly discriminates 80% to 90% of children with autism from children with developmental delays at early ages (Lewy & Dawson, 1992; Mundy, Sigman, Ungerer, & Sherman, 1986). Mundy (1995) reports that joint attention deficits distinguish up to 94% of young children with autism from those with mental retardation and are observable in very young children. These deficits persist and are readily apparent even in school age children with autism (Baron-Cohen, 1995).

It has been reported that children with autism do not use joint attention in the same way as typically developing children (Sigman & Kasari, 1995). Even verbal children with autism cannot modulate their speech properly (Frith, 1989) which may be because they lack a concept of the other person as an interested listener. Children with autism have difficulty understanding conventions. Even high-functioning children with autism are said to rely on figuring out conventions rather than knowing them intuitively (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). Wetherby (1986) notes that showing off, which is a purely social behavior, has never been reported in the literature on autistic individuals. Frith (1989, 1991) believes that children with autism have no awareness of other’s thought processes or feelings, although she feels they may have some awareness of their own.

Observational studies (Landry & Loveland, 1989; Loveland & Landry, 1986; Mundy, Sigman, Ungerer & Sherman, 1986; Sigman, Mundy, Ungerer & Sherman, 1986) have shown that joint attention behaviors occur less frequently in children with autism. This includes referential looking and gestures such as
giving, showing, and pointing. Gestural attention deficits have been found to be
specific to autism and not just a function of overall developmental delay (Landry &
Loveland, 1988; Loveland & Landry, 1986; Mundy, Sigman, Ungerer, &
Sherman, 1986; Sigman, Mundy, Sherman, & Ungerer, 1986). There appears to
be a degree of disorder in addition to an overall delay in the development of joint
attention skills in children with autism.

Joint attention deficits in autism could have considerable clinical significance.
Joint attention deficits, along with deficits in pretend play, are believed to affect
individuals with autism at all levels of ability and are believed to contribute to the
failure of these children to develop the representational abilities needed for the
development of a theory of mind (Baron-Cohen, Leslie, & Frith, 1985). Joint
attention has thus been identified as an important diagnostic indicator of autism at
very early ages. The early emergence of joint attention skills in normally
developing children may provide a means to measure the developmental
impairment of children who might not otherwise be identified as autistic until much
later in their preschool years which allows greater opportunities for early
identification and intervention (Baron-Cohen, Allen, & Gillberg, 1992).

Different developmental outcomes may be associated with individual
differences in the acquisition of joint attention skills in individuals with autism
(Dunham & Moore, 1995). The relationship of joint attention disturbance to
cognitive ability, language development, and severity of autism have been
partially investigated with mixed results depending on the specific skills measured
and the nature of the subject pool. The impact of the joint attention disturbance
on the prognosis for children with autism is not clear and will be the focus of this
study.

Baron-Cohen (1991a) concludes that children with autism are deviant as well
as delayed in their development of joint attention skills. If amenable to
intervention, joint attention may be a fruitful avenue of study to aid in programming for children with autism. Research to examine the relationship of the joint attention deficit to the severity of autism, the cognitive ability, and the language skills of children with autism may help to contribute to the development of appropriate intervention strategies.

**D. Definition of terms**

**Autistic Disorder**: A behaviorally defined disorder characterized by severe and pervasive impairments in several areas of development including at least some of the following (from DSM-IV, 1994):

**Reciprocal Social Interaction Skills** -

a. Impaired use of nonverbal behaviors such as eye gaze and gestures to regulate social interaction and communication.

b. Failure to develop peer relationships appropriate to the developmental level of the child.

c. Lack of spontaneous seeking to share enjoyment with others such as by showing or pointing out interesting objects to others.

d. Preference for solitary, self-directed activities over social games - others are sometimes used as tools or "mechanical aids."

**Communication** -

a. Both nonverbal and verbal skills are usually affected.

b. If speech is lacking, there may be little spontaneous effort to compensate with alternative modes of communication such as gestures.

c. If speech is present, it may be repetitive, stereotyped, or idiosyncratic.

d. Verbal children usually have difficulties in initiating or sustaining a conversation.
Restricted Interests -

a. Imaginative/pretend play is often absent or markedly impaired.
b. Functional play may also be limited, with a fixation on sensory issues or parts of objects without regard to their function.
c. May show a preoccupation with one or more interests that is abnormal in intensity or focus.
d. Rigid adherence to nonfunctional routines and rituals.
e. Repetitive, stereotyped body movements or motor mannerisms.

Gaze monitoring: directing one's gaze where someone else is looking (Sigman, Mundy, Sherman, & Ungerer, 1986).

Intersubjectivity: The ability to put oneself in another's place that is believed to be the basis for empathy and appropriate affective responses to others (Trevarthen, 1979).

Joint attention: The ability to coordinate attention with another person to an object or topic of shared interest (Bruner, 1975).

Baron-Cohen, Allen, and Gillberg (1992) include the following behaviors under the rubric of joint attention: pointing, showing, and gaze monitoring. They define joint attention as an attempt to monitor or direct the attention of another person to an object or event.

Raver & Leadbeater (1995) include head orientation, visual gaze, vocalizations coupled with a one-fingered pointing gesture, etc. which are used as a nonverbal communicative effort and sharing of experience beginning in later infancy.

Proto-declarative communication: the use of pointing, bringing, showing, or commenting to indicate to another person an object of interest, as an end in itself (Baron-Cohen, Allen, & Gillberg, 1992). This serves a social function.
Proto-imperative communication: the use of gestures or language in an attempt to attempt to obtain an object or an action such as the need for assistance (Baron-Cohen, Allen, & Gillberg, 1992). This serves a 'requesting' function.

Social referencing - the ability to use another's emotional display to guide one's own response to something novel (Campos, 1984).

Theory of Mind - the understanding that other people have thoughts and beliefs and that those thoughts and beliefs might be different than one's own (Baron-Cohen, Leslie, & Frith, 1985; Premack & Woodruff, 1978). This capacity emerges at about the age of four in typical development.

E. Research questions

This research looked at the relationships between early social skills development, particularly joint attention skills, to other aspects of the development of children with autism. The extent of the deficit in joint attention skill development for subjects with autism was compared to measures of nonverbal IQ, receptive and expressive language ages, and the severity of autism of the subjects. The following research questions were examined:

1. Is joint attention skill development related to the level of nonverbal cognitive ability of subjects with autism?

2. Is joint attention skill development related to the receptive and expressive language abilities of subjects with autism?

3. Do subjects with autism engage in more proto-declarative than proto-imperative communication?
4. Is joint attention skill development related to the overall severity of autistic symptoms?

5. Do joint attention, nonverbal IQ, or language ability predict the severity of autism?

6. Are higher levels of joint attention and other early social skills development reported by parents or teachers of students with autism?

F. Sample description and general data gathering procedures

Subjects were selected from students enrolled in the Southeastern Cooperative Educational Program's (SECEP) Autistic Children's Program. This is a regional day school program in southeastern Virginia which serves students with autism from several public school districts. The students represent the full range of the autistic spectrum with a tendency for more severely autistic students to remain in the program at higher ages. The available subjects ranged in age from two to 22. The majority of the students functioned in a range consistent with a diagnosis of mental retardation although many earned nonverbal IQ scores above this range. The SECEP program is designed to serve students who exhibit characteristics of autism to a degree that cannot be accommodated in a less restrictive educational setting. The student to staff ratio averages 6/2 in the classrooms. The available students generally had been receiving services through the Autistic Children's Program for at least one year before they would have been evaluated by the SECEP Evaluation Team.

Subjects were selected from the available pool of subjects based on the availability of the necessary data. Students were selected if they had received a
psychological evaluation from the SECEP Evaluation Team within the last year which included the administration of the Leiter International Performance Scale (1948/1979). This instrument is frequently administered to students with severe communication impairments such as that seen in autism in lieu of a more general or language-based intelligence test. The Leiter yields a nonverbal cognitive mental age and an IQ score. The Leiter has recently been revised (1997) but the differences in the two versions of the test may have compromised the analysis of results if newer subjects were included who were tested with the revised Leiter. Since the new Leiter is just coming into popular use, a much larger sample was available if results were taken from the administration of the original Leiter. Future replications of this study could obtain results from the revised Leiter or other instruments as appropriate. In addition to the Leiter score, data from language testing was obtained from the Speech/Language Assessment Report completed for the evaluation team during the same time frame as the Leiter administration. An expressive and receptive language age was obtained for each subject.

The students' parents and classroom teachers were asked to complete the Social Interest Inventory (SII), an instrument designed specifically for this study. In addition, the Secep Liaison who works with each child's class was asked to complete the Childhood Autism Rating Scale (CARS) which was developed by Schopler, Reichler, DeVillis, and Daly (1980). The Liaisons had experience with the CARS in their role as diagnosticians for the SECEP Evaluation Team. This is an observation rating scale which can be completed by teachers, diagnosticians, or other staff members familiar with the child and the instrument.

Parental permission was obtained for accessing the needed information and parental cooperation was needed in completing the parent copy of the SII questionnaire. Subjects for whom any of the necessary data could not be
collected were excluded from the study. The number of subjects was dependent on the availability of the needed data and parental consent to access the data. The number of subjects was projected to be between 30 to 50. Data were collected for analysis and coded to maintain the confidentiality of the subjects' records for the purpose of this study. Parents were given the option of designating that the information from the SII could be included in their child's individual classroom record for programming considerations.

G. Limitations of the study

Some potential limitations of the study are identified. There is a possibility that the somewhat restricted sample may affect the results to an unknown, but presumably mild, degree. The sample is restricted in that children with the mildest cases of autism may not be enrolled in the SECEP program and are therefore unavailable for participation. The mildest cases of autism will also tend to be excluded if they are already reintegrated from the Autistic Children's Program into other, less restrictive, educational settings. This may be especially pertinent for older students who are often reintegrated into programs where the primary disability is identified as their degree of mental retardation rather than their autism.

There may also be some restriction of the sample due to the conditions required for participation. Children with the most severe cases of mental retardation and autism are typically unable to take a nonverbal IQ test such as the Leiter which assumes a basal nonverbal mental age of at least two years. The most severe cases of mental retardation with autism were thus excluded. However, joint attention skills might be expected to be somewhat limited for children who function below a two year level anyway. Higher functioning children with autism (e.g. those who can take a more general test of intellectual ability
such as the Stanford-Binet: Fourth Edition) were also excluded from the study. However, a relatively small percentage of children with autism are able to take a verbal intelligence test in a standardized manner and their performance is typically much lower on such general ability tests than on nonverbal measures such as the Leiter. The Leiter is one of the most commonly administered tests given to children with autism and should offer a reasonably representative sample of the population of children with autism.

Data were collected from the students' school records as well as from rating scales completed by each student's Teacher, Liaison, and Parents. All normed instruments were presumed to be given under standard conditions and results should be comparable across evaluators. Reliability and validity data for each instrument should be considered when interpreting the final results. Rating scales such as the SII and the CARS are subjective and the potential for rater biases exists.

The time involved in collecting the data may have had some influence on the results obtained but this influence is believed to be minimal. Results were gathered on students tested with the Leiter within one calendar year of the time of this study. The maximum possible time between the collection of the measures for any given student was one calendar year and in most cases was much less. IQ testing was generally completed during evaluation procedures at the SECEP evaluation center. Speech and Language testing was generally done at the school shortly before the Leiter was administered. Speech/Language and IQ test results were generally obtained within 30 days of one another. The Teacher and Parent copies of the SII questionnaire were completed by the child’s classroom teacher and parents once the research study began. The Liaison staff member who works with each child’s classroom team completed the CARS once the parent permission was returned.
The correlational nature of the research limits to some degree the conclusions which can be drawn from the patterns and relationships which are identified in the data. It is, nevertheless, of interest to see whether the variables covary with one another or if they seem to develop independently of one another.
Chapter 2
Review of the Literature

A. Historical and theoretical development

1. Theory of Mind

In 1985, a paper was published by Baron-Cohen, Leslie, and Frith entitled "Does the autistic child have a theory of mind?" These researchers put forth the hypothesis that an impaired ability to use a theory of mind underlies the specific behavioral impairments of autism. This hypothesis was an extension of the research conducted on theory of mind in the 1970s and 1980s and was the first application of these ideas to the understanding of autism. This 1985 paper was followed by a number of studies on the application of theory of mind to the social, language, and cognitive impairments in autism (Baron-Cohen, 1989c & 1991c; Boucher, 1989; Holroyd & Baron-Cohen, 1993; Leslie, 1991; Ozonoff, Pennington & Rogers, 1991) along with books examining the topic (Baron-Cohen, 1995; Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Frye & Moore, 1991; Whiten, 1991).

Theory of mind is a term which was initially coined by Premack and Woodruff (1978) in reference to their work with chimpanzees. Their paper, "Does the chimpanzee have a theory of mind?" looked at whether chimpanzees could impute mental states to oneself or others. The mental states referred to by Premack and Woodruff are cognitive and volitional states such as believing, thinking, knowing, pretending, and desiring. Awareness of these mental states is believed to be important in that such an awareness allows one to make inferences about what others believe in a given situation which subsequently
allows one to predict what they will do. This is believed to be a crucial component of social skills (Baron-Cohen, 1995). Fodor (1983) notes that inferring mental states, or having a theory of mind, is a powerful method of making sense of and predicting behavior, which is exactly what is needed in the midst of a social situation. To relate appropriately to others, it is essential to know that other people know, want, feel, and believe things.

Baron-Cohen (1995) argues that "mindreading" is a universal human behavior which can be thought of as an instinct. He believes there is a strong likelihood that the phenomenon is biological, innate, and a product of natural selection. Baron-Cohen, Leslie, and Frith (1985) perceive the theory of mind deficit of autism as a case of specific developmental delay in which children with autism do not develop the necessary skills to be able to attribute thoughts and beliefs to others. This theory allows one to explain the specific impairments of childhood autism by considering the underlying cognitive mechanisms independent of IQ (Frith, 1982; Rutter, 1983).

Baron-Cohen (1995) points out that this mindreading capacity is not only useful for making sense of behavior but is essential to communication in that it allows the speaker to monitor the informational needs of the listener. Decoding speech involves interpreting a speaker's words with an awareness that the words represent the speaker's thoughts and beliefs. This applies to nonverbal forms of communication such as gestures as well. Sperber and Wilson (1986) refer to this capacity as the search for relevance. The listener will assume that the speaker's communication is relevant to their intentions.

Baron-Cohen speculates that there is a ceiling on the development of a theory of mind in the majority of individuals with autism (Holroyd & Baron-Cohen, 1993). Theory of mind, which typically emerges in normal development at around age four, is absent or impaired in children with autism at developmental ages.
much higher than four. Of greater relevance to the vast majority of children with autism is not the upper limits to which their theory of mind could develop but whether their theory of mind can develop at all. Many children with autism seem unlikely to accomplish even the most rudimentary degree of metarepresentational ability as described in the studies on theory of mind. As a result, much of the research that followed Baron-Cohen's original (1985) paper on the theory of mind deficit in autism has focused on the apparent precursors to the development of a theory of mind and how those precursor skills are affected in autism.

Baron-Cohen's hypothesis about the theory of mind deficit in autism has come to include a detailed model of the stages through which children are believed to progress in their development of a theory of mind (Baron-Cohen, 1993 & 1995). These stages include the "Eye Direction Detector," the "Shared Attention Mechanism," and the "Intentionality Detector." Some of the key behaviors which are believed to develop in these stages include those commonly grouped under the heading of joint attention and involve the sharing of interests with another person. Baron-Cohen (1989a, 1991b, & 1993) has specifically identified joint attention behaviors and pretend play as important early precursors in the development of a theory of mind. Holroyd and Baron-Cohen (1993) report that children with autism often fail to show joint attention behavior or pretend play skills equivalent to a one to two-year-old level which is interpreted as evidence of a failure at the very early stages in the development of a theory of mind (Baron-Cohen, 1987, Sigman, Mundy, Sherman, & Ungerer, 1986).

Other developmental psychologists (Bretherton, McNew, & Beeghly-Smith, 1981) have hypothesized that theory of mind has its origins in normal children at the end of their first year of life. DeGelder (1987) argues that it is more likely that lower-order biological functions are impaired in autism rather than some single more advanced cognitive mechanism such as theory of mind. DeGelder notes
that autism originates in early childhood, long before theory of mind would have emerged even in normal development. Hobson (1989) is another researcher who argues for an earlier, innate capacity for perceiving the emotional states of others which is impaired in autism and leads to later problems in developing a theory of mind. Boucher (1989) also believes that the impaired metarepresentational ability in autism is secondary to some impairment in lower level and much earlier developing capacities, most likely involving inner language and symbolic functions. Frith (1989) suggests that there is a point in the process responsible for forming and using second-order representations in which there is a fault in autism.

Leslie (1988) notes that comments referring to the content of mental states are apparent well before the age of four in normal development and are evidence of a common underlying mechanism, namely second order representations. Leslie (1987, 1988) and Leslie and Frith (1988) have researched lower level indicators of representational ability such as the ability to use pretense and the ability to understand that others may know less than oneself. Leslie views pretense as a manifestation of a primitive theory of mind.

Baron-Cohen (1995), Leslie (1994), and Premack (1993) have each proposed modular systems to explain the development of a theory of mind and account for the emergence of lower level skills leading eventually to an understanding of a theory of mind. In every case, skills such as joint attention and pretense are considered pivotal areas of development from which more advanced mindreading skills later emerge.
a. Joint attention as a precursor to theory of mind

Joint attention, the sharing of attention with another person to an object or activity of mutual interest, has received a great deal of emphasis in recent research as a necessary precursor to the development of a theory of mind (Baron-Cohen, 1989a & 1991b; Meltzoff & Gopnik, 1993; Mundy, Sigman & Kasari, 1993; Tantum, 1992; Wellman, 1993). Joint attention may be a precursor to the development of a theory of mind by demonstrating a beginning awareness that another person has feelings and thoughts that may be useful to consider (Landry, 1995). At its most sophisticated level, Bruner (1983) describes joint attention as a "meeting of the minds." Bretherton (1991) notes that from about nine months of age, infants seem to operate with an implicit theory of mind which becomes all the more apparent as language begins to emerge. Evidence for this awareness is said to come from infants' emerging ability to engage in intentional communication, their ability to reverse roles in social games (Ratner & Bruner, 1978) and their ability to engage in deliberate imitation of another person's facial movements (Piaget, 1962).

Tomasello (1995) believes that early joint attention is more than just a precursor to the child’s theory of mind. He believes it is more fruitful to conceive of joint attention as a foundation or "scaffold" for later forms of theory of mind. The ability to see others as intentional agents is foundational. It describes what is uniquely human. Tomasello notes that only humans can enter joint-attentional states to interact with others as intentional beings and learn to use symbols without special training.

Tomasello, Savage-Rumbaugh, and Kruger (1993) believe that the change which occurs at around one year of age in the infants' understanding of persons with whom they can share their attention is just as important as the change that occurs at about four years of age when theory of mind is said to emerge. One
year olds come to understand others as intentional agents in terms of their concrete goals and their behaviors designed to reach these goals. In other words, at about one year of age, infants come to understand that other persons 1) have intentions, 2) that they may have intentions that differ from their own, and 3) that others’ intentions (concrete goals) may not match the current state of affairs (e.g. accidents or unfulfilled intentions).

In contrast, four year olds, with an emerging theory of mind, come to understand others as mental agents with thoughts and beliefs. By age four, children come to understand that other persons 1) have thoughts and beliefs, 2) that their thoughts and beliefs may be different from their own, and 3) that others can have thoughts and beliefs which are false or do not match the current state of affairs (Tomasello, Savage-Rumbaugh, & Kruger, 1993).

2. Joint Attention

Bruner (1975) originally defined joint attention as the ability to coordinate attention with another person to an object or topic of shared interest. Infants typically begin to display an increased interest in external objects and events while interacting with their caregivers at about the time they are approaching their first birthday (Dunham & Moore, 1995). Previously established dyadic (infant-other) interactional structures are transformed into triadic (infant-object-other) social systems. This change signals the beginning of joint attention interactions.

Dunham and Moore (1995) note that episodes of joint attention during infant-caregiver interactions seem to be functionally significant "social hot spots" which influence many different dimensions of early development. Bruner (1995) reports that joint attention interactions contribute to early problem solving and affective skills (Bruner, 1977) and to social cognition in general (Bruner, 1993 & 1995).
Adamson and Bakeman (1991) argue that episodes of shared attention are used for mutual regulation of affect, problem solving, negotiation of communicative intentions, and for the sharing of cultural meanings (p. 9). Landry (1995) has described the relationship of joint attention skills to the emergence of language, toy exploration, and social competence. Joint attention is believed to involve an integration of information processing and emotional responsiveness (Sigman & Kasari, 1995). Bruner (1995) feels that this active engagement or sharing with others is essential to the infant's understanding of others as agents with intentions that might be different from their own. He describes joint attention as a mandatory condition for the sharing of social realities and notes that humans are the only species that seems driven by the need to share the objects of our attention with others (Bruner, 1995). Dunham and Moore (1995) point out that Bruner's original work in the 1970s "provoked a strong and persisting interest in the developmental role of these early social experiences at a time when Chomsky's deep innate structure and Piagetian egocentrism constituted a formidable opposing Zietgeist among researchers concerned with early language and social cognition," (p. 16).

The skills included under the general term "joint attention" have varied somewhat according to the focus of the researchers who have published studies, but some general consensus has been apparent in the research. Butterworth (1991) has used the simplest definition of joint attention. He defines joint attention as simply looking where someone else is looking. This is a responsive form of joint attention which has been studied extensively in Butterworth's work (Butterworth, 1991 & 1995; Butterworth & Cochran, 1980; Butterworth & Grover, 1990; Butterworth & Jarrett, 1991). Most other researchers have included this skill in their work to some degree but usually within the context of a much broader range of behaviors.
Scaife and Bruner (1975) coined the term "shared reference" to describe the ability of infants to reliably follow their mother's line of visual regard after the age of about eight to nine months of age. The alternation of gaze between the adult and the object and back to the adult again is often a key descriptive feature of joint attention which is interpreted as a coordination of the attention between interactive social partners to share an awareness of an object or event (Landry, 1995; Mundy, Sigman, & Kasari, 1990).

Sigman and Kasari (1995) include responsive measures of joint attention such as following another person's gaze in their research, but emphasize the child's spontaneous initiation of joint attention interactions. The measures of joint attention studied by these researchers include acts such as holding up something for someone else to see and pointing at something to share an interest. These researchers also studied social referencing behaviors such as checking another person's face while playing with something, when a task has been accomplished, after pointing to something of interest, or in the presence of an ambiguous situation.

Baron-Cohen, Allen, and Gillberg (1992) include behaviors such as pointing to show (or proto-declarative pointing), bringing an object to another person to share an interest in that object, and monitoring another person's gaze in their operational definition of joint attention. Raver and Leadbeater (1995), note that joint attention is represented by behaviors which are believed to represent nonverbal communicative effort and the sharing of experience. These researchers include behaviors such as head orientation and vocalization coupled with one-finger pointing as indications of joint attention.

Mundy (1995) includes behaviors he describes as social-emotional approach behaviors in his studies on joint attention. These behaviors include the use of eye contact and gestures to show objects to others or share an experience or an
event with others. Mundy points out the distinction between proto-imperative (requesting) behaviors which are instrumental in nature and are generally not considered to be indicators of joint attention vs. proto-declarative (showing/sharing) behaviors which are considered to be indicators of joint attention.

The term joint attention has come to define a fairly broad spectrum of behaviors which are all related to the child's emerging awareness of others as intentional agents with whom they can share their interests (Baron-Cohen, 1995). The broad definition of joint attention includes responsive joint attention as well as initiating behaviors related to showing, sharing, and pointing, imitating, as well as social referencing behaviors such as checking another person's face in reaction to ambiguous situations, finishing a task, or after pointing to something of interest. Gestural forms of joint attention evolve into shared verbal exchanges and the emergence of predictive, reciprocal conversation (Dunham & Moore, 1995). Levelt (1989) notes that joint visual attention in infancy leads to more ideational joint attention skills once language becomes established.

Joint attention is what Adamson and McArthur (1995) refer to as opening and maintaining a communicative channel with the partner. Communicative intent is often a factor involved in the analysis of joint attention behavior (Bates, Camaioni, & Volterra, 1975; Bruner, 1975). Communicative intent is defined as the sender's prior awareness of the effect that a message will have on the addressee. The ability to share a topic of conversation eventually evolves into shared presuppositions based on cultural and community experiences and norms.

Children vary in their ability to regulate attention, their level of social understanding, and their interest in the reactions of other people (Sigman & Kasari, 1995). A major theme in joint attention research has been the study of the functional significance of joint attention and the consequences of individual
differences on various aspects of social, emotional, and motivational development (Dunham & Moore, 1995). The functional significance of joint attention becomes apparent when individual differences are associated with different developmental outcomes across time and context (Dunham & Moore, 1995) especially as these skills relate to the deficits of autism.

B. The joint attention disturbance in autism

Baron-Cohen (1995) reports that children with autism do not show any of the main forms of joint-attention behavior and also notes that joint attention deficits are likely to be the earliest social deficits of autism yet identified (Baron-Cohen, 1991). Baron-Cohen, Tager-Flusberg, and Cohen (1993) note that without a ready ability for joint attention, human beings fall into a "grievous state of pathology." The appreciation that objects may or may not be of interest to others may be the drive behind all communication. Even in children with autism for whom syntax and semantics are intact, spontaneous communication in terms of two-way sharing is seldom seen (Baron-Cohen, 1988).

Mundy (1995) and his colleagues have also noted that joint attention skill deficits appear to be a fundamental component of the early expression of the social disturbance of autism (Kasari, Sigman, Mundy, & Yirmiya, 1990). Mundy suggests that it is joint attention that is initially disrupted in autism. The observation of a more pronounced disturbance of joint attention development, as opposed to other types of social-communication skills, in children with autism is a finding that has now been reported in at least 11 studies (Mundy, 1995). Mundy (1995) notes a connection between deficits in early social-emotional approach behaviors, such as joint attention bids, and the subsequent social-cognitive disturbances that typify children with autism. The capacity of the child to engage
in states of intersubjectivity with others is what allows infants to compare their affective experiences with their partner's (Mundy & Hogan, 1994; Stern, 1985; Trevarthen, 1980). Mundy (1995) reports that the research and theory on the psychology of prelinguistic communication development has been one of the primary catalysts for the study of social behavior in young children with autism. Joint-attention behavior is normally present by nine to 14 months of age but is absent or rare in autism (Sigman, Mundy, Sherman, & Ungerer, 1986). This is a strikingly specific deficit. For example, the joint attention behavior of proto-declarative (showing, sharing, commenting) pointing is rare in autism but proto-imperative (non-social) pointing to make requests may be present (Baron-Cohen, 1989c) and pointing for naming is present (Goodhart & Baron-Cohen, 1992).

Frith (1989) also notes that one of the first signs of autism is a lack of shared interest and attention with others. Even developmentally delayed children usually have this by the age of two or three which is when the diagnosis of autism usually becomes easier. Evidence of problems in joint attention are in evidence well before the emergence of the symbolic play deficits in autism, which have been previously described as another early marker of autism and of the types of cognition involved in theory of mind processes (Leslie, 1987, 1988).

Faulty joint attention early on is prognostic of later difficulty in figuring out what might reasonably be on someone's mind when they do or say something. This leads to difficulty in sharing presuppositions about thoughts and feelings or understanding social conventions. Children with autism have difficulty understanding social conventions. Even those with high-functioning autism rely on figuring out conventions rather than knowing them intuitively (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). Baron-Cohen has hypothesized that children with autism as a group fail to employ a Theory of Mind which allows them to
hypothesize about what others might be thinking, believing, or expecting during social exchanges (Baron-Cohen, Leslie, & Frith, 1985).

Mundy, Sigman, and Kasari (1990) note the importance of joint attention skills in the acquisition of theory of mind processes. Mundy advocates a neuro-motivational explanation for the joint attention deficit as opposed to a simple cognitive deficit explanation such as Baron-Cohen's. Mundy (1995) believes that social emotional approach behavior such as joint attention bids are so important for development (Stern, 1985; Trevarthen, 1980) that neurological subsystems may be organized to specifically promote and regulate this type of child-initiated behavior (Mundy, 1995). Joint attention deficits may reflect developmental anomalies in neurological, cognitive, and affective processes which affect the operation of the social-emotional executive function (Mundy, 1995). Measures of joint attention skill development, in the 12 to 30 month developmental period, may therefore provide a sensitive index of social-emotional approach behavior and executive function in young children with autism (Mundy, 1995).

Children with autism display considerable variation in symptoms (Wing & Gould, 1979). Nevertheless a specific disturbance of social behaviors has been identified as a common pathological feature of all children with this syndrome (Fein, Pennington, & Waterhouse, 1987; Kanner, 1943; Wing & Gould, 1979). Joint attention disturbance reportedly discriminates 80% to 90% of young children with autism from children with developmental delays (Lewy & Dawson, 1992; Mundy, Sigman, Ungerer, & Sherman, 1986). Mundy (1995) reports that joint attention deficits distinguish up to 94% of young children with autism from those with mental retardation and are observable in very young children. These deficits persist and are readily apparent even in school age children with autism (Baron-Cohen, 1995).
Children with autism do not use joint attention in the same way as typically developing children (Sigman & Kasari, 1995). Most children with autism of less than four years are similar to six month olds in joint attention behaviors (Baron-Cohen, 1991b). Even verbal children with autism cannot modulate their speech properly (Frith, 1989) which may be because they lack a concept of the other person as an interested listener. Wetherby (1986) notes that showing off, which is a purely social behavior, has never been reported in the literature on autism. Frith (1989, 1991) believes that children with autism have no awareness of other's thought processes or feelings but she feels they may have awareness of their own.

Studies in which children have been observed during structured interactions (Landry & Loveland, 1989; Loveland & Landry, 1986; Mundy, Sigman, Ungerer & Sherman, 1986; Sigman, Mundy, Ungerer & Sherman, 1986) have shown that joint attention behaviors occur less frequently in children with autism when compared with other children matched for language age and cognitive ability who do not have characteristics of autism. The joint attention behaviors studied include referential looking and gestures such as giving, showing, and pointing. Gestural joint attention deficits have been found to be specific to autism and not just a function of overall developmental delay (Landry & Loveland, 1988 & 1989; Loveland & Landry, 1986; Mundy, Sigman, Ungerer, & Sherman, 1986; Sigman, Mundy, Sherman, and Ungerer, 1986).

Osterling and Dawson (1994) found four characteristics that discriminated children who were later diagnosed with autism from more typically developing children at one year of age by studying their home videos. These characteristics are: 1) pointing, 2) showing objects, 3) looking at others, and 4) orienting to their name. These behaviors are considered examples of joint attention processes and are the earliest identified characteristics of autism thus far.
Baron-Cohen, Allen, and Gillberg (1992) recently developed a screening instrument called the Checklist for Autism in Toddlers (CHAT) to measure joint attention skills in very young children. A large scale screening of toddlers was conducted in Great Britain using the CHAT. These researchers found that joint attention deficits carried an 83.3% risk of autism at 18 months of age and were a powerful discriminator of autism from general developmental delay.

Sigman and Kasari (1995) studied joint attention behaviors in normal infants, mentally challenged children and children with autism at a developmental age of 18-24 months. They measured joint attention across three social contexts: the amount of gaze monitoring during natural play with an adult, the likelihood of referencing the affective expressions of an adult in the presence of an ambiguous object, and the duration of attentional responses to an adult expressing distress. Subjects with autism displayed less joint attention in each of these contexts. Sigman and Kasari (1995) suggest that the difficulty may be in the children's inability to integrate the attentional and affective information they receive more than a failure to perceive it in the first place.

Mundy, Sigman, and Kasari (1994) studied children with autism who functioned developmentally around 20-24 months of age and found very little joint attention during a play interaction with an examiner. Children with autism looked at the examiner to receive help, if tickled by the examiner, or if they were engaged in rolling a car back and forth. They did not alternate gaze, look at the examiner, point, or follow points as much as normally developing children and children with mental retardation matched for mental age. Subjects with autism rarely looked to their parent when completing a task, when praised, or to show them a toy, all of which normally developing children and those with mental retardation did.
Baron-Cohen, Campbell, Karmiloff-Smith, Grant, and Walker (1995) looked at the manner in which children with autism "read" eyes, particularly eye direction, in order to understand mental states such as desire, goal, refer, and think. Normally developing children and those with mental retardation used eye direction as a cue for reading mental states. Subjects with autism failed to use eye direction to do so. It was hypothesized that the gaze abnormalities in autism may be a failure to comprehend that the eyes can convey information about a person's mental states.

It has also been documented that children with autism do not use eye contact to regulate turn-taking (Mirenda, Donnellan, & Yoder, 1983). Children with autism do not engage in normal gaze monitoring (Leekam, Baron-Cohen, Perrett, Milders, & Brown, 1993; Loveland & Landry, 1986; Mundy, et al., 1986). Subjects with autism rarely look at other's faces for information or reassurance (Sigman, Kasari, Kwon, & Yirmiya, 1992) and fail to pay attention to the distress of others. Children with autism appear to acquire some facility in responding to attention-directing bids of others with advances in development but continue to have a profound disturbance in initiating joint attention acts (Baron-Cohen, 1989a; Mundy, Sigman, & Kasari, 1994). Young children with autism also have difficulty in responding to the joint attention bids of others (Loveland & Landry, 1986; Mundy, et al., 1986).

Joint attention deficits in autism could have considerable clinical significance. Individual differences in joint attention have been related to parental reports of the intensity of the social disturbance, but not to other aspects of autism such as stereotypies or perseverative play (Mundy, 1995). Individual differences in joint attention development may also be prognostic indicators of language development (Loveland & Landry, 1986; Mundy, Sigman, & Kasari, 1990 & 1994) although the nature of this relationship is uncertain.
A taxonomy of early social-communication skills such as those described as evidence of joint attention development has been recognized for its potential utility in studying the social behavior of children with autism (Mundy, 1995). Both pretend play and joint attention behaviors, especially proto-declarative pointing, are universal developmental achievements (Butterworth, 1991; Leslie, 1991) normally present in simple forms by 15 months of age (Baron-Cohen, Allen, & Gillberg, 1992). Hence, their absence in children as young as 18 months of age could be a clear, specific indicator of autism and related disorders. Baron-Cohen, Tager-Flusberg, and Cohen (1993) note that the absence of joint attention behaviors in early development can lead to a "grievous state of pathology."

It is not known to what degree the joint attention deficit in autism might be overcome through early intervention and training programs designed to teach joint attention skills. Klinger and Dawson (1992) systematically evaluated a package of social interactive strategies on the early social-communicative skills of children with autism. They successfully taught a degree of eye contact, joint attention, and imitation to two 5 year old boys with autism. It may be wise to use joint attention measures in early identification efforts and focus early intervention efforts on joint attention development. Further clarification of the relationship of joint attention skill development to other aspects of autistic pathology such as language, cognition, and the overall severity of autism may help in developing appropriate interventions and determining prognosis.

1. Sequences of development of joint attention skills

Dunham and Dunham (1995) describe shared attention as an optimal interactions structure during middle and late infancy. The number of functionally significant joint attention behaviors identified during the infancy period has
increased over time and different opinions exist about the development of these skills and their influence on other aspects of development (Dunham & Moore, 1995). The development of joint attention skills spans most of infancy with the majority of joint attention behaviors emerging between 8 to 13 months of age in normal development (Bakeman & Adamson, 1984; Bates, 1979).

The process of joint attention occurs initially because caregivers follow their infant's attention to toys (Bruner, 1982). In joint attention interactions, mothers assist infants in practicing early social and exploratory skills. By sharing a focus of attention, infants begin to communicate with a partner about their own and their partners' goals and intentions (Trevarthen, 1979). Butterworth (1991) believes that joint attention serves an important communicative function during the prelinguistic period in that it provides a reason for communication to occur in the first place. Joint attention shows an awareness of a communicative partner. The earliest purpose of communication can be to regulate the behavior of others (by requesting or rejecting) which is minimally social or to achieve more social ends such as by sharing joint attention to a common interest (eg. by showing an object or commenting) (Butterfield & Arthur, 1995). The joint attention process is expanded as infants become able to coordinate their gaze between the object of focus and the caregiver and back again to the object during play episodes (Sugarman, 1984; Walden & Ogan, 1988) and to use the more advanced joint attention gestures of pointing and showing (Hannan, 1987; Leung & Rheingold, 1981). It has also been noted that typical infants show more frequent displays of positive affect when the infant and caregiver are jointly attending to a toy than when the infant is alone with the toys (Adamson & Bakeman, 1985). The sharing of affect, attention, and intentions with a partner develops in a hierarchical sequence (Buchsbaum & Emde, 1990; Rogoff, 1990; Stern, 1985) although
different opinions exist about the antecedents and developmental timing of the skills in this sequence (Dunham & Moore, 1995).

Research on joint attention has focused on age of onset (Scaife & Bruner, 1975), accuracy of target localization (Butterworth & Grover, 1990; Butterworth & Jarrett, 1991), and the cues or behaviors important for establishing joint attention including head and eye orientation (Butterworth & Jarrett, 1990) and pointing (Butterworth, 1991). The earliest investigators to explore the emergence of joint visual attention in infants were Scaife and Bruner (1975) who established the prototypical joint attention paradigm. Their results indicated that infants as young as two months turned their heads to follow a model's line of regard. By 11 to 14 months, all infants demonstrated head turning in the appropriate direction at least 50% of the time.

From three to nine months of age (before the emergence of joint attention to objects or events), infants frequently participate in mutually regulated affective exchanges with parents. Each partner modifies his own behavior to match the affective expression of the other (Cohn & Tronick, 1983; Stern, 1985). This early dyadic phase consists largely of the regulation of mutual attention and the exchange of affective expressions between the infant and caregiver (Kasari, Sigman, Mundy, & Yirmiya, 1990). Dunham and Dunham (1995) note that episodes of contingent face-to-face turn-taking are optimal during the first five months of development but become increasingly difficult to maintain as the infant finds objects and events of interest in the external environment and begins to show reduced interest in the caretaker alone.

Bakeman and Adamson (1984) describe joint attention development as the emergence of a "triadic" (infant-object-other) interactive system. In the period between 9 to 24 months, mutual engagement in mother-infant interaction gradually shifts to accommodate a shared focus of attention on external events.
and objects (Trevarthen & Hubley, 1978). Infants become more interested in object play after six months of age and there is a shift from exclusively dyadic affective interactions to interactions that involve both objects and people. The shift to object play generally marks the beginning of joint attention interactions (Kasari, Sigman, Mundy, & Yirmiya, 1990). At around six months, infants begin to gain the ability to attend to both caregivers and toys simultaneously (Butterworth & Cochran, 1980; Butterworth & Grover, 1990; Butterworth & Jarrett, 1991; Newson & Newson, 1975; Scaife & Bruner, 1975). By about nine months of age, infants are no longer limited to sharing their attention with an interactional partner but can intentionally establish and sustain attention on a shared topic (Bretherton, 1991). Infants become increasingly able to understand their partner's attention as indicative of an interest in an object or event (Phillips, Baron-Cohen, & Rutter, 1992) and learn to direct their partner's attention toward desired objects (Leung & Rheingold, 1981).

Tomasello (1995) notes that infants nearing their first birthday begin to engage in a variety of behaviors that evidence their developing understanding of other persons. This occurs in two phases: From 9-12 months infants begin to follow into and direct the attention and behaviors of others. From 12-18 months they demonstrate an awareness of intentional agents through qualitative changes in their joint attention interactions, the emergence of social referencing, imitative learning of instrumental and symbolic behaviors, and the use of gestures and language in symbolic, intentional communication. Toward the end of the first year, infants begin to follow another's gaze and respond to gestures such as pointing and showing (Lempers, Flavell, & Flavell, 1977). By 18 months of age children are able to establish communication nonlinguistically.

Babies begin to act intentionally toward people and objects by about eight months of age (Frye, 1991; Tomasello, 1995). Intention implies there is a means
and a goal. After eight months the infant develops a degree of social awareness that allows them to understand that they can move beyond the physical manipulation of others and use gestures and eventually words intentionally to affect the behavior of another person but not an object. At this point they have learned to recognize the physical and mental attributes of people (vs. only physical attributes of objects) (Frye, 1991). When the infant starts to see that other people also have intentions is when gestures such as pointing become meaningful.

Tomasello (1995), who advocates a cultural learning approach, assumes infants begin to understand a selective sharing of the attentional states and goals with their adult partners near the end of their first year of life. Reaching is the first intentional act. Once the child learns that their behavior (eg. reaching for desired objects) can influence others, intentional communication begins. Infants can generally distinguish between psychological causality (agency) and physical causality by one year of age (Pouin-Dubois & Schultz, 1990). It is around the age of two years that infants begin to understand that others may have intentions that are different than their own (Tomasello, 1995).

Bates (1979) identified three behaviors from which communicative intent of infant gestures can be inferred: 1) gaze alternation  2) repair of failed messages, and 3) ritualization of previously instrumental gestures. Support for these behaviors as emerging evidence of intentional communication in preverbal infants is provided by studies such as Sugarman (1984) who studied gaze alternation as a means for infants to "comment" about an object to a partner. In addition to comprehending the attentional focus of others, infants as young as nine months can actively produce shared reference through a variety of gestures. Golinkoff (1983) showed that infants use increasingly sophisticated attempts to repair failed messages during the last months of the first year of life. For example, infants
might look back and forth from an adult to a toy, perform an action and then wait for a response, or hold out their hands in invitational gestures. Infants generally have several of these strategies at their disposal by 12 months of age.

Trevarthan and Hubley (1978) have described the development of joint attention skills as representative of the development of what is called secondary intersubjectivity. Secondary intersubjectivity is defined as understanding that others have mental states and is a development which generally begins at around eight months of age. Examples of behaviors which represent secondary intersubjectivity include social referencing (Feinman, 1982; Hornik, Risenhoover, & Gunnar, 1987) and other forms of joint attention.

The process of social referencing involves looking to an adult in an unfamiliar or ambiguous situation and using the adult’s affective state to guide one’s own reaction to the situation (Campos, 1983; Feinman, 1982). For example, a child might look to an adult when first given a new toy or food or something else they do not understand. Social referencing involves a coordination of the infant's attention toward both a social partner and an object of mutual interest. The appearance of social referencing (Feinman, 1982; Hornik, Risenhoover, & Gunnar, 1987; Uzgiris, 1989) has been documented to emerge before the end of the first year of life. It has been concluded that by 12 months, children are affected by their mother’s emotional reactions (Walden & Ogan, 1988). This change in the infant's behavior signals the beginning of a different type of social awareness and lays the groundwork for more advanced forms of joint attention and social understanding which emerge later (Corkum & Moore, 1995).

Imitation skills are not always included in joint attention studies but are related in the sense of following adult behavior and attention. The earliest examples of infants imitating novel adult actions on objects comes after about nine months of age in normal development (Meltzoff, 1988a). By 14 months, infants can usually
model after an adult to achieve the same goal even by using different means (Meltzoff, 1988b) which is interpreted to mean they understood the intention of the adult.

In the 1970s, Bruner and his colleagues (Bruner, 1975; Bruner & Sherwood, 1983; Scaife & Bruner, 1975) distinguished between different types of social-communication skills that emerge in normal development between 9 to 12 months of age. These include the ability to engage in vocal or object turn-taking routines and the infant's ability to respond to another person's line of regard and gestures to coordinate visual attention to objects or events with another person. These latter joint attention routines are not clearly manifest until nine to 12 months when infants consistently begin to follow the line of regard of others (Scaife & Bruner, 1975).

Bretherton (1991) points out that it is during the period when preverbal infants acquire the ability to engage in intentional communication, they become able to reverse roles in social games (Ratner & Bruner, 1978) and to engage in deliberate imitation of another person's facial movements (Piaget, 1962). This is not to imply that one year old infants can reflect on their own theory of mind. However, from about nine months of age, infants seem to operate with an implicit theory of mind (Bretherton, 1991) which becomes all the more apparent as language begins to emerge.

In the intentional phase, the child is able to intentionally convey a message using increasingly conventional forms, combining vocalizations and gestures, and coordinating attention between the partner and the object or topic of the interaction (joint attention). Children at this level understand that their behavior can be used for a variety of communication purposes. This purposeful quality of communication must be mastered using non-symbolic means before more
symbolic abilities develop to achieve various language functions (Butterfield & Arthur, 1995).

Bates and her collaborators (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979) noted that the infants' capacity to initiate social interaction appeared to separate into two different functions in the 9 to 12 month period. These two distinct communicative functions appear to develop simultaneously in normal development. By the time of a child's first birthday, they typically have begun to use gestural acts for instrumental or requesting (proto-imperative) functions, such as pointing to elicit aid in obtaining objects out of reach. Simultaneously, they begin to point for more social (proto-declarative) purposes, such as showing an object to another person in order to share an interest. This proto-declarative function defines much of what is included in the definition of joint attention behavior.

The influence of joint attention skills continues to be apparent as children mature beyond infancy. Participation in joint attention interactions during the first two years of life is believed to facilitate later developing social skills by providing opportunities for children to attend to their mother's attempts to share their interests and vice versa (Landry, 1995). This is the beginning of reciprocal social interaction.

a. Gaze monitoring

Butterworth (1995) defines gaze monitoring behavior as an intentional search for the goal of a partner's gaze. Two individuals know they are attending to something in common by monitoring each other's gaze. Butterworth reported that even young babies may enter into a communication network with others through comprehension of an adult's direction of gaze. The direction of the adult's gaze has a signal function. The observer searches for plausible intentions behind the
In gaze monitoring, the participants are sharing an intentional relation to the world (Hobson, 1989).

Mundy (1995) notes that up to about six month of age, infants typically "communicate" through the exchange of facial and vocal affective signals in dyadic, face-to-face interactions with an adult. Preferential orientation to faces precedes and probably enables the later development of joint attention which occurs when the infant's and adult's gazes are both directed to the same target (Adamson & Bakeman, 1991).

Schaffer (1984) reviewed a number of studies that show the majority of early episodes of joint attention arise as a result of the mother's monitoring of the infant's gaze. The process of joint attention occurs initially because caregivers follow their infant's attention to toys. Infants begin to look at objects around them, looking back to the mother as if to confirm the shared experience. Infants' ability to follow another's gaze to an object of interest represents a crucial transition from face-to-face engagement in early infancy to joint exploration of, and communication about, objects in the environment (Mundy, Kasari, & Sigman, 1992; Trevarthen & Hubley, 1978; Tronick, Als, & Brazelton, 1979). This kind of eye contact is called triadic (Bakeman & Adamson, 1984). Scaife and Bruner (1975) coined the term "shared reference" to describe the ability of infants to reliably follow their mother's line of visual regard after the age of about eight to nine months of age. The joint attention process is expanded as infants become able to coordinate their gaze between the object of focus and the caregiver and back again to the object during play episodes (Sugarman, 1984; Walden & Ogan, 1988) and to use the more advanced joint attention gestures of pointing and showing which emerge at around age one (Hannan, 1987; Lempers, Flavell, & Flavell, 1977; Leung & Rheingold, 1981; Raver & Leadbeater, 1995).
"Onlooking" behavior is when a child is simply watching an adult engaging with an object, or when two individuals have their attention focused on the same thing independently of one another (Bakeman & Adamson, 1984). Onlooking typically develops prior to nine months of age and is generally not considered to be a form of joint attention.

Scaife and Bruner (1975) established the prototypical joint attention paradigm. They found that young infants could follow an adult's line of regard in search of a target after having been in eye-to-eye contact followed by an exclamation, "Oh, look!" and a head turn. Their results indicated that infants as young as two months turned their heads to follow a model's line of regard.

The onset of triadic skills between six to nine months of age is important because they allow the intentional nature of communicative acts to become apparent. At six months, the signal value of the mother's head and eye movements will indicate the general direction in which to look (Scaife & Bruner, 1975). Communication occurs because the baby will attend to the same attention-compelling features of the objects in the environment as the mother. Such an agreement on the object of a shared experience is a form of early communicative behavior.

Scaife and Bruner (1975) report that referential looking (one person following another's gaze or looking at what they are looking at) is present in many eight month olds. At eight to nine months, infants begin to follow another person's line of regard which becomes standard by about 12 months (Corkum & Moore, 1995; Scaife & Bruner, 1975). Infants follow gaze but engage in little coordinated joint attention until after 12 months (Adamson & Bakeman, 1985; Bakeman & Adamson, 1984). Infants routinely check the caregiver's gaze by 14 to 18 months of age. Trevarthen and Hubley (1978) report that after the age of nine months, infants begin to look from object to mother during joint play and invite mothers'
participation by offering and giving objects. It has also been noted that by ten months infants smile more at caregivers who are looking at them during toy play than at caregivers who are inattentive (Jones, Collins, & Hong, 1991).

Butterworth and Cochran (1980), Butterworth and Grover (1990), and Butterworth and Jarrett (1991) conducted a series of studies that replicated and extended the work of Scaife and Bruner (1975). They found evidence for three successive mechanisms of joint visual attention from six to 18 months: At six months, babies look to the correct side of the room but cannot tell to which of two identical targets on that side of the room the mother is attending. Butterworth calls this an "ecological" mechanism.

Butterworth and his associates report that by 12 months, the infant begins to localize the target as long as it is stationary in the visual field. The infant watches the mother while she is turning and when she is still, the infant makes a rapid head and eye movement in the direction of the target. Butterworth calls this the "geometric" mechanism because it involves extrapolation of an invisible line between the mother and the object of her gaze. This "geometric" mechanism allows babies to follow a line of regard and discriminate between targets based on direction and location. This seems to be one of the cognitive changes necessary for the comprehension of manual pointing.

Butterworth and his associates report that by 11 to 14 months of age, all infants demonstrate head turning in the appropriate direction at least 50% of the time. Butterworth and Jarrett (1991) found that if the infant did not find the target or if the mother was looking into space, they looked back at the mother's gaze direction to try again.

During the first year, joint visual attention is limited to locations within the infant's own visual space (Butterworth, 1995). By 18 months, infants are accurate at localizing targets behind them provided there are no distractors in
their visual field. Representational space (outside of the immediate visual field) is thus accessed by 18 months. Butterworth (1991) calls this the "representational" mechanism. Also apparent by 18 months, toddlers recognize that the object an adult is looking at, while naming, is the object to which the adult is referring (Baldwin, 1991). Coordinated joint attention, in which the infant attempts to maintain engagement with the caregiver begins to take up sizeable amounts of play time after 18 months of age (Bakeman & Adamson, 1984).

Mundy (1995) notes that gaze monitoring behavior, which is normally present by at least one year of age, is usually absent even in school age children with autism. Deficits in gaze monitoring may be representative of broader deficits in social referencing. The possibility of teaching gaze monitoring and social referencing to children with autism has not yet been investigated but some success has been reported in teaching gaze-following behavior to normal infants beginning at age eight months which suggests that learning is a possible mode of acquisition for joint visual attention.

b. Pointing

The comprehension and production of manual pointing (use of the outstretched arm and index finger to denote an object in visual space) is specific to humans and is believed to be intimately linked to language acquisition (Bates, Camaioni, & Volterra, 1975; Butterworth, 1991, 1995; Werner & Kaplan, 1963). Pointing is one of the earliest overt methods of intentional communication. It is basic to human nonverbal communication (Butterworth, 1995) and reflects a specialized communicative function (Fogol & Thelen, 1987). Desrochers, Morisette, and Ricard (1995) argue that pointing in infancy is a preverbal behavior that can be interpreted as a sign of the onset of an implicit theory of mind. It implies a beginning awareness of the mental states of others.
It has been shown that infants do not understand or produce a pointing gesture before six to nine months of age (Desrochers, Morisette, & Ricard, 1995). Comprehension of manual pointing (looking where others point) occurs toward the end of the first year of life (Schaffer, 1984), somewhat in advance of the production of the pointing gesture. Manual pointing for an infant before 12 months does little to help the infant localize a target (Butterworth, 1995). Below 10 to 12 months of age, infants usually fixate on the finger.

Infants begin to follow another's point to nearby objects starting at approximately nine months (Murphy & Messer, 1977) or 10 months (Butterworth, 1991). Infants can reliably follow their mother's pointing gestures to more distant objects by 14 months (Murphy & Messer, 1977) or 15 months (Morisette, Ricard, & Gouin Decarie, 1992). The majority of infants understand the pointing gesture by 15 months of age (Desrochers, et al., 1995). Looking, accompanied by pointing, increases the probability that an infant of 12 months or older will respond to the mother’s gaze and follow it (Butterworth, 1995). By 15 months, infants consistently look at the pointed target more often than elsewhere (Desrochers, et al., 1995). This is consistent with the emergence of what Butterworth refers to as the "geometric" mechanism in reference to gaze monitoring (Butterworth, 1991). After age one, infants are able to follow the imaginary line of the point to localize a target in space.

The production of manual pointing is said to operate in an interpersonal context from its inception (Butterworth, 1995). It comprises a specialized posture of the index finger, vocalization, social referencing, and attentional processes involved in object identification. Bruner (1983) and Stern (1985) note that gestures such as giving, showing, and pointing emerge simultaneously in normal development between nine to 12 months of age. Infants begin to reliably produce a pointing gesture by the end of the first year of life (Lempers, 1979; Leung &

Desrochers, et al. (1995) report that a majority of infants are able to produce noncommunicative pointing (pointing without looking at the mother) at 12 months. By 15 months, more than half of the infants could produce communicative pointing (defined as pointing accompanied by eye contact). Schaffer (1984) notes that the production of pointing for others is observed at about 14 months. By 15 months, infants will first check that the mother is attending to them, and only then do they point (Franco & Butterworth, 1988).

Both proto-imperative (requesting) and proto-declarative (commenting) pointing emerge at around nine to 12 months of age in normal development (Tomasello, 1995). Proto-imperative pointing is often considered to be noncommunicative in that it serves an instrumental rather than a social purpose. Proto-imperative pointing involves the child pointing to something he wants without engaging another person through eye contact or other social interaction. Baron-Cohen (1989c) believes that proto-imperative pointing need not take into account the other person's mental state. It involves physical (instrumental) interaction (Harding & Golinkoff, 1979). The adult provides a mechanism for meeting one's needs in a cause-effect fashion. Baron-Cohen (1989c) believes proto-imperative pointing is intact in autism because such children can understand physical-causal interactions or agency without attributing mental states to others (Baron-Cohen, Leslie, & Frith, 1985, Curcio, 1978).

Proto-declarative pointing, which is defined as pointing at an object in order to direct another person to look at the object, as an end in itself, normally emerges sometime between nine to 14 months of age (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). The function of such a point is to comment nonverbally. This type of pointing is considered to be an expression of joint
attention, whereas proto-imperative pointing is not. Baron-Cohen (1989c) notes that proto-declarative pointing is likely to take into account the other person's mental state, in that it serves to get the other person to take notice of an object or event. It is a mental interaction or a sharing of interests. Although proto-imperative and proto-declarative pointing emerge closely to one another in normal development, the acquisition of proto-declarative pointing is reported to be specifically impaired in children with autism (Baron-Cohen, 1989). Pointing for naming and nonsocial (proto-imperative) pointing may be present in autism but proto-declarative pointing is reported to be very rare (Baron-Cohen, 1989c; Goodhart & Baron-Cohen, 1992).

Social/communicative (proto-declarative) pointing has been related to both the comprehension (Bates, et al., 1979) and production (Camaioni, Castelli, Longobardi, & Volterra, 1991) of language in normally developing children. Butterworth (1995) notes that infants point because they are attracted by interesting events and wish to share them with others. Communicative intent is apparent in these interactions. On the other hand, Desrochers, et al., (1995) found that noncommunicative pointing (proto-imperatives) was not significantly related to the typical child's language development.

The importance of eye contact and its contribution to the communicative use of pointing has also been studied. Head and eye orientation along with pointing are perceptual cues that play an important role in the establishment of joint attention (Tomasello, 1995). By 12-14 months, infants point and simultaneously look to the eyes of the adult in spontaneous gaze alternation (Tomasello, 1995). Pointing evolves further during the second year (Desrochers, et al., 1995). Initially the infant points without looking at the mother, then the infant's pointing is followed by looking at the mother, and finally, the infant learns to look at the
mother before the point which generally occurs by about 18 months of age. This is the normal sequence of development which appears to be disrupted in autism.

c. Imitation

Imitation has been identified as an important early form of social exchange which serves to facilitate early reciprocal social interactions (Klinger & Dawson, 1992). It has been identified as a possible precursor to the development of a theory of mind (Meltzoff & Gopnik, 1993; Rogers & Pennington, 1991; Whiten, 1991). Baron-Cohen (1995) argues that the evidence for an imitation deficit in autism is inconsistent and points out that it is doubtful an imitation deficit alone could lead to a deficit in theory of mind. He views imitation as a possible precursor which may ultimately prove to be irrelevant to the development of mindreading. Hwang and Hughes (1995) note that imitation is one of the early social-communicative skills that should be emphasized before moving on to more advanced forms of social interaction and communication. Regardless of its role in the development of theory of mind, imitation is recognized as an important early social-communicative skill to be mastered before higher level social-communicative exchanges will be possible.

Imitation is a skill which begins to emerge in the earliest stages of infancy. Early imitative play, in which parents repeat the movements, facial expressions, and vocalizations of their infants, has been found to elicit visual interest and smiles in infants of less than six months of age (Uzgiris, 1981). Infants have also been shown to imitate the movements and facial expressions of their caregivers in very early infancy (Meltzoff & Moore, 1977). Heinmann (1989) found that infants with the highest levels of imitative behavior before three months of age engaged in the fewest episodes of gaze aversion, suggesting that early imitative behavior plays a role in early social interaction.
Imitation is said to "epitomize the presence of mutuality," in that it allows one to understand the similarities between oneself and another (Uzgiris, 1981). Early episodes of imitation are said to facilitate reciprocal interaction by maintaining and extending social exchanges. Imitation plays a role in the infant's awareness of having participated in a social exchange and increases the infant's understanding that others have mental states that are knowable (Stern, 1985). The infant's capacity for imitation allows the infant to understand what the other person is experiencing when performing a given action (Meltzoff & Gopnik, 1993).

It has been documented that children with autism display significant deficits in their use of imitation (Curcio, 1978; Dawson & Adams, 1984). Half of a group of preschool children with autism were found to function at the one to four month level in their imitation of actions produced by others (Dawson & Adams, 1984). Imitation skills in this study were positively correlated with social responsiveness, free-play, and language development.

It is not known whether children with autism fail to respond during early infancy to their parent's imitations of their actions since autism is not currently identifiable in infancy and this has not been studied. However, Klinger and Dawson (1992) conclude it is likely that they fail to spontaneously engage in such early social exchanges. Dawson and Galpert (1990) examined the effects of parental imitation of their children's actions over a two week period and found that children with autism showed significant increases in eye gaze toward their mothers during imitation sessions. This indicates that intervention focused on improving the most basic early imitation awareness may hold some promise for children who generally lack interest in sharing their attention with others.

Klinger and Dawson (1992) note that without participation in early imitative interactions, children with autism are likely to display delayed or aberrant development of more advanced reciprocal interactions that provide a foundation.
for communication and an understanding of themselves in relation to others. Klinger and Dawson view imitation as an important socioemotional precursor to the development of language, along with other skills such as gaze and affective sharing which are related to joint attention and may ultimately be related to the development of a theory of mind.

d. Pretense

Pretend play has been described as play involving object substitution and/or the attribution of absent properties to objects or situations (Leslie, 1987). Pretend play is a universal developmental achievement normally present in its simplest form by 14 to 15 months of age (Bretherton, 1984; Butterworth, 1991; Leslie, 1987 & 1991). Pretense emerges in normal development at approximately the same time most joint attention skills are being mastered. Studies show that by 18 months, normal toddlers have begun to pretend in their play and recognize the pretending of others (Dunn & Dale, 1984; Leslie, 1987). The emergence of pretense marks a qualitative change in a toddler’s play.

Alan Leslie (1987) highlights pretense (along with joint attention) as a major milestone in the development of a theory of mind. The ability to pretend presupposes a capacity to form and process internal representations (memories) of mental states. This capacity is fundamental to the child’s ability to conceive of someone else having a different belief than themselves. Leslie (1991) notes that the child’s understanding of pretense in others requires that the child make an inference about the intended message of the other party. This understanding, Leslie argues, requires the same ability to engage in metarepresentation that is needed to understand communicative gestures. To understand gestures as intentional communication, the child must recognize the mentalistic significance of the gesture. The specific intended message has to be inferred. The message is
determined by the intention behind the act, not the act itself (Leslie, 1991). The ability to understand pretense can turn any act into a communicative gesture. Leslie argues that this ability to pretend, which requires an understanding of intention and metarepresentation, is one of the important factors in the evolution of communication and ultimately in the capacity to acquire a theory of mind.

Pretend play is absent or abnormal in autism (Baron-Cohen, 1987; Baron-Cohen, Allen, & Gillberg, 1992; Sigman & Ungerer, 1981; Wing & Gould; 1979). The deficit is highly specific in autism. There is not a general absence of play. Sensorimotor play (exploring the physical properties of objects without regard to function: e.g. banging, waving, sucking, throwing) and functional play (using toys as they were intended) may be present in autism (Baron-Cohen, 1987; Wing & Gould, 1979). Even high-IQ children with autism lack pretend play however, while severely retarded children with Down's syndrome do not (Hill & McCune-Nicolich, 1981). The absence of pretend play in autism has frequently been noted as a potential factor, along with joint attention skills, in the subsequent failure of these children to develop a theory of mind (Baron-Cohen, 1989b, 1991b; Sigman, Mundy, Sherman, & Ungerer, 1986).

2. **Joint attention and language development**

Children establish a variety of social-communicative routines with their caregivers before they begin to engage in productive language usage (Tomasello & Farrar, 1986). The importance of joint attention skills to the development of language has been recognized and investigated for many years in normally developing children. Bruner (1978, 1983) and Scaife and Bruner (1975) argue that joint attention skills are crucial to the child's acquisition of language. The preverbal ability to coordinate attention between objects and people via the
expression and understanding of gestures, such as pointing and showing, have been described as important precursors to normal language development (Bates, 1979; Bruner & Sherwood, 1983; Schaffer, 1984; Sugarman, 1984). The development of gestural joint attention skills in the first year of life has been said to reflect the emergence of social-cognitive processes that provide a foundation for language acquisition (Bates, 1979; Sugarman, 1984; Werner & Kaplan, 1963). Loveland and Landry (1986) hypothesize that early social interactions contribute specifically and necessarily to language development. The ability to share one's attention with others is believed to signal the emergence of the skills that are precursors to more advanced cognitive and language abilities (Bakeman & Adamson, 1984; Bruner, 1977; Sugarman, 1984).

There seems to be little argument that joint attention is related to the typically developing child's learning to use language effectively, but the nature of the relationship has been described in various ways. Tomasello and Farrar (1986) note that joint attention, as a modality used by infants and parents to nonverbally communicate, provides an important platform or scaffold for a child's early language development. Many others have described joint attention in similar, foundational terms (Bates, 1979; Sugarman, 1984; Werner & Kaplan, 1963).

Clark (1982) notes that there seem to be four requirements for speech communication to develop: a) a common background of knowledge, b) an awareness of collaborative processes involved in interacting, c) a sense of how to design our messages for our audiences to understand, and d) a willingness and ability to coordinate and negotiate meanings. None of these requirements are possible without there first being a coordination of "raw" joint attention.

Some researchers, especially those studying the disordered patterns of development seen in autism, have viewed joint attention as interrelated but perhaps developmentally separate from language development (Landry &
Loveland, 1988; Loveland & Landry, 1986; Mundy, 1995). Joint attention is nevertheless seen as important to learning about normal language usage and the functional use of language to communicate with others (Loveland, 1984; Loveland & Landry, 1986).

Wetherby (1986) points out that the notion of "communicative intent" should be a major focus of initial language intervention efforts, especially for children with disordered patterns of communication development. The understanding that a particular vocalization can influence the behavior of another person in a prescribed way is central to the use of language as a means to communicate with others (Wetherby, 1986). Infants' use of gestures with communicative intent has been studied by Bates, Camaioni, & Volterra (1978) and Bruner (1975). Communicative intent is defined as the sender's prior awareness of the effect that a message will have on the addressee and is generally first recognized in infants as they begin to exhibit joint attention skills. Gestural communicative intent and gestural imitation are precursors to the more symbolic use of referential sign language and speech. Shared interactive episodes help the infant determine the adult's attentional focus and thus the intended referent of their language (Bakeman & Adamson, 1984).

Baron-Cohen (1995) notes that even prelinguistic communication is based on the development of what he calls a mindreading capacity. In other words, "mindreading" enables the language faculty, and not vice versa. The limitations of language without an accompanying mindreading system, as in autism, suggests that mindreading may have preceded language in evolution (Baron-Cohen, 1995). This is not to say that mindreading has not also benefitted from the existence of a language faculty, especially at its more sophisticated levels.

Bruner (1983) notes that very young children can perceive of adult acts as requests. They make requests of adults and adults make requests of them, even
prelinguistically. Young infants can correct their own requests to be better understood and reinterpret misunderstood requests by engaging in maneuvers such as looking back at the adult to check their line of regard or facial expression. In other words, they grasp various "pragmatic" functions of language even before they have the language skills to perform these functions linguistically.

Tomasello (1988, 1992) has outlined a comprehensive theoretical account of the role of shared attention in early language development, following the model of Bruner (1977, 1983), Werner and Kaplan (1963), and others. Tomasello and Todd (1983) provide evidence that individual differences in the ability of adult-infant dyads to establish and maintain joint attentional focus is related to the child's subsequent language growth. They conclude that joint attention is critical for the development of early language in normally developing children (Tomasello & Farrar, 1986).

a. Joint attention and language development in autism

The communicative functions used by children with autism appear to be relatively homogeneous among subjects with autism but are quantitatively and qualitatively different from those used by other disabled and nondisabled peers (Wetherby, 1986; Wetherby & Prutting, 1984; Wetherby, Yonclas, & Bryan, 1989). This appears to be true regardless of the variety of communicative functions or the level of semantic sophistication evidenced by the children with autism. The more limited repertoire of communicative functions used by children with autism is viewed as a deviation from normal pragmatic development at all levels of ability.

It has been found that children with autism consistently fail to use interactive labeling and commenting gestures (indicators of joint attention) at the prelinguistic
level nor do they vocalize in the same manner as normally developing infants (Curcio, 1978; Wetherby & Prutting, 1984). This pattern is consistent with the findings of Landry and Loveland (1988, 1989), Loveland and Landry (1986), Mundy, Sigman, Ungerer, and Sherman (1986), and Ricks and Wing (1975). Loveland and Landry (1986) found that children with general developmental delays (including language) exhibited no particular deficit in joint attention skills while children with autism exhibited a joint attention deficit in addition to their language deficit. Adamson and McArthur (1995) compared children with autism to those with severe deficits in expressive language. They report that children with autism engage in significantly less joint attention behaviors than children with comparable language delays when an adult partner attempted to engage them in object-focused play. It has been consistently demonstrated that children with autism are more limited in the types of gestures they use with fewer attention-sharing gestures such as showing and pointing when compared with normal and developmentally delayed peers.

The language usage of children with autism has been viewed as differing from that of developmentally language-delayed children in important ways (Loveland & Landry, 1986). The speech of children with autism is characterized by fewer spontaneous remarks (Cantwell, Baker, & Rutter, 1978) and more unusual features such as echolalia (Prizant & Rydell, 1984). The utterance of a child with autism may be formally correct but fail to function normally, appearing in inappropriate contexts or as stereotyped or echolalic speech.

There may be no significant difference in the grammatical competence of children with autism compared to a language-matched sample with developmental delays (Rutter & Bartak, 1971). It is the pragmatic skills that differentiate children with autism from those with developmental delays (Fay & Schuler, 1980). Their phrase structure and morphology are similar but the two
groups differ in their functional use of language (Bartak, Rutter, & Cox, 1975). Impairment in joint attention may have less effect on how well the syntax and semantics of language are acquired compared with the effect such an impairment has on the pragmatics of communication (Loveland & Landry, 1986).

Developmentally delayed children exhibit specific impairments in language but not in the communicative skills related to joint attention. By contrast, the language of children with autism is further impaired by deficits in joint attention which provides the basis for the effective use of language for communication.

There are individual differences in the social behaviors of children with autism (Sigman & Ungerer, 1984) and in their nonverbal communication skills (Curcio, 1978). Individuals with autism also differ in the rate and quality of their language development. The specifics of the covariance among cognitive, social, and communication variables may be helpful in understanding the patterns of deficits which are at the core of the syndrome (Mundy, Sigman, Ungerer, & Sherman, 1987). There is disagreement about the basis and nature of the language disorder of autism (Wetherby & Prutting, 1984) but many look to the functional, pragmatic aspects of language development and the communicative use of language as centrally involved (Fay & Schuler, 1980).

Various researchers have described the joint attention deficit and language disorder of children with autism. McHale, Simeonsson, Marcus, and Olley (1980) found that subjects with autism engaged in predominantly motoric and gestural behavior with minimal use of symbolic behavior such as speech or signs. It has also been noted that nonverbal children with autism are more likely than other prelinguistic children to use basic motoric/gestural forms of communication without accompanying vocalizations (Wetherby, Yonclas, & Bryan, 1989). Children with autism are reported to be less able than other children to respond to or use attention-directing gestures (Landry & Loveland, 1988). Children with
autism have been found to be poor at interpreting words and gestures used to
direct attention (Mundy, Sigman, Ungerer, & Sherman, 1986) and to have
difficulty using indicating gestures such as pointing and showing (Curcio, 1978;
Sigman, Mundy, Sherman, & Ungerer, 1986).

Curcio (1978) examined how nonverbal children with autism communicate
through gestures. He collected data from observations and teacher
questionnaires and reported that children with autism show some request,
refusal, and greeting gestures but no pointing or showing (joint attention)
gestures. The absence of pointing and showing gestures in children with autism
is described as a striking deviation from normal prelinguistic development (Curcio,
1978) and may be a contributing factor in their difficulty using spontaneous
language for communicative purposes. It has been hypothesized that these
functions may not be entirely absent but may be acquired very late through the
use of immediate and delayed echolalia by some children with autism who
function at more advanced levels of linguistic development (Prizant & Duchan,

Children with autism have difficulty with both gestural and linguistic attention-
directing behaviors, even when language is present. Children with autism
characteristically have severe deficits in each of the areas of language thought to
be developmentally related to joint attention skills, including pronominalization
and the functional use of language (Loveland & Landry, 1986). The disordered
language behaviors reported for children with autism include reversals of first and
second person pronouns, poor functional use of language, echolalia, neologisms,
inappropriate intonation, and primitive syntax (Bloom & Lahey, 1978; Ricks &
Wing, 1975). At higher levels, communicative acts such as irony and sarcasm
are impossible to understand without a developed "mindreading" system (Baron-
Cohen, 1988; Sperber & Wilson, 1986).
What remains unclear is the exact relationship between joint attention skills and language development. At issue is not just the acquisition of vocabulary but the functional use of language to communicate. Research has been conducted to assess the degree to which children with autism are able to communicate gesturally and the functions these gestures serve. Children with autism show major limitations in pointing and showing behaviors, which require an awareness that others have interests and shows an interest in directing another's attention as an end in itself. Children with autism can, however, conceive of others as agents as seen in their more frequent use of instrumental gestures such as touching and taking which function to reach goals directly (Landry & Loveland, 1988).

b. Proto-imperative and Proto-declarative communication

It appears that children with autism may initially acquire the intent to communicate outside the context of social interaction in order to achieve an environmental end such as requesting desired items. Children with autism are more advanced in their use of communication to achieve an environmental end relative to their use of communication to request social interaction. These functions emerge simultaneously in normal development (Wetherby & Prutting, 1984). The appearance of proto-imperative (requesting) and proto-declarative (commenting) gestures has been documented to emerge near the end of the first year of life in normal development (Bates, 1979; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979).

Curcio (1978) reported that schoolage children with autism tended to frequently communicate with teachers in a classroom using nonverbal requests (proto-imperatives), but rarely, if ever, using nonverbal joint attention acts (proto-declaratives). Data consistent with this possible disassociation between the
development of nonverbal requesting and joint attention skills in children with autism were also reported by Wetherby and Prutting (1984) and have more recently been studied extensively by Landry and Loveland (1988), Loveland and Landry (1986), and by Mundy and his colleagues (see Mundy, 1995; and Mundy & Hogan, 1994).

Mundy (1995) distinguishes between social-emotional approach behaviors such as directing the visual attention of others, showing, or sharing objects with others from behaviors such as nonverbal requesting which can be social but does not involve social-emotional rewards or affective expression. Requesting behaviors are viewed as instrumental. Children with autism rarely, if ever, attempt to direct the visual attention of others using the pointing gesture in its proto-declarative (commenting) form such as to point out items of interest (Baron-Cohen, 1989c & 1995; Loveland & Landry, 1986; Mundy, et.al., 1986; Curcio, 1978; Wing, 1976; Sigman, Mundy, Sherman, & Ungerer, 1986). Children with autism may, however, use pointing gestures for other, non-joint-attentional functions such as for requesting objects out of reach (Baron-Cohen, 1989c; Goodhart & Baron-Cohen, 1993). Children with autism show relative facility in the use of eye contact and similar gestures with a social partner to request aid in obtaining an object or event (Curcio, 1978; Loveland & Landry, 1986; McEvoy, Rogers, & Pennington, 1993; Mundy, Sigman, Ungerer, & Sherman, 1986; Wetherby & Prutting, 1984). Proto-imperative pointing is not thought to be specifically impaired in autism (Baron-Cohen, Cox, Baird, Swettenham, Nightengale, Morgan, Drew, & Charman, 1996) to the same degree as proto-declarative pointing. Baron-Cohen (1991a, 1995) concludes that children with autism only seek out others for utilitarian purposes - to get something or to get someone to operate an object for them but not simply to share their interest or the focus of their attention.
Corkum and Moore (1995) have suggested that the affective sharing that occurs in joint attention interactions is inherently rewarding to normally developing children. This type of reward is very different from that which results from requesting behavior. Requesting generally leads to nonsocial rewards such as the acquisition of a preferred item. Joint attention bids, on the other hand, yield primarily social reinforcers such as eye contact, exchange of affect, and the coordination of attention (Mundy, 1995). Research suggests the initiation of nonverbal joint attention acts involves the expression of positive affect to a greater degree than do nonverbal requesting acts for normal and developmentally delayed children (Kasari, Sigman, Mundy, & Yirmiya, 1990; Mundy, Kasari, & Sigman, 1992). Children with autism do not display more affect during joint attention compared to requesting acts. Mundy sees the joint attention deficit in autism as a decreased tendency to initiate episodes of shared positive affect. Baron-Cohen (1993) notes that proto-declaratives have the purely social motive of sharing attention to something, which would seem by itself to be indicative of a child understanding that others have perspectives on things that may differ from their own (Gomez, Sarria, and Tamarit, 1993).

This discrepancy in the development of proto-imperatives vs. proto-declaratives could be important in teasing apart the critical from less critical processes involved in autism (Leslie & Thaiss, 1992; Sigman & Ungerer, 1984). The question remains of whether language can develop in the absence of these early joint attention gestures, and if so, what functions that language can serve.

Several researchers have looked at the relationship of joint attention deficits to the level of language development in children with autism. Individual differences in the development of nonverbal communication skills such as joint attention have been found to be significantly correlated with individual differences in language development in children with autism by some researchers (Mundy,
Sigman, Ungerer & Sherman, 1987; Sigman & Ungerer, 1984). The joint attention behaviors studied involve using gestures such as pointing and showing to coordinate joint visual attention with a social partner.

Deficits in attention-directing gestures (showing, pointing) have been associated with the level of receptive and expressive language for autistic, developmentally delayed, and normal children (Mundy, 1995). Mundy, Sigman, and Kasari (1990) examined the degree to which differences in gestural joint attention skills predict language development among children with autism when compared to children with mental retardation who were matched by IQ in one case and matched by Language Age in the second case. Their results suggest that those children with autism who use joint attention to some extent are more likely to acquire language skills than children with autism who do not use joint attention at all (Mundy, Sigman, & Kasari, 1990). None of the other nonverbal communication variables they studied were predictive of language development. Neither initial language score, mental age, chronological age, nor IQ were significant predictors of language development. Their results indicate that language abilities are related to behaviors such as pointing, the use of eye contact, and gestures used to coordinate attention with a social partner to objects and events. It was also noted that joint attention deficits remained stable over time (13 months).

Mundy and his associates report that nonverbal requesting behavior, which does not involve a joint attention function, is not predictive of language acquisition in children with autism. Thus, these researchers conclude that the association between gestural and verbal communication skills in children with autism may be mediated by joint attention (Mundy, Sigman, Ungerer, & Sherman, 1987) and that joint attention is uniquely important in the development of language among children with autism (Sigman & Kasari, 1995).
Unlike Mundy, et al. (1987), Loveland and Landry (1986) found that spontaneous joint attention behaviors (showing, pointing) were in general not related to mental age, chronological age, or mean length of utterance for children with developmental delays and those with autism. Landry & Loveland (1988) showed that joint attention behaviors are delayed as are language skills for the group with autism but the exact nature of the relationship between joint attention behaviors and language acquisition is still unclear. The joint attention behavior of children with autism is very discrepant with their language level and their mental ages and is not similar to the behavior of other language-matched children without autism (Landry & Loveland, 1988). Children with higher joint attention skills tended to have higher language skills, but many autistic subjects developed some language with very limited skills in joint attention. Others continued to exhibit deficits in joint attention even when their language skills improved. This suggests that language development may not be totally dependent on a certain level of preverbal pragmatic development in the same way as described for normal children. These children may have learned language through means less dependent on understanding varying social and contextual cues. Landry and Loveland (1988) note that joint attention deficits persist in children with autism even if they develop language. They found that joint attention did not improve with increasing mental age, chronological age, or mean length of utterance. They view the development of joint attention skills as a separate factor which combines with language acquisition to contribute to a grasp of pragmatics more than to semantics or syntax. Landry and Loveland (1988) did not answer the question of whether the joint attention deficits were amenable to intervention but evidence suggests that joint attention deficits persist and can still be observed in much older children with autism who have developed a considerable amount of language. Children with autism show long-term deficits in preverbal
communication as well as in the pragmatics of linguistic communication. Loveland and Landry studied only verbal children with autism which may not have provided a completely representative sample of the autistic spectrum.

Stone and Caro-Martinez (1990) found that communication patterns varied as a function of the child's cognitive level and severity of autism. The deficits in joint attention were most striking in the subgroup of children who did not use speech but persisted even in those subjects who acquired some speech.

There appears to be some disparity with respect to the relationship of joint attention skills to nonverbal IQ, chronological age, and language level between groups of children with autism versus those with developmental delays. The interrelationships of these variables over development remains to be specified, as does the contribution of joint attention to communicative competence (Loveland & Landry, 1986). Landry (1995) points out it is possible for a child to have good joint attention skills and little language or a large amount of language and poor joint attention skills. Landry and Loveland (1988) interpret this to mean that joint attention and language may be separate but related developmental issues rather than a part of the same sequence of development.

Individual differences in the variables associated with language acquisition may differentiate which children with autism have the best prognosis (Lotter, 1974). The correlates of language, if they can be specified, may aid in the design of language intervention programs for children with autism. It is still not clear to what extent joint attention skill is necessary for language to develop. Language may be able to develop to some degree without joint attention. When joint attention is deficient, language may be more likely to serve instrumental than social purposes. The relationship of language development to various levels of joint attention development and to the pragmatic use of language requires further investigation.
3. Joint attention and cognitive ability in autism

Joint attention disturbance appears to be present to some degree in young children with autism regardless of their intellectual level (Mundy, Sigman, & Kasari, 1994). Although the majority of children with autism also have mental retardation (Wing, Yeates, Brierley, & Gould, 1976) this in itself is not a sufficient explanation for their social impairments. Some children with autism have normal IQs despite their social deficits while children with mental retardation are generally socially competent relative to their mental ages (Gibson, 1978). A large majority of children with autism display deficits in joint attention while very few children with mentally retardation display comparable deficits. Research has documented that the joint attention disturbance is specific to autism and not a more general effect of mental retardation or communication disorder (Baron-Cohen, 1989a; Landry & Loveland, 1988; Loveland & Landry, 1986; McEvoy, Rogers, & Pennington, 1993; Mundy, Sigman, Ungerer & Sherman, 1986; Mundy, Sigman, & Kasari, 1994; Wetherby, Yonclas, & Bryan, 1989).

Children with autism show strengths in skills that can be learned through trial-and-error problem solving, such as tool use and combinatorial play, and weaknesses in skills that need to be learned through observation, such as symbolic play and conventional gestures (Wetherby & Prutting, 1984). Subjects with autism may provide an opportunity to observe the effects of cognition on language acquisition in the relative absence of social influences. Wetherby and Gaines (1978) found that for all subjects with autism, their stage of nonverbal cognitive development exceeded that of their language development. Wetherby and Gaines note that further cognitive development may not be the only factor necessary for advances in language development as cognition and language may
vary in their relationship to one another. Factors such as joint attention skill also need to be considered.

McHale, Simeonsson, Marcus, and Olley (1980) found a general relationship between IQ and certain aspects of communication. Higher functioning children demonstrated more frequent use of symbolic forms of communication such as speech and signs and more frequent interactive communication. The significance of joint attention skills to these areas of development was not clearly defined.

Loveland and Landry (1986) found that spontaneous joint attention measures were not related to chronological age or mental age for their subjects with developmental delays or autism. However, their research looked at a fairly narrow range of skills and was conducted with only verbal subjects who may have already mastered many of the "prerequisite" joint attention skills being assessed, leaving little likelihood of finding a statistically significant relationship between cognitive functioning and joint attention skill. Mundy, Sigman, and Kasari (1994) report that differences in IQ are related to the sophistication of the joint attention behaviors used by subjects with autism.

Despite difficulties in identifying and delineating the degree of correlation between joint attention disturbance and cognitive functioning, the joint attention deficit is assumed by many researchers to reflect some form of cognitive disturbance (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bretherton, 1991; Bruner, 1975; Baron-Cohen, 1989a&c; Leslie, 1987). Deficits in joint attention are believed to have serious consequences for the later development of more advanced mental concepts such as recognizing the beliefs and desires of others which is key to developing a theory of mind (Baron-Cohen, 1989a&c). Baron-Cohen (1990) notes that children with autism are clearly disordered in their acquisition of the skills which lead to a theory of mind. They understand desire earlier than belief as do normal children. Children with autism find imagination
and pretense more difficult to understand than desire which is different than normally developing children who understand imagination and pretense before they understand desire (Baron-Cohen, 1991a). Autism may involve a core disturbance in the capacity for representational thought (Baron-Cohen, 1989a; Leslie, 1987). Children with autism may fail to develop aspects of cognition that support the awareness that individuals can share attention, share affect, and ultimately share thoughts and beliefs as in theory of mind. The influence of these deficits on overall cognitive ability is unclear.

A related but alternative cognitive hypothesis suggests that some functions subserved by the frontal lobes may be involved in the etiology of autism (Hughes & Russell, 1993; Ozonoff, Pennington, & Rogers, 1991; Rumsey, 1985). The frontal lobes are believed to mediate executive functions such as attention regulation. A disturbance of the frontally mediated executive processes is viewed by some (Hughes & Russell, 1993; Ozonoff, Pennington, & Rogers, 1991; Rogers & Pennington, 1991) as central to the developmental psychopathology of autism. Mundy (1995) notes that the joint attention disturbance in autism may be secondary to a disturbance in the capacity for the flexible deployment of attention, the inhibition of behavior, and other cognitive executive functions (McEvoy, et al., 1993; Rogers & Pennington, 1991). However, he notes that it may be premature to conclude that these are the only, or even the most important, characteristics of impaired neurological functioning that are reflected in the joint attention deficits of autism. Mundy (1995) also notes the importance of other social-emotional factors which must be considered, since he views joint attention as a social, affective experience, not a purely cognitive one.

It appears that many children with autism have a disordered profile which allows them to function at a relatively more advanced level in nonverbal, noncommunicative skills than in their joint attention skills. They may function at a
more advanced level in language development relative to their joint attention skills as well, especially where language is used for instrumental, but not social, purposes. It is not known if there is a cognitive ceiling above which a child cannot progress without basic joint attention skills. The severity of the joint attention disturbance and its impact on the cognitive functioning of subjects could prove to be a significant issue for diagnosis, prognosis, and treatment. Stone and Caro-Martinez (1990) point out that the relationship between developmental characteristics such as cognitive level and spontaneous communication have rarely been investigated. The nature of the relationship of joint attention deficits to a child's age and level of cognitive functioning is still unclear. Further research on the developmental aspects of joint attention appears to be warranted (Mundy & Sigman, 1989; Prizant & Wetherby, 1987; Tager-Flusberg, 1985).

C. Summary of previous research and its relationship to the proposal

The importance of joint attention and its relationship to normal child development has been studied since the 1970s (Bruner, 1975). Baron-Cohen, Mundy and others have recently renewed interest in joint attention as an apparent early precursor to the development of a theory of mind in children with autism. Joint attention deficits, along with deficits in pretend play, affect individuals with autism at all levels of ability and are believed to contribute to the failure of these children to develop the representational abilities needed for the development of a theory of mind (Baron-Cohen, Leslie, & Frith, 1985).

Joint attention has recently been identified as an important diagnostic indicator of autism at very early ages. The early emergence of joint attention skills in normally developing children may provide a yardstick by which to measure the developmental impairment of children who might not otherwise be
identified as autistic until much later in their preschool years which allows greater opportunities for early identification and intervention (Baron-Cohen, Allen, & Gillberg, 1992).

Different developmental outcomes may be associated with individual differences in the acquisition of joint attention skills in individuals with autism (Dunham & Moore, 1995). The relationship of joint attention disturbance to cognitive ability, language development, and severity of autism have been investigated with mixed results depending on the specific skills measured and the nature of the subject population. Studies to date have relied on relatively small sample sizes with a fairly restricted range of skills and may not fully represent the impact of joint attention disturbance on these global developmental issues for children with autism.

The impact of the joint attention disturbance on the prognosis for children with autism is not clear. Thus far, the severity of the joint attention disturbance has been related to the severity of the social disturbance of autism (Mundy, 1995) but has not been clearly related to the overall severity of autism (McHale, Simeonsson, Marcus, & Olley, 1980). The current study considers the relationship of the joint attention deficit to the overall severity of the children's autistic symptoms.

Although joint attention deficits have been described as somewhat independent of IQ (Frith, 1982) and of more importance to understanding social, emotional, and motivational factors related to autism (Sigman & Kasari, 1995), the nature of the relationship to overall cognitive functioning is unclear. This study looked at the severity of the joint attention deficit as it relates to the nonverbal intelligence level of children with autism.

Joint attention between a child and an adult has been said to form the social context of normal language acquisition (Bruner, 1978). Studies relating to joint
attention and the pragmatics of language are believed to have important implications for the planning of intervention programs for children with autism (Landry & Loveland, 1988). By definition, the joint attention disturbance of autism eliminates many of more social functions of communication (showing, sharing, commenting) even in the presence of language. Individual differences in joint attention development may be an important prognostic indicator of language development (e.g. Loveland & Landry, 1988; Mundy, Sigman & Kasari, 1990) but this relationship is not clear. At issue is whether language can develop, and to what level, in the absence of precursor skills such as pointing and showing. This study attempts to more clearly define the relationship between the degree of joint attention disturbance compared to the level of language development among children with autism at varying ages and levels of ability. It is hoped that a better understanding of the relationship between these variables could lead to improvements in intervention strategies.

It is also important for researchers to consider that the context of social interaction influences communicative behavior. Controlled experimental situations unfamiliar to the child have been used for most of the joint attention research on children with autism. These measures may distort the profile of communicative behaviors displayed by the children with autism. Such a distinction could have an effect on the results obtained and the inferences which can be drawn. Cantwell, Baker, and Rutter (1978) found that the abnormal language of subjects with autism was more evident in an unfamiliar environment when there are high cognitive or linguistic demands and Wetherby (1986) concluded that social communicative behaviors should be studied in naturally occurring interactions in order to help elucidate how these behaviors function for the child with autism. It is thus important for research to examine the joint attention behavior of children with autism in naturally occurring situations.
involving familiar persons or caregivers. This study attained a more natural view of each child's joint attention skills and other autistic features than might be attained through artificial evaluation procedures by relying on questionnaires completed by parents and staff members familiar with each child.

Baron-Cohen (1991a) concludes that individuals with autism are deviant as well as delayed in their developmental sequences. The disordered nature of autistic development and the varied emphasis on particular joint attention behaviors has led to inconsistencies in the research findings. The questionnaire developed for this study includes a broad range of joint attention behaviors including related measures such as pretense in order to get a better sense of the relationships between these skills and other developmental and behavioral characteristics of autism.
Chapter 3

Collection of Data

A. Sample description

Subjects were selected from the students enrolled in the Southeastern Cooperative Educational Program's (SECEP) Autistic Children's Program. This is a regional day school program in southeastern Virginia which serves students with autism from several local public school districts. The student to staff ratio averages 6/2 in the classrooms. The SECEP program is designed to serve students who exhibit characteristics of autism to a degree that cannot be accommodated in a less restrictive educational setting. The students in the program represent the full range of the autistic spectrum with a tendency for more severely autistic students to remain in the program at higher ages. The majority of the students function in the range of mental retardation although many earn nonverbal IQ scores above this range. Students are routinely evaluated by the SECEP Evaluation Team for programming purposes, for making placement decisions, and for their triennial special education reviews. The students have generally been receiving services through the Autistic Children's Program for at least one year before they are evaluated by the SECEP Evaluation Team. Students who received the necessary evaluations to be considered for inclusion in this study are believed to represent a fairly random cross-section of the students in the SECEP program. The available subjects ranged in age from two to 22.

Subjects were selected for inclusion in the study based on the availability of the necessary data. Students were selected if they had received a psychological
evaluation within the last year which included the administration of the Leiter International Performance Scale (1948/1979). This instrument is frequently administered to students with severe communication impairments such as that seen in autism in lieu of a more general, language-based intelligence test. The Leiter yields a nonverbal mental age and a nonverbal IQ score. The Leiter has recently been revised (1997) but the differences in the two versions of the test are considerable and may have compromised the analysis of results if subjects tested with the revised instrument were included. Since the revised Leiter is just now coming into popular use, a much larger sample was available if results were taken from recent administrations of the original Leiter. Future replications of this study could obtain results from the revised Leiter or other instruments as appropriate.

Data from language testing were obtained from the Speech/Language Assessment Report completed for the evaluation team at the time of each student's comprehensive evaluation. Receptive and expressive language ages were obtained for each subject. The tests most commonly administered to obtain these language ages were the Preschool Language Scale - 3, the Peabody Picture Vocabulary Test- Revised (PPVT-R), and the Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R).

The number of subjects available was dependent on the availability of the needed Leiter scores and language data for each subject. Approximately 50 to 60 students are typically evaluated using the Leiter during a given school year. Parental consent was obtained to access the data and parental cooperation was needed for completing the parent copy of the Social Interest Inventory (SII) which was developed for the study. Teacher cooperation was also needed for completion of the Social Interest Inventory. The Childhood Autism Rating Scale (CARS) was completed by the Liaison staff member who works with each child's
SECEP classroom. All children for whom the needed data could be obtained were included in the study. The data were collected for analysis and then coded to maintain the confidentiality of the subjects' records.

B. Data gathering

Parental permission was obtained to access the students' test records and to complete the questionnaires. Students selected for the study had received a psychological evaluation within the calendar year prior to the start of the study which included the administration of the Leiter International Performance Scale (1948/1979). In addition to the Leiter IQ score, data from language testing was obtained from the Speech/Language Assessment Report completed for each child's comprehensive evaluation. Language testing was generally completed within the same month as the Leiter administration but in no cases was there more than three months difference between the Leiter administration and the language testing. A Receptive and Expressive language age was obtained for each subject although not all subjects were administered the same language tests. Those subjects for whom the PPVT-R and/or EOWPVT-R were administered were ultimately selected as the subjects for correlations that included receptive and expressive language skills.

Parents were asked to complete the Social Interest Inventory (SII), an instrument designed for this study. The student's current classroom teacher was also asked to complete the SII. Parents were given the option of having their child's teacher receive a copy of their Parent ratings on the SII for classroom programming purposes after the data collection was complete. The results collected for the study were coded and recorded anonymously. Overall scores were obtained for the Parent and Teacher copies of the SII. SII scores were also broken into categories or clusters of specific early social skills related to Joint
Attention such as Social Referencing, Imitation, Pointing, Pretense, and the use of Proto-imperative versus Proto-declarative forms of communication.

Every SECEP classroom has a Liaison staff member who works with the classroom team, the family, and community agencies as appropriate for each child's needs. The Liaison for each participating child was asked to complete the Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVillis, & Daly, 1980; Schopler, Reichler, & Renner, 1986) for that child. The Liaison staff members are school psychologists, school social workers, and educational specialists with experience in evaluating children with autism and in using the CARS. In addition to their first-hand knowledge of the child in the classroom, the Liaison typically participates in the evaluation of their assigned students as a member of the evaluation team. It is believed that the Liaison staff members were able to provide the most reliable CARS scoring for the children involved in the study. CARS scores were obtained for each subject.

C. Instrumentation

The Social Interest Inventory

The Social Interest Inventory (SII), which was developed for this study (see Appendix A), is a compilation of questions emerging from the research on joint attention skills in normal development and in autism. The items are intended to survey the various skills which have been identified in the research as evidence of early social relating and joint attention skill development and possible precursors to the development of a theory of mind. Some of the items are similar to those on the Checklist for Autism in Toddlers (Baron-Cohen, Allen, & Gillberg, 1992). A broad perspective was taken in developing the survey in order to include as many skills as possible which have been described by previous researchers as measures of joint attention or related skills. An initial pool of 30
items was reduced to the present 21 item scale following field testing. Items which were difficult for scorers to interpret or which contained content judged too similar to other items were discarded.

The items on the SII have been grouped into specific skills clusters with some items included in more than one cluster. A scoring profile showing the item groupings for each skills cluster is included in Appendix A. The Joint Attention cluster includes items which are almost always included in definitions of joint attention. The Social Referencing and Pointing and Proto-declarative communication clusters also include many items which would be included as measures of joint attention by most researchers but which can also be described by their more specific SII cluster names. In addition, the Imitation cluster score includes items which are often considered measures of joint attention. The skills measured in the Pretense and Proto-imperative communication clusters are typically viewed as separate from, but related to, joint attention skill development.

The SII items are scored on a four point scale (0, 1, 2, 3) indicating that the skill rarely or never occurs, sometimes occurs, frequently occurs, or nearly always occurs. Results from field testing of the SII indicated that the four point scale provided better discrimination than a Yes/No or three point scale. Choices greater than four did not appear to increase the sophistication of the responses and seemed to lead to greater scorer bias. Total scores for the SII as well as scores for particular skill clusters were considered in the final analysis of results.

**The Leiter International Performance Scale**

The Leiter International Performance Scale (1948, 1979) was used to obtain a nonverbal IQ for each subject included in the study. This instrument is a nonverbal means of assessing cognitive ability which is often used with children who are deaf or who have language and communication difficulties such as in
autism. It is a visual test which can be presented nonverbally by the examiner and which does not require verbal mediation or response from the subject. The items are administered in a very structured, repetitive format which is well-suited to students with autism. The early items consist of basic matching (e.g., colors, shapes) and become more abstract (e.g., analogies, patterns, concepts) at higher age levels. The Leiter has been found to have test-retest reliabilities in the .80s and .90s (Black, 1973; Spellacy & Black, 1972). Correlations with other intelligence tests are reported to range from .37 to .92 (Ratcliffe & Ratcliffe, 1979), the highest correlations being seen with other performance scales. E. Werner reviewed the Leiter in the Sixth Mental Measurements Yearbook (1965) and noted the high correlations with other individual intelligence tests and the promise the instrument showed as a potentially culture-fair instrument. She also noted the potential for the testing of many children who could not be properly evaluated by more general, language-based instruments which has led to the popularity of the scale for use in evaluating children with autism. The need for better norms, a better scoring system, and the lack of evidence for the predictive validity of the scale are noted as weaknesses. The norms for the scale are outdated and have been found to underestimate children's intelligence (Leiter, 1959). Despite these flaws, the Leiter is one of the few instruments which has shown promise in evaluating students with severely delayed and disordered communication profiles and those having autism. The Leiter continues in popular use with language-impaired and autistic subjects as evidenced by numerous recent studies (e.g., Atkinson, Bevc, Dickens, & Blackwell, 1992; Harrison & Barbasz, 1991; Holroyd & Baron-Cohen, 1993; Lewis & Lorentz, 1994; Swisher & Plante, 1993; & Szatamari, Archer, Fisman, & Streiner, 1995). The norming problems with the Leiter should not seriously affect the results of this study since the scores which were used should be able to indicate each student's relative
position on this nonverbal scale regardless of the normative interpretation of the score for other purposes.

The recently published Leiter International Performance Scale-Revised (1997) is a new, more comprehensive nonverbal battery which may overcome many of the deficiencies of the original Leiter. No studies have been published to date using the Leiter-R with autistic subjects. It is not known if the new Leiter-R scale will be able to meet the needs of this population at the same level as its predecessor.

The current study used the results of subjects tested with the Leiter rather than the Leiter-R since the Leiter-R is just coming into popular use and a much larger sample was available with the older test. The differences in the two versions of the test are considerable and it may have compromised the results to incorporate subjects tested with the newer Leiter-R. The use of the Leiter-R would be an important consideration for any future replications of the study.

**The Childhood Autism Rating Scale**

The Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980; Schopler, Reichler, & Renner, 1986) is a questionnaire that was completed by each subject's classroom Liaison to get an estimate of the degree of severity of the autistic characteristics exhibited by the subject. The CARS evaluates 15 dimensions of behavior which may be affected in autism and gives a total score which estimates the overall severity of the autistic characteristics. The CARS is intended for subjects age two and above and its stated purpose is to identify children with autism and to distinguish them from developmentally handicapped children without autism. A copy of the CARS questionnaire is included in Appendix A.
The CARS has "a considerable amount of research to support its validity and reliability" (Gillberg, 1989, p. 142). The authors of the CARS report internal consistency ratings of .94. Interrater reliability is reported at .71. Test-retest reliability with a one year interval is reported at .88. Validity between CARS scores and clinical ratings ranges from .80 to .84. Parent ratings compared with those of professionals yielded a coefficient of .75. Validity ratings of .81 were obtained when the CARS was rated by a variety of professionals with little training in autism and scores were compared with "expert clinical directors." The CARS was reviewed by B. Prizant in the Eleventh Mental Measurements Yearbook (1992). He concludes that the CARS appears to be the best instrument available for the initial classification of children suspected of having the autistic syndrome. Weaknesses of the scale include a lack of weighting of symptoms and the inclusion of some items that would not be considered necessary or sufficient for a diagnosis of autism on their own. The CARS also assumes some knowledge of developmentally appropriate functioning in the domains assessed and may not be appropriate for untrained observers. This should not be an issue in the current study as the Liaisons who completed the CARS have had training in child development in addition to their daily experiences in working with children having autism.

More recent reviews of the available instruments for the classification of autism have ranked the CARS as highly effective for diagnosis (Gillberg, Nordin, & Ehlers, 1996; Chung, Smith, & Vostanis, 1995). The CARS has also demonstrated good internal consistency (Sturmey, Matson, & Sevin, 1992) and has been found to successfully discriminate between autism and psychosis (Matese, Matson, & Sevin, 1994). The CARS correctly identified 98% of the autistic subjects in a study by Eaves and Milner (1993) which was the highest success rate of the scales being compared. It also identified 69% of the "possibly
autistic" subjects as autistic. DiLalia and Rogers (1994) have identified three major domains of the CARS which may be useful for programming and treatment considerations. These include Social Impairment (SI), Negative Emotionality (NE), and Distorted Sensory Response (DSR). The scores on the Social Impairment items were particularly relevant in distinguishing between milder cases of pervasive developmental disorder and autism in this study.

**Language Testing**

The receptive and expressive language ages of each subject were obtained from a speech/language assessment report which was completed on each subject, generally within the same month as the Leiter administration. In no case was the language testing more than three months apart from the Leiter administration. Scores from instruments such as the Preschool Language Scale - 3rd Edition, the Peabody Picture Vocabulary Test - Revised (PPVT-R), and the Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R) were typically available for each subject. For benefit of consistency, only subjects with scores on the PPVT-R and/or the EOWPVT-R, which were the most frequently given language tests, were included in those aspects of the study which required an analysis of the language level of the subjects.

**D. Research design**

This is a correlational study designed to investigate the relationships between a measure of the early social skills of the subjects with autism and their nonverbal IQs, receptive and expressive language age scores, and a measure of the severity of their autism. The relationships between these variables was
examined along with a determination of the strength and patterns of those relationships.

Data were collected from standardized tests available in the students' records and by questionnaires completed by the students' teachers, parents, and classroom Liaison. The measures compared for each student include:

a. raw scores from the Social Interest Inventory (SII). Total scores were available for each subject along with scores for specific skills clusters within the SII. Both Teacher ratings and Parent ratings on the SII were available for each subject,

b. raw scores on the Childhood Autism Rating Scale completed by each subjects' classroom Liaison,

c. nonverbal IQ scores from a recent administration of the Leiter International Performance Scale,

d. receptive and expressive language age scores from recent administrations of the PPVT-R and the EOWPVT-R.

Results were analyzed to determine what relationships exists between the various scores obtained. The SII Total and cluster scores for Parents and Teachers were correlated with measures of each subject's severity of autism (CARS), to the nonverbal IQ of the subjects, and to the receptive and expressive language ages of the subjects. Comparisons were made between parent and teacher ratings on the Social Interest Inventory. Specific skills clusters on the SII were compared with one another to ascertain the pattern of development of the early social skills being assessed in reference to a sample of children with autism.
E. Specific research questions

This research explored the relationships that exist between the level of early social skill development and the nonverbal IQ, receptive and expressive language ability, and the severity of autism of the subjects. Specifically, the following research questions were explored:

1. Is joint attention skill development related to the level of nonverbal cognitive ability of subjects with autism?

2. Is joint attention skill development related to the receptive and expressive language abilities of subjects with autism?

3. Do subjects with autism engage in more proto-declarative than proto-imperative communication?

4. Is joint attention skill development related to the overall severity of autistic symptoms?

5. Do joint attention, nonverbal IQ, or language ability predict the severity of autism?

6. Are higher levels of joint attention and other early social skills development reported by parents or teachers of students with autism?
F. Data analysis

This research entailed the use of Pearson r correlations and multiple regression to evaluate the relationships between the variables. Specifically, the scores on the SII were correlated with the other independent variables in order to determine the relationship of the severity of the early social skill deficits of the subjects to their nonverbal IQs, receptive and expressive language age scores, and the severity of their autism on the CARS. The relationship of the variables to one another was investigated singly and in combination. Specific skill clusters from the SII were also compared to the nonverbal IQ, language ages, and severity of autism of the subjects to help determine the developmental patterns and relationships that may exist. In addition, t tests were used to compare measures such as Teacher vs. Parent ratings on the SII.

G. Ethical considerations

Subjects in this study were at minimal risk from the research in that their inclusion in the study was based on their participation in routine assessment procedures which would occur even in the absence of the research. The addition of the Social Interest Inventory, completed by the students' teachers and parents, was an extra feature of the usual evaluation process. The SII provides a more formal means of assessing behaviors which would typically be considered to a lesser or more informal degree during the evaluation process. It is believed that the responses to the Inventory may be helpful in making programming decisions for the students, independent of the use of the results for the research study.

Parental consent was obtained for the collection of the data and the completion of the Teachers' and Liaison's questionnaires. Parental cooperation
was required for the completion of the parents' questionnaires. Information was obtained from the child's educational records without the need to personally identify the students following the completion of the data collection. Parents were informed of the intended use of their child's test scores with a brief explanation as to the nature of the study and the safeguards in place to ensure that their child's results would be used in a confidential manner. Parents of participating students will be offered a summary of the research findings.

Steps were taken to ensure that the subjects' data was handled with confidentiality. Individual student's scores were safeguarded by coding them anonymously as they were collected and deleting the child's personal information from the scoring records.

Consent forms and samples of all questionnaires are included in Appendix A.
Chapter 4
Results

A. Summary of Data

1. Subjects

A total of 66 subjects were eligible for participation in the study based on the availability of data from the administration of the Leiter International Performance Scale within the year prior to the start of the data collection. A recent speech and language assessment was also required. Three additional subjects who would have been eligible for the study had moved and were unavailable.

The Social Interest Inventory (SII) and parent permission forms were mailed to the families of the 66 eligible subjects. A total of 31 parent responses were received after the first mailing. A reminder card was mailed to the parents of the remaining subjects after three weeks and an additional seven parents responded. Following receipt of the parent permission forms and completed parent Social Interest Inventories, a copy of the SII was forwarded to each participating child's classroom teacher for completion. The Liaison for each subject's classroom was also asked to complete the Childhood Autism Rating Scale (CARS) at this time. Data were collected on a total of 38 subjects from the initial pool of 66. The age range of the subjects was from 4 years, 9 months to 18 years, 7 months. There were 34 male subjects and four female subjects. This ratio reflects the increased incidence of males in the Autistic Children's Program and the population of autism as a whole, although most estimates of the female/male ratio are not quite as high (DSM-IV reports ratios of 1/4 to 1/5).
2. Leiter IQ scores

The nonverbal IQ data for the subjects is presented in table 4.1.

Table 4.1 Nonverbal IQ on the Leiter International Performance Scale

<table>
<thead>
<tr>
<th>Nonverbal IQ</th>
<th>Frequency</th>
<th>Cum. Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>1</td>
<td>2.6</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>30</td>
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<td>7.9</td>
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<td>1</td>
<td>13.2</td>
</tr>
<tr>
<td>38</td>
<td>1</td>
<td>15.8</td>
</tr>
<tr>
<td>43</td>
<td>1</td>
<td>18.4</td>
</tr>
<tr>
<td>44</td>
<td>1</td>
<td>21.1</td>
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<td>26.3</td>
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<tr>
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<td>55</td>
<td>1</td>
<td>34.2</td>
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<td>103</td>
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<td>94.7</td>
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<tr>
<td>109</td>
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<td>97.4</td>
</tr>
<tr>
<td>129</td>
<td>1</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The mean IQ score for the subjects on the Leiter International Performance Scale was 64.3 with a median score of 60.5. The standard deviation of the distribution was 24.2. The mean and median scores fall within the range of mild mental retardation. The overall range of scores was very broad with a low of 18, which indicates severe to profound levels of mental retardation, and a high of
129, which is in the very superior range. The range of nonverbal mental ages for
the subjects was from 2 years, 4 months to 7 years, 9 months.

Sixty-three percent of the subjects earned Leiter nonverbal IQ scores which
fell within the range of mental retardation. This sample is believed to be a good
representation of the overall population of children with autism, where estimates
of comorbid retardation generally range from about 75% to 80%. A higher
percentage of these subjects would have scored within the range of mental
retardation if administered a more general, language-based intelligence test
rather than the Leiter. Only one subject's nonverbal IQ score (129) was above
the average range. This was a young student with moderate to severe
characteristics of autism and significant language delays who was able to perform
well on the concrete matching tasks at his age level of the Leiter. He was not as
atypical of the autistic population as his Leiter score might appear.

3. Childhood Autism Rating Scale Scores

The Childhood Autism Rating Scale (CARS) was completed by the SECEP
Liaison for each subject. The range of possible scores for this instrument is from
15 to 60, with higher scores indicating the presence of more severe autistic
features. The range of CARS scores obtained on the 38 subjects was from 20.5
to 47. Total scores on the CARS are grouped by the authors of the scale into
categories of severity. Scores of less than 30 are considered to be non-autistic
although some characteristics of Pervasive Developmental Disorder may be
present. Seven of the 38 subjects in this study had scores of less than 30 on the
CARS. However, these subjects have been identified as having sufficient autistic
features to warrant placement in the Autistic Children's Program. These subjects
should represent the mildest end of the autistic spectrum and were retained in the
study to allow for the full range of the spectrum to be considered. The remaining
31 subjects scored in the autistic range on the CARS with 16 subjects scoring at or above a score of 37 which places them in the severely autistic range on the CARS. A summary of the CARS data is presented in Table 4.2.

<table>
<thead>
<tr>
<th>CARS Score</th>
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<tbody>
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<tr>
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</table>

The mean score on the CARS was 35.6 with a median score of 36.0. The standard deviation for the CARS scores was 6.5.

4. Language Scores

Language testing was completed on all 38 subjects near the time of their Leiter administration. There were 25 subjects who were administered the
Peabody Picture Vocabulary Test-Revised (PPVT-R), which is a measure of receptive vocabulary development. There were 24 subjects who were administered the Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R), which is a measure of expressive vocabulary development. The data for these subjects are presented in Tables 4.3 and 4.4. Data for the PPVT-R and EOWPVT-R are reported in language ages since not all subjects were able to perform within the available range of standard scores provided for these tests.

Table 4.3  PPVT-R Scores in Months  

<table>
<thead>
<tr>
<th>PPVT-R Score</th>
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<td>36</td>
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<td>52</td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>56</td>
</tr>
<tr>
<td>39</td>
<td>2</td>
<td>64</td>
</tr>
<tr>
<td>40</td>
<td>1</td>
<td>68</td>
</tr>
<tr>
<td>41</td>
<td>1</td>
<td>72</td>
</tr>
<tr>
<td>43</td>
<td>1</td>
<td>76</td>
</tr>
<tr>
<td>44</td>
<td>1</td>
<td>80</td>
</tr>
<tr>
<td>45</td>
<td>1</td>
<td>84</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>88</td>
</tr>
<tr>
<td>54</td>
<td>1</td>
<td>92</td>
</tr>
<tr>
<td>84</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>109</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

The range of age scores for the PPVT-R was from 25 to 109 months with a mean of 40.2 months and a median score of 36 months. The standard deviation for the PPVT-R scores was 18.9. The range of age scores for the EOWPVT-R
was from 27 to 137 months with a mean of 49.1 months and a median of 44.0 months. The standard deviation for the EOWPVT-R scores was 23.4.

<table>
<thead>
<tr>
<th>EOWPVT-R Score</th>
<th>Frequency</th>
<th>Cum. Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>28</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>33</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>33.3</td>
</tr>
<tr>
<td>38</td>
<td>1</td>
<td>37.5</td>
</tr>
<tr>
<td>40</td>
<td>1</td>
<td>41.7</td>
</tr>
<tr>
<td>41</td>
<td>1</td>
<td>45.8</td>
</tr>
<tr>
<td>44</td>
<td>2</td>
<td>54.2</td>
</tr>
<tr>
<td>49</td>
<td>2</td>
<td>62.5</td>
</tr>
<tr>
<td>52</td>
<td>1</td>
<td>66.7</td>
</tr>
<tr>
<td>54</td>
<td>1</td>
<td>70.8</td>
</tr>
<tr>
<td>55</td>
<td>1</td>
<td>75.0</td>
</tr>
<tr>
<td>59</td>
<td>1</td>
<td>79.2</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
<td>87.5</td>
</tr>
<tr>
<td>68</td>
<td>1</td>
<td>91.7</td>
</tr>
<tr>
<td>82</td>
<td>1</td>
<td>95.8</td>
</tr>
<tr>
<td>137</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

Minimally verbal or nonverbal subjects were administered either the Nonspeech Test, the Preschool Language Scale, or the Birth-to-Three Developmental Scale. The language age scores of the subjects who were not able to take the PPVT-R or EOWPVT-R ranged from 10 to 37 months. The average receptive language age score for this group was 22.3 months and the average expressive language age score was 20.33 months. Subjects who lacked the verbal ability to obtain a basal on the PPVT-R or the EOWPVT-R were not included in some analyses of the relationships of language skills to other variables in the study because the differences between the language instruments did not allow the results to offer useful comparisons. The exclusion of these subjects from some aspects of the study eliminated nonverbal subjects and those

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with the lowest language ages from the correlations of language age scores to the other variables. However, comparisons were made between the mean scores of subjects with and without verbal language on the SII measures.

5. Social Interest Inventory Scores

Scores on the Social Interest Inventory (SII) are reported separately for Parent-completed surveys and Teacher-completed surveys. The Social Interest inventory has a total of 21 items with each item having a possible score of zero to three points. A score of zero on an item indicates that a particular social skill is rarely or never observed. A score of one indicates that the skill is sometimes observed when expected. A score of two indicates that the skill is often observed, and a score of three indicates that the skill is nearly always observed when it would be expected. Higher scores are intended to represent a more advanced degree of social interest and skill. The possible range of scores on the SII is zero to 63. The actual range of scores obtained was 7 to 47 for the Teacher-scored SII and 7 to 52 for the Parent-scored SII. The total SII score is made up of the total of the raw scores for the 21 items.

In addition to the total SII score obtained for each subject, the SII is broken into seven clusters of early social skills which are associated with the development of joint attention and theory of mind in the literature. These skills are generally described as emerging at about the same time as basic joint attention skills in the normal course of development. Detailed descriptions of these skills and their relevance to early social skill development is provided in Chapter 2. Each SII cluster score consists of three or four items with some items included in more than one cluster. For example, pointing to share an interest is included in the Joint Attention cluster as well as the Pointing cluster. The Social Referencing and Imitation clusters each have three items for a total of nine
possible points in each cluster. The other SII clusters include Joint Attention, Pointing, Proto-imperative (requesting) communication, Proto-declarative (social/commenting) communication, and the use of Pretense. These latter five clusters each have four items included in their scoring for a total possible score of 12 points in each cluster. The items included in each cluster and the rationale for their inclusion are described more fully in the previous chapters. Summaries of the Parents' and Teachers' SII data are presented in Tables 4.5 and 4.6. The mean of each cluster is described as a percentage of the total possible points for each cluster in the final column of Tables 4.5 and 4.6 in order to facilitate comparisons between cluster means.

Table 4.5  Parent Ratings on the Social Interest Inventory  N = 38

<table>
<thead>
<tr>
<th>SII Cluster</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>Total Possible Score</th>
<th>Mean as a Percentage Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing Joint Attention</td>
<td>4.97</td>
<td>1.99</td>
<td>1 - 9</td>
<td>9</td>
<td>55.22</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>5.53</td>
<td>3.28</td>
<td>0 - 12</td>
<td>12</td>
<td>46.08</td>
</tr>
<tr>
<td>Pointing</td>
<td>6.42</td>
<td>3.01</td>
<td>0 - 11</td>
<td>12</td>
<td>53.50</td>
</tr>
<tr>
<td>Imitation</td>
<td>4.82</td>
<td>2.32</td>
<td>0 - 9</td>
<td>9</td>
<td>53.55</td>
</tr>
<tr>
<td>Proto-imperative</td>
<td>8.47</td>
<td>2.82</td>
<td>3 - 12</td>
<td>12</td>
<td>70.58</td>
</tr>
<tr>
<td>Proto-declarative</td>
<td>4.45</td>
<td>3.67</td>
<td>0 - 11</td>
<td>12</td>
<td>37.08</td>
</tr>
<tr>
<td>Pretense</td>
<td>3.39</td>
<td>3.50</td>
<td>0 - 12</td>
<td>12</td>
<td>28.25</td>
</tr>
<tr>
<td>Total SII</td>
<td>29.79</td>
<td>12.88</td>
<td>7 - 52</td>
<td>63</td>
<td>47.29</td>
</tr>
</tbody>
</table>
Table 4.6  Teacher Ratings on the Social Interest Inventory  \( N = 38 \)

<table>
<thead>
<tr>
<th>SII Cluster</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>Total Possible Score</th>
<th>Mean as a Percentage Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing Joint Attention</td>
<td>4.53</td>
<td>2.23</td>
<td>0 - 9</td>
<td>9</td>
<td>50.33</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>4.39</td>
<td>2.97</td>
<td>0 - 10</td>
<td>12</td>
<td>36.58</td>
</tr>
<tr>
<td>Pointing</td>
<td>6.42</td>
<td>2.84</td>
<td>0 - 11</td>
<td>12</td>
<td>53.50</td>
</tr>
<tr>
<td>Imitation Proto-imperative</td>
<td>4.45</td>
<td>2.34</td>
<td>0 - 9</td>
<td>9</td>
<td>49.44</td>
</tr>
<tr>
<td>Proto-declarative</td>
<td>7.53</td>
<td>2.98</td>
<td>1 - 12</td>
<td>12</td>
<td>62.75</td>
</tr>
<tr>
<td>Pretense</td>
<td>3.37</td>
<td>3.35</td>
<td>0 - 10</td>
<td>12</td>
<td>28.08</td>
</tr>
<tr>
<td>Total SII</td>
<td>25.68</td>
<td>11.77</td>
<td>7 - 47</td>
<td>63</td>
<td>40.77</td>
</tr>
</tbody>
</table>

B. Specific research questions:

1. Is joint attention skill development related to the level of nonverbal cognitive ability of subjects with autism?

   Overall scores on the Social Interest Inventory were correlated with the Nonverbal IQs for all subjects (\( N = 38 \)). The correlations of the Parent and Teacher SII scores with the Nonverbal IQ scores of the subjects are presented in Table 4.7. Overall Parent ratings on the SII were not significantly related with the Nonverbal IQ scores for the subjects (\( r = .126, p < .451 \)). However, there was a significant relationship between overall Teacher SII scores and the Nonverbal IQ scores of the subjects (\( r = .475, p < .01 \)). Higher overall scores on the SII, as rated by teachers, were correlated with higher Nonverbal IQs. The overall SII scores include a variety of early social skills including, but not limited to, joint attention. The items on the SII are grouped into the following
seven score clusters: Social Referencing, Joint Attention, Pointing, Imitation, Proto-imperative communication, Proto-declarative communication, and Pretense. The items included in each cluster are shown on the SII Scoring form in Appendix A.

Table 4.7  Correlations of the Social Interest Inventory with Nonverbal IQ
N = 38

<table>
<thead>
<tr>
<th>SII Ratings</th>
<th>Parent SII with Nonverbal IQ</th>
<th>Significance</th>
<th>Teacher SII with Nonverbal IQ</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing</td>
<td>-.196</td>
<td>.239</td>
<td>.097</td>
<td>.564</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>-.077</td>
<td>.646</td>
<td>.240</td>
<td>.147</td>
</tr>
<tr>
<td>Pointing</td>
<td>.009</td>
<td>.959</td>
<td>.361</td>
<td>.026*</td>
</tr>
<tr>
<td>Imitation</td>
<td>.226</td>
<td>.172</td>
<td>.607</td>
<td>.000**</td>
</tr>
<tr>
<td>Proto-Imperative</td>
<td>.307</td>
<td>.061</td>
<td>.248</td>
<td>.134</td>
</tr>
<tr>
<td>Proto-Declarative</td>
<td>.047</td>
<td>.780</td>
<td>.189</td>
<td>.255</td>
</tr>
<tr>
<td>Pretense</td>
<td>.200</td>
<td>.228</td>
<td>.534</td>
<td>.001**</td>
</tr>
<tr>
<td>Total SII</td>
<td>.126</td>
<td>.451</td>
<td>.475</td>
<td>.003**</td>
</tr>
</tbody>
</table>

(*) = p < .05;  ** = p < .01

The cluster scores from the Parent and Teacher SII ratings were correlated with the Nonverbal IQ for each subject. None of the social skills clusters on the SII, as evaluated by Parents, correlated significantly with the Nonverbal IQs of the subjects. Three of the cluster scores, as rated by Teachers, had significant correlations with the subjects' Nonverbal IQs. The cluster scores which showed a significant correlation with Nonverbal IQ for these subjects were Pointing (r = .361, p < .05), Imitation (r = .607, p < .01), and Pretense (r = .534, p < .01).
Basic Joint Attention and the closely related skills of Social Referencing and Proto-declarative communication did not reach significance in their correlations with Nonverbal IQ, nor did Proto-imperative communication.

2. Is joint attention skill development related to the receptive and expressive language abilities of subjects with autism?

Total Sll scores for Parents and Teachers were correlated with scores on the Peabody Picture Vocabulary Test-Revised (PPVT-R) for the 25 subjects who took this test. Total Sll scores were also compared with the Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R) for the 24 subjects who took this test. There were 23 subjects who were included in both groups. The seven skills clusters of the Parent and Teacher SILLs were also correlated with the PPVT-R and EOWPVT-R scores. The correlations between the Sll and the language scores are presented in Tables 4.8 and 4.9.

Total Parent and Teacher Sll scores did not show a significant correlation with scores on the PPVT-R. An analysis of individual skills clusters on the Sll showed no significant relationships with receptive vocabulary as measured by the PPVT-R for most Sll skills clusters whether the ratings were made by Parents or Teachers. Pretense was an exception to this general finding. Pretense was related to receptive vocabulary as measured by the PPVT-R whether rated by Parents ($r = .444, p < .05$) or by Teachers ($r = .477, p < .05$). One other significant relationship with the PPVT-R was noted on the Teacher ratings of Proto-declarative (social) communication ($r = .425, p < .05$). In contrast, parent ratings of Proto-declarative communication were not correlated with the PPVT-R at a level that reached significance. Basic Joint Attention and related skills such
### Table 4.8 Correlations of the Social Interest Inventory with the PPVT-R (Parent and Teacher ratings) \( N = 25 \)

<table>
<thead>
<tr>
<th>SIll Ratings</th>
<th>Parent SIll with PPVT-R ( r )</th>
<th>Significance</th>
<th>Teacher SIll with PPVT-R ( r )</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing</td>
<td>.048</td>
<td>.821</td>
<td>-.025</td>
<td>.905</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>.144</td>
<td>.493</td>
<td>.339</td>
<td>.098</td>
</tr>
<tr>
<td>Pointing</td>
<td>.089</td>
<td>.674</td>
<td>.322</td>
<td>.116</td>
</tr>
<tr>
<td>Imitation</td>
<td>.184</td>
<td>.379</td>
<td>.141</td>
<td>.500</td>
</tr>
<tr>
<td>Proto-Imperative</td>
<td>-.044</td>
<td>.833</td>
<td>.167</td>
<td>.425</td>
</tr>
<tr>
<td>Proto-Declarative</td>
<td>.226</td>
<td>.278</td>
<td>.425</td>
<td>.034*</td>
</tr>
<tr>
<td>Pretense</td>
<td>.444</td>
<td>.026*</td>
<td>.477</td>
<td>.016*</td>
</tr>
<tr>
<td>Total SIll</td>
<td>.224</td>
<td>.282</td>
<td>.367</td>
<td>.071</td>
</tr>
</tbody>
</table>

### Table 4.9 Correlations of the Social Interest Inventory with the EOWPVT-R (Parent and Teacher Ratings) \( N = 24 \)

<table>
<thead>
<tr>
<th>SIll Ratings</th>
<th>Parent SIll with EOWPVT-R ( r )</th>
<th>Significance</th>
<th>Teacher SIll with EOWPVT-R ( r )</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing</td>
<td>.009</td>
<td>.967</td>
<td>-.057</td>
<td>.792</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>.117</td>
<td>.585</td>
<td>.276</td>
<td>.192</td>
</tr>
<tr>
<td>Pointing</td>
<td>.105</td>
<td>.624</td>
<td>.280</td>
<td>.185</td>
</tr>
<tr>
<td>Imitation</td>
<td>.145</td>
<td>.500</td>
<td>.205</td>
<td>.336</td>
</tr>
<tr>
<td>Proto-Imperative</td>
<td>-.114</td>
<td>.595</td>
<td>.110</td>
<td>.609</td>
</tr>
<tr>
<td>Proto-Declarative</td>
<td>.181</td>
<td>.397</td>
<td>.368</td>
<td>.077</td>
</tr>
<tr>
<td>Pretense</td>
<td>.302</td>
<td>.151</td>
<td>.269</td>
<td>.203</td>
</tr>
<tr>
<td>Total SIll</td>
<td>.152</td>
<td>.479</td>
<td>.295</td>
<td>.162</td>
</tr>
</tbody>
</table>
as Social Referencing showed no significance in their correlation to the receptive vocabulary scores of the subjects.

Total Parent and Teacher SII scores did not show a significant correlation with the expressive vocabulary skills of the subjects as measured by the EOWPVT-R. Nor did any individual skills clusters of the SII, whether rated by Parents or Teachers, show significance in their correlations to the EOWPVT-R.

It was noted that there was a significant correlation between the PPVT-R and EOWPVT-R scores for the 23 subjects with autism who took both tests ($r = .870$, $p < .01$). It was also noted that the subjects' age scores on the EOWPVT-R ($M = 49.522$) were significantly higher ($t (22)= 3.29, p < .01$) than their age scores on the PPVT-R ($M = 41.391$). This is consistent with the general pattern noted in autism (DSM-IV, 1994).

A total of 12 subjects who had little or no verbal language did not obtain scores on the PPVT-R or the EOWPVT-R and were not included in the correlations of the language scores with the SII. The mean receptive language age score for this low language group was 22.3 months while their mean expressive language age score was 21.3 months. The 23 subjects who obtained scores on both the PPVT-R and the EOWPVT-R were grouped in a high language condition. Three subjects were excluded from either condition because they had scores on the PPVT-R or the EOWPVT-R but not on both. The mean receptive language age score for the high language group was 40.2 months and their expressive language mean score was 49.1 months. The mean scores of the low language and high language subjects on the SII are presented in Table 4.10.

The mean SII Total and cluster scores for the 12 subjects in the low language condition were compared with the mean SII Total and cluster scores for the 23 subjects in the high language condition. Comparisons based on t-tests for independent samples are shown in Table 4.11.
Table 4.10  Parent and Teacher SII Mean Scores for Low Language (n = 12) and High Language (n = 23) Groups

<table>
<thead>
<tr>
<th>SII Ratings</th>
<th>Parent Ratings</th>
<th>Teacher Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group Mean</td>
<td>Group Mean</td>
</tr>
<tr>
<td>Social Referencing</td>
<td>5.25</td>
<td>4.65</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>4.50</td>
<td>5.78</td>
</tr>
<tr>
<td>Pointing</td>
<td>5.58</td>
<td>6.57</td>
</tr>
<tr>
<td>Imitation Proto-imperative</td>
<td>7.17</td>
<td>8.83</td>
</tr>
<tr>
<td>Proto-declarative</td>
<td>3.00</td>
<td>4.96</td>
</tr>
<tr>
<td>Pretense</td>
<td>2.50</td>
<td>3.91</td>
</tr>
<tr>
<td>Total SII</td>
<td>25.75</td>
<td>30.83</td>
</tr>
</tbody>
</table>

Table 4.11  Comparisons of Group Means for Low Language vs. High Language Students with Autism on the SII. Independent Samples t-tests  N = 35 (df 33)

<table>
<thead>
<tr>
<th>SII Ratings</th>
<th>Parent SII Ratings Low vs. High Language</th>
<th>Teacher SII Ratings Low vs. High Language</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>Significance</td>
</tr>
<tr>
<td>Social Referencing</td>
<td>-.83</td>
<td>.410</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>1.09</td>
<td>.284</td>
</tr>
<tr>
<td>Pointing</td>
<td>.90</td>
<td>.372</td>
</tr>
<tr>
<td>Imitation Proto-imperative</td>
<td>1.19</td>
<td>.242</td>
</tr>
<tr>
<td>Proto-declarative</td>
<td>1.70</td>
<td>.099</td>
</tr>
<tr>
<td>Pretense</td>
<td>1.51</td>
<td>.141</td>
</tr>
<tr>
<td>Total SII</td>
<td>1.13</td>
<td>.270</td>
</tr>
</tbody>
</table>

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Teacher SII ratings of Imitation and Pretense showed a significant difference between the mean scores for the low language group compared to scores of the high language group. The Total Teacher SII scores also showed a significant difference between the low language and high language groups. Teacher ratings of Joint Attention and the related skills of Social Referencing, Pointing, and Proto-declarative communication showed no significant differences between the low language and high language subjects. The mean SII ratings made by Parents did not yield any significant differences in social skill development between low language and high language subjects with autism.

3. Do subjects with autism engage in more Proto-imperative than Proto-declarative communication?

The means for the Proto-declarative (social) and Proto-imperative (instrumental) communication skills clusters of the SII were compared with a t-test for paired samples. Parent and Teacher ratings were available for each subject and were compared separately. The range of possible scores for each subject on each of the clusters was 0-12.

Parent ratings of the four Proto-imperative items of the SII resulted in a mean cluster score of 8.47 with a standard deviation of 2.82. Parent ratings of the four Proto-declarative items resulted in a mean cluster score of 4.45 with a standard deviation of 3.67. Parent ratings showed a significantly higher proportion of Proto-imperative than Proto-declarative communication for their children with autism ($t (37) = -8.37, p < .01$).

Teacher ratings on the four Proto-imperative items of the SII resulted in a mean score of 7.53 with a standard deviation of 2.98. Teacher ratings of the four Proto-declarative items resulted in a mean score of 3.37 with a standard deviation
of 3.35. Teachers also reported a significantly higher proportion of Proto-imperative than Proto-declarative communication ($t(37) = -9.33$, $p < .01$) for their students with autism.

A significant correlation was found between the ratings of Proto-declarative communication and Proto-imperative communication whether these skills were rated by Parents ($r = .611$, $p < .01$) or by Teachers ($r = .628$, $p < .01$).

4. Is joint attention skill development related to the overall severity of autism?

Parent and Teacher ratings on the SII were correlated with scores on the Childhood Autism Rating Scale (CARS) for all 38 subjects. Higher scores on the SII are indicative of more advanced social skill development. Higher scores on

<table>
<thead>
<tr>
<th>SII Ratings</th>
<th>Parents SII with CARS</th>
<th>Parents Significance</th>
<th>Teacher SII with CARS</th>
<th>Teacher Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing</td>
<td>-.463</td>
<td>.003**</td>
<td>-.523</td>
<td>.001**</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>-.510</td>
<td>.001**</td>
<td>-.695</td>
<td>.000**</td>
</tr>
<tr>
<td>Pointing</td>
<td>-.491</td>
<td>.002**</td>
<td>-.506</td>
<td>.001**</td>
</tr>
<tr>
<td>Imitation</td>
<td>-.368</td>
<td>.023*</td>
<td>-.571</td>
<td>.000**</td>
</tr>
<tr>
<td>Proto-Imperative</td>
<td>-.550</td>
<td>.000**</td>
<td>-.597</td>
<td>.000**</td>
</tr>
<tr>
<td>Proto-Declarative</td>
<td>-.564</td>
<td>.000**</td>
<td>-.723</td>
<td>.000**</td>
</tr>
<tr>
<td>Pretense</td>
<td>-.373</td>
<td>.021*</td>
<td>-.472</td>
<td>.003**</td>
</tr>
<tr>
<td>Total SII</td>
<td>-.582</td>
<td>.000**</td>
<td>-.772</td>
<td>.000**</td>
</tr>
</tbody>
</table>

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the CARS are indicative of a greater severity of autistic symptoms. A significant negative relationship was noted when CARS scores were compared with overall Parent SII scores ($r = -.582, \ p < .01$) and with overall Teacher SII scores ($r = -.772, \ p < .01$). In addition to the Total SII scores, all cluster scores on the SII reached significance in their correlations with the CARS scores as well. Strong correlations were apparent whether ratings were made by Parents or Teachers. Correlations of the SII with the CARS are summarized in Table 4.12.

5. Do joint attention, nonverbal IQ, or language ability predict the severity of autism?

Stepwise multiple regression analyses were run for various combinations of independent variables including overall Parent and Teacher SII ratings, SII cluster scores, Nonverbal IQ scores, scores on the PPVT-R, and scores on the EOWPVT-R. The CARS, which represents the severity of autistic symptoms, was the dependent variable. The inclusion of the PPVT-R and EOWPVT-R scores limited the number of subjects to 24 who had measurements on all of the independent variables. A multiple regression including all independent variables (SII total scores, SII cluster scores, IQ, PPVT-R, and EOWPVT-R) was run for the Parent SII scores and the Teacher SII scores.

The following variables were identified as significant predictors of the severity of autism: When Parent ratings were analyzed, Total Parent SII scores were the best predictor of the subjects' CARS scores with a multiple $R = .64$. A second significant variable was Nonverbal IQ which increased the multiple $R$ to .73. A third variable, the Imitation cluster score, was also significant and raised the multiple $R$ to .79.
When Teacher SII scores were included with the other independent variables the total Teacher SII score was found to be the best predictor of the subjects' CARS scores (multiple $R = .74$). There were no other independent variables (SII cluster scores, IQ, PPVT-R, and EOWPVT-R scores) which added significantly to the relationship. For both Parents and Teachers, the Total SII score was found to be the best predictor of the severity of autism.

To test the robustness of the analysis of the SII Total and cluster scores, an additional multiple regression was run with the CARS as the dependent variable and without the PPVT-R and EOWPVT-R as predictors. This analysis allowed the inclusion of all 38 subjects. Total Parent SII scores were still the best predictor of the CARS ($R = .58$), with IQ serving as a secondary variable and raising the multiple $R$ to .68. A third significant variable, the Social Referencing cluster score, raised the multiple $R$ to .73. No other SII cluster scores on the Parent scale contributed significantly to the prediction of the CARS in this analysis.

Total Teacher SII scores also proved to be a better predictor of the CARS ($R = .77$) than any of the individual SII cluster scores or the Nonverbal IQ when analyzed with the bigger sample size of all 38 subjects. Unlike comparisons with the Parent scale, IQ did not contribute significantly to this relationship. However, teacher ratings of the Pointing cluster did provide additional significance and this secondary variable raised the multiple $R$ to .80. No other Teacher SII cluster scores were of significance in predicting the CARS in this comparison.

A final analysis of the seven SII cluster scores for the Parent and Teacher-rated SII was run to determine which SII cluster scores contributed to the prediction of the CARS in the absence of the other independent variables. Of the Parent-rated SII cluster scores, Proto-declarative communication was the most significant predictor of the CARS scores ($R = .56$). No other Parent cluster scores were of significance in predicting the CARS in this analysis.
scores improved this prediction. Proto-declarative communication was also the most significant predictor of the CARS from the Teacher-rated SII cluster scores ($R = .72$). A second variable, Pretense, added significantly on the prediction of the CARS from the Teacher-rated SII cluster scores, raising the $R$ to .77.

6. Are higher levels of joint attention and other early social skills development reported by parents or teachers of students with autism?

The Parent and Teacher ratings of the seven SII cluster scores were compared for all subjects using paired samples t-tests. The data for these comparisons is presented in Table 4.13.

| Table 4.13 Paired Samples t-tests for SII Cluster Scores: Parents vs. Teachers N = 38 (df 37) |
|-----------------------------------------------|-----------|-----------|-----------|-----------|
|                                     | Parent Mean Score | Standard Deviation | Teacher Mean Score | Standard Deviation | t         | Significance |
| Social Referencing Joint Attention  | 4.97        | 1.99       | 4.53        | 2.23       | 1.267     | .213        |
| Joint Attention                  | 5.53        | 3.28       | 4.39        | 2.97       | 2.217     | .033*       |
| Pointing                        | 6.42        | 3.01       | 6.42        | 2.84       | .000      | 1.000       |
| Imitation Proto-imperative       | 4.82        | 2.32       | 4.45        | 2.34       | .879      | .385        |
| Proto-declarative                | 8.47        | 2.82       | 7.53        | 2.98       | 2.418     | .021*       |
| Pretense                        | 4.45        | 3.67       | 3.37        | 3.35       | 2.095     | .043*       |
| Total SII                       | 29.79       | 12.88      | 25.68       | 11.77      | 2.21      | .033*       |

As can be seen in Table 4.13, a significant difference ($p < .05$) was noted between Parent and Teacher ratings on the Joint Attention, Proto-imperative,
Proto-declarative, and Pretense clusters of the SII. In addition, the Total SII scores differed significantly ($p < .05$) between Parent and Teacher ratings. No significant difference was noted between Parent and Teacher ratings of Social Referencing, Imitation, and Pointing skills.

Table 4.14 Correlations of Parent and Teacher SII scores

<table>
<thead>
<tr>
<th>SII Ratings</th>
<th>Parent/Teacher $r$</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Referencing</td>
<td>.472</td>
<td>.003**</td>
</tr>
<tr>
<td>Joint Attention</td>
<td>.497</td>
<td>.002**</td>
</tr>
<tr>
<td>Pointing</td>
<td>.626</td>
<td>.000**</td>
</tr>
<tr>
<td>Imitation</td>
<td>.388</td>
<td>.016*</td>
</tr>
<tr>
<td>Proto-imperative</td>
<td>.653</td>
<td>.000**</td>
</tr>
<tr>
<td>Proto-declarative</td>
<td>.595</td>
<td>.000**</td>
</tr>
<tr>
<td>Pretense</td>
<td>.452</td>
<td>.004**</td>
</tr>
<tr>
<td>Total SII</td>
<td>.573</td>
<td>.000**</td>
</tr>
</tbody>
</table>

Parent ratings on the SII were correlated with Teacher SII ratings for all 38 subjects. The results of these correlations can be seen in Table 4.14. Parent and Teacher ratings were found to correlate highly with each other on the Total SII and on all SII skills clusters.
Chapter 5
Conclusions

Children with autism at all cognitive and language levels exhibit delays in the acquisition and use of joint attention skills and the related skills of imitation and pretense. The relationship of these early social skill deficits to one another and to other developmental and behavioral features of autism offers insights into the disordered developmental patterns seen in autism. Joint attention deficits represent the earliest identified characteristics of autism and research into these patterns may prove to be invaluable in the diagnosis and treatment of autism, in determining the prognosis for individuals with autism, and in the exploring the potential for individuals with autism to develop a theory of mind.

The relationship of the joint attention disturbance of autism to other developmental and behavioral features of the disorder was examined. The Social Interest Inventory (SII), an instrument designed for this study, provides a measure of each subject's interest or skill in interacting with others at the earliest levels of social relating. Comparisons of early social skill development to measures of the severity of autism and additional measures of nonverbal intelligence and language development yielded some significant and surprising results. The correlational nature of the data which was collected precludes a causal analysis of the results but appears to shed some light on patterns of development which could yield useful information for making diagnostic and programming decisions for students with autism. It is hoped that more clearly defining the relationship of joint attention and other early social skill deficits to other aspects of autistic
pathology will improve the potential for remediation of these deficits and help mitigate the effects these deficits have on children's development over time.

The following discussion will look at the relationships of these measures of early social skills to each other, to the language level and cognitive abilities of the subjects, and to the severity of autism.

A. The relationship of joint attention to nonverbal IQ in autism

Consistent with previous research (Baron-Cohen, 1989; Landry & Loveland, 1988; Mundy, Sigman, & Kasari, 1994), this study found that joint attention deficits are apparent in subjects with autism at all levels of ability. Mean scores on the SII showed that subjects with autism, on average, earned less than 50 percent of the total possible points on the SII scale despite the fact that the skills measured on the SII are typically mastered by children at mental ages of two to three years. The highest scoring subjects with autism did not earn perfect scores, indicating that even for those subjects with autism who exhibit joint attention and other early social skills, these skills are not used with the same frequency or degree of sophistication seen in normally developing toddlers.

Generally the results support the conclusion that the development of early social skills related to joint attention are delayed in all subjects with autism. However, the severity of the delay in early social skill development, especially those skills most closely related to joint attention, was generally not related to the level of nonverbal cognitive development of the subjects.

Parent and Teacher ratings on the SII differed in how they compared to the nonverbal IQ levels of the subjects. The overall Teacher SII rating was significantly correlated with the nonverbal IQ level of the subjects while the overall Parent SII ratings did not show the same relationship. However, the higher correlation between Teacher SII ratings and nonverbal IQ was largely accounted
for by the Teacher ratings of Imitation and Pretense in their students ($p < .001$). These skills are typically considered to be separate from the development of joint attention skills although these skills are clearly related to joint attention in developmental sequences and are also considered important as precursors to the later development of a theory of mind. Parent ratings of Imitation and Pretense did not show a significant relationship to nonverbal IQ which leads to some questions about the general nature and strength of the relationship. Imitation and pretense may be more closely tied to the cognitive abilities of children with autism than are more basic early social skills such as joint attention.

The only SII cluster score considered to be a measure of joint attention which showed a significant relationship to nonverbal IQ was the Teacher rating of Pointing which was significant at $p < .05$. Interestingly, the Parent rating of Pointing showed virtually no relationship to nonverbal IQ despite the fact that the mean score for the Teacher and Parent ratings of Pointing were identical. In general, teachers appeared to see a more developmental pattern to the development of early social skills in their students with autism as apparent on their ratings of Pointing, Imitation, and Pretense, but this tendency was not observed on other measures such as Social Referencing, Joint Attention, and Proto-declarative communication.

In general, Parent ratings on the SII clusters showed no relationship to the nonverbal IQ level of the subjects. Only one Parent cluster score, Proto-imperative communication, came close to reaching significance and this cluster is not considered to be a measure of joint attention skill development or a precursor skill specifically tied to the development of a theory of mind.

The results of this study indicate that deficits in joint attention skill are not specifically tied to the level of nonverbal reasoning ability of subjects with autism. Such deficits appear to persist in all students with autism regardless of their
nonverbal functioning level. This was the conclusion reached earlier by Loveland and Landry (1986) and Landry and Loveland (1988) in a series of studies which grouped children by their nonverbal mental ages on the Leiter for comparisons with matched non-autistic control groups. The current results extend Loveland and Landry's findings across a broader range of subjects including approximately one third of the subjects who were nonverbal or minimally verbal. Loveland and Landry's studies included only verbal subjects with higher overall mental ages. They also had a much smaller sample size with a more restricted range of ages than the current study. The current study looks in more detail at within-group comparisons as well.

In contrast, Mundy, Sigman, and Kasari (1994) report that the sophistication of joint attention behaviors was related to differences in IQ in their work. Mundy and his colleagues measured mental age in their subjects with the Cattell Infant Intelligence Scale or the Stanford-Binet Intelligence Scale. These more general, language-based instruments may have contributed to the differences in outcome between the studies. More general measures of intelligence such as the Stanford-Binet generally depend more heavily on social and communicative interactions than do nonverbal instruments such as the Leiter. An inability to maintain a shared interest in materials or respond to the social overtures of an examiner giving the Stanford-Binet would seem more likely to be affected by the type of deficits measured on tests of joint attention. Subjects in the current study were largely unable to take a verbal test such as the Binet which is fairly typical of subjects in the autistic population.

As Happe (1994) points out, the very uneven IQ profile of subjects with autism makes it difficult to get a measure of general intelligence that is valid or which is useful for comparing groups. Most subjects with autism can only obtain prorated or partial scores on general IQ tests or show such extreme scatter
between subtests as to render their overall IQ score meaningless. The subjects in the present study were successful in obtaining nonverbal IQ scores on the Leiter but in most cases were unable to take a standardized, language-based test of intelligence. Comparisons of the subjects' SII scores with their language testing considers the need for a more complete assessment of the developmental levels of the subjects compared to their early social skill development.

The failure of joint attention and other early social skills to show a consistent developmental pattern in relation to the functioning level of the subjects with autism mirrors the failure of mental age to correlate with the subsequent development of a theory of mind in subjects with autism. Charman and Baron-Cohen (1992) concluded that a relatively high verbal mental age is necessary but not always sufficient for subjects with autism to pass tests of theory of mind. A much higher verbal mental age is required for subjects with autism to pass theory of mind tasks compared to subjects in the normal population. Leekam and Perner (1991) saw a similar pattern for verbal mental age, but they found no relationship between nonverbal mental age and success on theory of mind tasks for subjects with autism. It seems that subjects with the strongest joint attention skill development, along with other presumed precursor skills such as imitation and pretense, may have the best prognosis for the development of a theory of mind in the presence of an adequate level of verbal intellectual ability. The contribution of a child's nonverbal intelligence to the development of a theory of mind is less clear, but either form of intellectual ability may ultimately be of less importance to the development of a theory of mind than the child's joint attention skills and early social skill development.
B. The relationship of joint attention to receptive and expressive language in autism

The general conclusion that children with autism tend to have higher expressive than receptive language skills was supported by the data ($t(22) = 3.29, p < .01$). Children with autism tend to express their own ideas better than they comprehend those of their communicative partner which may be accounted for in part by the general failure of these individuals to share their partner's focus of attention. All of the subjects exhibited delays in their development of receptive and expressive language. Similarly all subjects were delayed in their acquisition of early social skills such as measures of joint attention.

However, the results of this study do not indicate a significant relationship between the deficits in joint attention skills and the receptive or expressive vocabulary development of the subjects with autism. Only one of the Teacher SII measures related to joint attention (Proto-declarative communication) showed a significant ($p < .05$) correlation to receptive language. Parent ratings of Proto-declarative communication did not reach significance in their correlation to receptive language. The strongest correlation between the SII and the language testing ($p < .05$) was seen in the relationship of Pretense to the subjects' receptive language scores on the PPVT-R. This strong relationship of Pretense with receptive vocabulary skill was apparent on comparisons with both Parent and Teacher SII ratings (see Table 4.8).

Children with autism who have higher receptive language skills appear more likely to engage in pretend play than those with lower receptive language skills. The level of the subjects' expressive language skill does not share this same relationship to the use of pretense. It is worth noting that the use of pretense was severely restricted relative to the normal course of development for all subjects with autism. Pretense has been presumed to be one of the major milestones in
the development of a theory of mind (Leslie, 1987, 1991). It seems likely that receptive language skills, which may depend on understanding the intentions of others, play an important part in the development not only of pretense but in the later development of a theory of mind. To understand the thoughts and beliefs of others would seemingly be dependent on an understanding of the language with which those thoughts and beliefs are expressed, at least up to a point. However, the common finding (Baron-Cohen, 1995) that children with autism typically fail theory of mind tasks until much higher language levels than children in language-matched control groups would seem to indicate that something more critical, such as precursor skills related to joint attention and pretense, are the critical determinant of the children's eventual success. Receptive language facility may be a necessary but not sufficient factor in the acquisition of a theory of mind.

Most joint attention skills measured by the SII failed to show any relationship to the receptive or expressive language levels of the subjects with autism in this study. In fact, some skills such as social referencing showed virtually no relationship at all to the development of the subjects' language skills. A spontaneous sharing of interests, as seen in Proto-declarative communication, may be somewhat related to the children's receptive language level. Teacher ratings of Proto-declarative communication showed this to be the case although parent ratings of their children in the home setting showed no relationship between Proto-declarative communication and either receptive or expressive language. Prelinguistic forms of Proto-declarative behaviors such as pointing to share an interest may be related to a child's understanding of others as communicative partners and thus to their receptive understanding of others but this was not consistent.

The joint attention and early social skills of children with minimal or no verbal language were compared with the social skills of children with language ages of
at least two years on the PPVT-R and EOWPVT-R. If some basic level of joint attention is essential for language to emerge, a difference might be expected between the means for these groups. No differences were noted between the means of the low language and the high language groups if social skills were rated by Parents (see Table 4.11). Some significant differences were noted in the means of the low language and high language groups when the social skills were rated by Teachers. Ratings of Imitation and Pretense differed significantly between the low language and high language groups, and the Teacher rated Total SII scores showed a significant difference ($t (df33) = 2.43, p < .05$) between groups. However, the basic characteristics of the joint attention disturbance of autism did not differ significantly between the low and high language subjects whether rated by Parents or Teachers.

It has long been assumed that joint attention skills are crucial as a foundation or precursor to the development of language in typically developing children (Bakeman & Adamson, 1984; Bates, 1979; Bruner, 1977; Scaife and Bruner, 1975; Sugarman, 1984). Joint attention skills have been called a platform or scaffold on which later language skills are built (Tomasello & Farrar, 1986). These presumptions have been explored extensively in studies of children with normal language development. The opportunity to study the joint attention deficits of children with the disordered patterns of communication seen in autism has led to questions about the foundational importance of joint attention in the development of language. Clearly, children with autism are deficient in joint attention skills and in language development, but it is not so clear that these deficits are directly related to one another. Joint attention and related deficits appear to be present at all levels of nonverbal and verbal ability in autism.

Unlike the results of this study, Mundy and his colleagues (Mundy, 1995; Mundy, Sigman, & Kasari, 1990; Sigman and Kasari, 1995) have studied joint
attention deficits in subjects with autism and found them to be predictive of language development. Possible reasons for the discrepancy between the Mundy studies and the current study are apparent in the different sample characteristics and the nature of the measures used. The measures of joint attention skill used by Mundy and his colleagues have been nonverbal (eg. pointing, showing) and their research was conducted with subjects having little or no expressive language. Measurements were based on ratings of children's interactions with adults during structured interaction tasks. The current research employed both verbal and nonverbal skills in the SII cluster scores and was conducted with a broad range of both verbal and nonverbal students. SII ratings were based on reports from parents and teachers familiar with each child on a daily basis. The current study looked at subtle differences in the nature and degree of the joint attention skill deficits of the subjects with autism and did not find a significant correlation between the level of joint attention skill and the level of language development although subjects with autism were clearly delayed in both areas.

Loveland and Landry (1986) and Landry and Loveland (1988) note that the relationship of joint attention to language development is not entirely clear. The spontaneous joint attention behaviors of their subjects with autism were related to the language level of the subjects to a degree, but the relationship was not completely consistent. Their research was conducted with verbal, higher functioning subjects than those examined by Mundy and his colleagues. Although subjects with higher joint attention skills often had higher language skills, some subjects developed language with very limited joint attention skills. Loveland and Landry suggest that language development may not be totally dependent on a certain level of preverbal communication development as appears to be the case in the normal course of development.
The current results would seem to support the idea that joint attention skills may be interrelated but developmentally separate from language development. It seems plausible that an understanding of agency is all that is needed for the earliest attempts at using language, especially if those attempts are designed to communicate basic requests rather than to share a social exchange. An understanding of proto-imperative (requesting) functions may be enough for language to emerge in children with severely restricted social interests and skills.

Children with autism may be able to learn language in the absence of an understanding of early social skills or through less social means than is typical of normal development. Language learned through paired associations with objects or events and reinforced in functional, nonsocial routines is likely to be available to subjects with autism even in the absence or reduced frequency of many joint attention skills. Language which is socially meaningful or reinforced by social interaction may not be so easily acquired or used as frequently by children with autism.

Within the autistic spectrum, it appears that joint attention deficits do not specifically correlate with the development of language except in the most general way. However, the autistic child's facility with joint attention combined with their knowledge of semantics will most likely interact to determine the level of sophistication the child will exhibit in the pragmatic use of language. It is the pragmatic aspect of communication, more than vocabulary development itself, which appears most likely to suffer with deficiencies in joint attention and related skills. Joint attention might be more accurately described as a foundation for the development of communication skills rather than the actual development of language. Deficiencies in joint attention, which persist at all levels of autism, appear to have far more influence over the social aspects of communication than the actual vocabulary level or semantic skills of the subjects. The relationship is
not entirely predictable and may be dependent on social and motivational factors as well as specific skill deficits. It seems likely that core deficits in joint attention are an integral part of the social and communication deficits of children with autism and will contribute to difficulties in social interaction even for very verbal, high-functioning individuals with the disorder.

C. Proto-imperative vs. Proto-declarative communication in autism

Proto-declarative communication includes many of the prototypical joint attention behaviors such as showing objects to others or pointing to share an interest with a partner. Proto-imperative communication is more instrumental in nature and usually involves the attainment of nonsocial rewards. Subjects with autism in the current study consistently engaged in more Proto-imperative (instrumental) than Proto-declarative (social) communicative efforts whether rated by Parents (t (37) = -8.37, p < .01) or Teachers (t (37) = -9.33, p < .01). This is consistent with numerous prior studies of children with autism (Baron-Cohen, 1989 & 1995; Loveland & Landry, 1986; Mundy, et al., 1986). The current study includes measures of Proto-imperative and Proto-declarative communication across a broad range of nonverbal and verbal skills and allows for the relative frequency of the skills to be considered rather than strictly their presence or absence.

Children with autism generally engage in communicative behaviors that lead to instrumental or nonsocial rewards with a much higher frequency than they communicate to seek social reinforcers. This pattern was apparent across a broad range of intellectual and language levels and at all levels of the autistic spectrum. However, it was also noted that Proto-imperative and Proto-declarative skills correlated quite highly with one another whether rated by
Parents \( (r = .611, p < .01) \) or Teachers \( (r = .628, p < .01) \). Children with relatively higher levels of Proto-imperative communication skills tend to also have higher levels of Proto-declarative communication skills. This would seem to imply that the development of these communicative functions are related to one another even if they do not develop in the normal developmental sequence. In typical development, these skills emerge fairly simultaneously. There may be a certain point in the acquisition of Proto-imperative skills that Proto-declarative skills begin to emerge in children with autism. Proto-declarative skills may have the potential to emerge simultaneously with Proto-imperative skills in subjects with autism as they do in normal development but may fail to do so due to the limited social understanding or interest of the children.

Teacher ratings of Proto-declarative behaviors were correlated significantly \( (r = .425, p < .05) \) with the receptive language level of the subjects on the PPVT-R but Parent ratings were not (see Table 4.8). The expressive language level of the subjects as measured by the EOWPVT-R was not related to their use of Proto-declarative communication whether rated by Parents or Teachers (see Table 4.9). Parent and Teacher ratings of Proto-imperative communication showed even less of a relationship to the receptive and expressive language level of the subjects with no comparisons approaching significance. The limited relationships between the proto-imperative and proto-declarative communicative functions and the language level of the subjects lends support to the idea that joint attention and language develop somewhat independently of one another although subjects with autism are clearly deficient in both areas. The use of proto-declaratives may signal an interest in social relating that serves to motivate children with autism to learn to use language more readily, but the stronger interest in using proto-imperatives may be the most fruitful avenue for motivating children with autism to learn to use language to meet their basic needs. The
failure to show a relationship between proto-imperatives and language further indicates that children with autism are able to learn to use others to meet their needs through seemingly non-social and non-verbal means, at least up to a point. The understanding of agency may be all that is needed for a child with autism to accomplish basic proto-imperative communication to meet their immediate needs in the absence of normal joint attention skills.

The subjects' use of Proto-imperative and Proto-declarative communication shows highly significant ($p < .001$) negative correlations with the severity of the subjects' autism as measured by the CARS (see Table 4.10). The more severe the autism, the less the subjects tended to communicate using either function. Neither Proto-imperatives nor Proto-declaratives were significantly related to the non-verbal IQ level of the subjects. Deficits in the use of both Proto-imperative and Proto-declarative communicative functions persisted at all functioning levels and appeared to be more closely related to the severity of autism than to either the intellectual or language levels of the subjects. Once again, the social, motivational aspects of these skills must be considered along with the apparent failure of these skills to develop at a normal developmental pace.

The SII provides measures of imitation and pretense in addition to clusters of behaviors associated with joint attention skill development. All of these skills are considered to be important in the development of a theory of mind. Proto-declarative communication is generally considered to be a function of joint attention while Proto-imperative communication is not. Additional comparisons between both forms of communication and the development of Imitation and Pretense showed a high degree of correlation. Both Proto-imperative and Proto-declarative communication were highly correlated to the Imitation skills of subjects with autism whether rated by Parents ($r = .708 \& r = .577$, $p < .01$) or Teachers ($r = .523 \& r = .491$, $p < .01$). Both Proto-imperative and Proto-
declarative communication were also related to Pretense whether rated by Parents ($r = .515 \& r = .608, p < .01$) or Teachers ($r = .325 \& r = .322, p < .05$). Within the autistic population, as children improve in their use of either form of communication they are also likely to increase in their imitation skills and use of pretense. This is unlike the conclusion reached by Mundy and his colleagues (1990, 1995) who note that joint attention skills were not related to measures of pretense. This may have been due to the very limited use of pretense that would be expected in his sample of minimally verbal children. The current study looked at a much broader range of ages and abilities and found strong correlations between all of the presumed precursor skills to theory of mind. Proto-imperatives appear to have as much or more effect on the prediction of imitation and pretense skills in children with autism as do Proto-declaratives according to these results. One might have expected social forms of communication to have more effect in this area but that was not proven to be the case.

Children with autism clearly engage in more instrumental forms of communication compared to their use of social forms of communication. The joint attention deficit of autism may account for this discrepancy. It is not certain that there is a general failure of children with autism to develop the skills needed for social communication so much as there appears to be a delay or reduced frequency of the use of those skills as compared with nonsocial forms of communication. Social abilities and motivational factors appear to be more influential than either intellectual or language levels in explaining these differences in communication. Both instrumental and social forms of communication are related to the imitation skills and use of pretense in children with autism, all of which may help to establish the foundation for the later development of an understanding of theory of mind.
D. The relationship of joint attention deficits to the severity of autism

All of the early social skills measured by the SII were significantly correlated to the severity of the subjects' autism as measured by the CARS (see Table 4-10). This relationship was seen for both Parent and Teacher SII ratings. Deficits in overall SII scores and all cluster scores related to joint attention skills were highly correlated with the severity of autism (p < .01). The related skills of Imitation and Pretense were also highly correlated with the CARS although these measures were more highly correlated with the severity of autism when rated by Teachers (p < .01) than when rated by Parents (p < .05).

Deficits in joint attention have been associated with autism by many (Baron-Cohen, 1991 & 1995; Frith, 1989; Loveland & Landry, 1986; Mundy, 1995; Sigman & Kasari, 1994) and are included in the definition of autism (see DSM-IV, 1994). The presence of joint attention deficits in autism has been recognized for some time but up to now individual differences in joint attention have not been directly associated with the overall severity of the autistic disturbance.

Individual differences in joint attention skills have been related to the intensity of the social disturbance of autism (Mundy, 1995), but Mundy specifically notes that individual differences in joint attention skills were not correlated with other aspects of autism such as stereotypical or perseverative behaviors. The CARS is heavily weighted with items assessing sensory irregularities and restricted interests with only one item specifically measuring social relating and one item measuring imitation out of the 15 items on the scale. The joint attention skills on the SII showed strong correlations to this much broader measure of autistic pathology than the more limited relationships to measures of social relating noted by Mundy. This would indicate that individual differences in joint attention and other early social skills such as imitation and pretense are related to the overall degree of autistic pathology when a broad view of autism is considered. This
relationship between the severity of the joint attention deficit and the severity of autism could have important implications for early diagnosis, intervention decisions, and possibly for determining prognosis.

Deficits in joint attention are described in DSM-IV as "a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)." Such deficits are listed as one of the four possible qualitative impairments in social interaction (p. 70) that comprise one of the core features of autism. Two of the four possible social impairments in DSM-IV are required for a diagnosis of Autism or Asperger's Disorder if accompanied by additional deficits in communication and behaviors reflecting a restriction of interests. It would be possible to earn a diagnosis of autism, according to DSM-IV, without actually having a deficit in joint attention, but based on recent research findings including this study, it seems unlikely that this would be likely to occur. Joint attention deficits and related early social skills have been identified as the earliest and possibly the most pervasive features of autism. Such early social deficits may ultimately prove to be of far greater significance than the language delays and other behavioral features of autism which are typically the first areas targeted for intervention. The strong correlation between joint attention deficits and other autistic characteristics would seem to imply that these early social skill deficits are perhaps fundamental to the later development of communication deficits and probably contribute to the restricted interests and self-involved behaviors of children with autism as well.

E. Early social skills as predictors of the severity of autism

Of all the variables considered, the Total SII score was found to be the best predictor of the severity of autism. Total SII ratings were stronger predictors of
the CARS ratings (Parent ratings: $R = .64$; Teacher ratings: $R = .74$) than any of the individual SII cluster scores, the Nonverbal IQs, or the Language ages of the subjects. In some cases, the Nonverbal IQ level of the subjects contributed additionally to the prediction of the severity of autism.

The relationship of the individual SII cluster scores to the CARS were considered separately from the Total SII scores. As noted previously, all of the SII cluster scores were significantly correlated to the CARS. Proto-declarative communication skills (which include the proto-typical joint attention behaviors of pointing or showing) proved to be the most significant of the early social skills assessed in predicting the overall severity of the subjects' autism (Parent rating: $R = .56$; Teacher rating: $R = .72$). In the presence of a measure of Proto-declarative communication, no other SII clusters were able to improve the prediction of the severity of autism except for Pretense as rated by teachers which raised the $R$ slightly to .77.

A measure of early social skill development such as the SII, which focuses on measures of joint attention, imitation, and the use of pretense appears to provide a useful measure of the overall severity of autism. Although the SII is restricted to the rating of early social skills, it appears to provide a useful measure of the severity of overall autistic pathology for individuals at all levels of language development and intellectual ability. Deficits in early social skill development, which have been shown to persist over time and across intellectual functioning and language levels, appear to be the earliest identified features of autism in many cases and were the best predictors of the severity of autism in this study. Deficits in areas such as Proto-declarative communication, by definition, contribute to the pragmatic communication deficits of autism. Joint attention skills such as Proto-declarative communication also appear to underlie the inadequate development of reciprocal social relating skills that occurs in
autism. The strong association between the severity of autism as measured by the CARS and the severity of the joint attention and early social skill development as measured by the SII would lend some support to the notion that deficits in these early social skills are also associated with even the more sensory-based aspects of autism such as the restricted and perseverative interests which are heavily weighted on an instrument such as the CARS.

F. Ratings of early social skills by parents and teachers

Overall, parents tend to report higher levels of early social skill development in their children with autism than do the same children's teachers (see Table 4.13). Parents report significantly higher levels of overall social skill development as measured by the SII than do Teachers and Parent ratings were significantly higher on the individual SII skills clusters of Joint Attention, Proto-imperative and Proto-declarative communication, and the use of Pretense. Despite the differences in means between the Parent and Teacher ratings, it was noted that the ratings of Parents and Teachers correlated significantly with each other on all cluster scores and on the Total SII (see Table 4.14). Parents and Teachers appear to see similar patterns of development in the early social skills of children with autism despite the mean differences.

This study of joint attention skill development used naturalistic measures of early social skills by employing rating scales scored by parents and teachers who are familiar with each child on a daily basis. Most prior studies of joint attention have looked at skills in controlled experimental situations unfamiliar to the child. As Cantwell, Baker, and Rutter (1978) noted, the abnormal language of subjects with autism is more evident in unfamiliar settings or circumstances. Wetherby (1986) concluded that gestural and verbal behaviors should be studied in...
naturally occurring interactions to get a better sense of how the behaviors function for the child with autism. A goal of this research was to obtain a more natural picture of the subject's social skills by obtaining a measure of their social skills in familiar settings with familiar adults. Although direct comparisons of how the subjects might have performed under experimental conditions are not available, the change in venue from previous research may help to account for some of the discrepancies between the findings of this study and other related research. The tendency for parents to rate their children higher than teachers on several variables could be accounted for by a tendency of parents generally to be somewhat biased in favor of their child, but teachers are likely to experience similar biases, making relative comparisons of Parent and Teacher ratings meaningful. Differences in the ratings of Parents and Teachers appear to represent a higher frequency of use of basic early social skills by children with autism in their most familiar, comfortable environment: the home setting. The home is typically less structured than a school setting and these less structured circumstances may be conducive to higher levels of spontaneous social expression on the part of the children with autism. Children may inhibit their spontaneous expression of early social interest in the presence of increased cognitive, linguistic, or social demands. Social expectations may seem overwhelming or confusing to children with autism due to their difficulties in organizing and processing the social input of others or predicting the effect their behaviors may have on their social partner. It has been reported that children with autism seem to depend on cognitively figuring out, rather than knowing intuitively, what is expected in social situations. This would seem to allow them more ease of expression in familiar, routine environments and interactions with familiar partners.
G. Discussion

The pattern of development of the earliest social skills in autism is very delayed overall, but individual social skills have been found to correlate closely to one another and to the development of the related skills of imitation and pretense. It seems likely that the relationship of these early social skills to one another might be extended further to include a relationship to the later development of a theory of mind. The developmental patterns of these early social skills, when considered separately from other autistic features, may not be as disordered as some have described (e.g. Baron-Cohen, 1991).

The disordered developmental patterns of children with autism become more apparent when the limited correlation of early social skills such as joint attention to cognitive and language development is considered. Over a broad range of the autistic spectrum, there appears to be very little relationship between the development of early social skills such as joint attention and the cognitive and language development of the students. This is a pattern which is quite discrepant from typical childhood development.

Children with autism appear to have persistent deficits in joint attention skills at all levels of language and cognitive ability. At the lowest levels, such deficits are apparent in the children's failure to join others in looking or pointing at objects or showing objects to one another. At the highest levels, such deficits may be seen in the failure of children with autism to share the interests of their communicative partners in interactive verbal discourse. These delays in joint attention and other early social skills may help to account for the disordered patterns of skills in the cognitive and language domains for children with autism by influencing how their cognitive and language skills are used.

Deficits in joint attention and related early social skills are highly correlated with the overall severity of autism and seem to be a core feature of the disability.
Joint attention deficits can be identified as early as 18 months of age (Baron-Cohen, Allen, & Gillberg, 1992) and are apparent in the home videotapes of 12 month old infants who are later diagnosed with autism (Osterling & Dawson, 1994). Although considered to be only one of several possible features which could lead to a diagnosis of autism in DSM-IV, it may be more realistic to list joint attention and related deficits as a necessary, but certainly not sufficient, feature for a diagnosis of autism or Asperger's Disorder.

Joint attention deficits seem to reflect a lack of social interest, motivation, or skill in interacting with others. The failure of social reinforcers to encourage more social interaction among children with autism may be tied to social cognitive structures which fail to develop adequately. The apparent lack of motivation to engage in social interactions may also reflect difficulties in attending to and organizing relevant environmental stimuli which is difficult for children with autism generally and is compounded by the less obvious social cues and subtle nuances that are involved in interpreting and responding to social interaction. Students with autism may prefer to avoid the less predictable and seemingly less rewarding reactions of a social partner in favor of more instrumental forms of interaction geared to meet immediate needs or environmental manipulations which allow the children to be reinforced independently of others. Other features of autism such as preoccupations with parts of objects may reflect similar cognitive organization problems which make it difficult for children with autism to understand the world on a more general level even when dealing with nonverbal or nonsocial materials. The obsessive interests, preoccupations, and compulsive behaviors of autism may ultimately be a reflection of the same type of restricted awareness and disorganized information processing that seems to be associated with joint attention deficits, although these difficulties seem less likely to become apparent
until after the more obvious social relating and communication deficits of autism have been identified.

The failure of joint attention skills to relate to language and cognition in autism is a deviance from what has been described in the normal course of child development for many years and which has also been indicated in some studies of autism. Sharing one's attention with others has been described as a precursor or foundation to language development, but the frequency of use and level of sophistication of joint attention and related early social skills does not appear to have a direct relationship to subsequent language development in autism. Language and joint attention appear to be two separate developmental continuums. It appears to be more fruitful to conceive of joint attention as the foundation for the social or pragmatic use of language rather than as a foundation for the actual development of the semantics of language. Similarly, joint attention may not be essential to the development of cognitive skills. Children with autism appear to be able to respond to cognitive tasks in a goal-directed manner if the purpose of the task is made clear through nonsocial means. The frequency of use and degree of sophistication of joint attention skills is largely unrelated to the level of cognitive ability of subjects with autism. Deficits in joint attention and related skills can be used to describe the social relating deficits of children with autism at all ages and levels of cognitive and language ability.

It has been said (Lotter, 1974) that individual differences in language development differentiate children with autism with a fair prognosis from those with a poor prognosis. It is a commonly held perception that failure to develop language before age five is a sign of a very poor prognosis in autism. This belief appears to be one of the driving forces behind some intervention methods such as discrete trial strategies which emphasize intensive language instruction for children with autism in their preschool years. However, current research is
showing that early social skill development may be at least as important and quite possibly more important than language or any other developmental feature of autism in the first years of life and possibly for determining the eventual outcome or course of the disorder. The percentage of available time that children with autism spend in joint attention interactions rather than preoccupied with their own interests may be an important prognostic indicator of how well they will learn to function in life.

How much a child with autism is able to incorporate the interests, ideas, thoughts, or feelings of others into their social interactions is a powerful determinant of the child's social aptitude. This applies to most forms of social engagement and is not an issue specific to autism. In typical development, children gradually shift from a focus on their self-interests to a shared focus of attention and then to an appreciation of their social partners' needs, interests, or ideas as separate from their own. It may be important at higher levels of joint attention skill development to consider not just how well the child with autism can coordinate their attention with another person but also how well the child can attend to the interests, ideas, thoughts or feelings of their partner as separate from their own. The level of success children with autism demonstrate in acquiring social skills along this continuum, which ranges from basic joint attention through the understanding of a theory of mind, may be an important measure of each child's progress. This measure may be far more useful than a measure of language acquisition by age five, or any other age, in determining the long-term prognosis for a child with autism, at least in regard to the potential for the child to function interactively with others in a social environment which may be the strongest predictor of their success.

Further research is needed to determine the overall functional significance of particular levels of joint attention (and theory of mind) skill deficits on the ability of
individuals with autism to participate effectively in various social and community settings. It is important to consider how much of the joint attention deficit in autism reflects a lack of skill in this area or a failure to use available skills in the expected manner. The failure of children with autism to respond with shared attention to the salient aspects of their environment would seem to be a critical intervention variable which could help determine how receptive children will be to various external influences as well as direct instruction.

A variable such as the severity of the joint attention deficit could be important for determining the programming and staffing needs of particular children and judging the potential effectiveness of exposing children to various levels of social opportunities. For example, children with very limited joint attention skills or those who show little recognition of the interests or ideas of others may not be viable candidates for inclusion in large group instruction. Teaching children with severe deficits in joint attention may require more efforts to engage with the children on an individual level, allowing them to learn the simple give-and-take of the most basic shared attention interactions. Moving too quickly into larger group instruction or emphasizing social skills which are learned through rote teaching of repetitive interactions (eg. simple turn-taking routines) may overlook many of the prerequisite skills the children are lacking. For practical reasons, it may be necessary to teach higher level social skills such as those needed for social acceptance, but intervention efforts should also focus on teaching and reinforcing the children's interest in basic early forms of social interaction such as joint attention.

It seems likely that joint attention deficits should be addressed more specifically as part of a comprehensive intervention package for children with autism. At this time, little research has been done to study the effectiveness of teaching early social skills such as joint attention, pointing, and social referencing.
to children with autism. It has been largely assumed that joint attention and related social skills will improve as the language and cognitive abilities of the children with autism improve. This may be true for some cases of autism, especially where the language or cognitive abilities of the children may lag behind their level of social awareness, but the findings of the current study would indicate that this is usually not the case. If these early social skills develop along a separate continuum, as appears to be the case, then it may not be sufficient to address only the cognitive and language deficits of children with autism while neglecting those early social skills which may be most critical to the child's eventual success in interacting with their environment.

It is important to replicate this study to help resolve some of the inconsistencies with prior studies. The differences between various studies appear to be largely determined by the differences in subjects and methods but a replication might lend additional credibility to the results. Longitudinal studies may help determine the consequences and long-term effects of deficits in joint attention and give a better understanding of the expected prognosis of children with different levels of early social skills. Experimental studies of treatment effects may shed more light on the amenability of these deficits to intervention and the effects of early social skills interventions on the overall prognosis for children with autism. Further comparisons between children's joint attention behaviors across caregivers and environments may help to determine how much of the failure to engage in early social skills is an apparent cognitive dysfunction and how much is a performance issue related to the child's degree of social comfort, interest level, or motivation to interact. Some combination of skill deficits and motivational factors would seem to be plausible in explaining the joint attention skill deficit of children with autism.
CARS
The Childhood Autism Rating Scale
Eric Schopler, Ph.D., Robert J. Reichler, M.D.,
and Barbara Rochen Renner, Ph.D.

Published by

wps

12031 Waukegan Boulevard

Las Angeles, California 90025-1251

Name: ____________________________ Sex: __________

ID Number: ________________________

Test Date: Year ___________ Month ___________ Day ___________

Birth Date: Year ___________ Month ___________ Day ___________

Chronological Age: Years ___________ Months ___________

Rater: ____________________________

Category Rating Scores

Total Score

Non-Autistic  Mildly-Moderately  Severe

Autistic   Autistic

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### I. RELATING TO PEOPLE

<table>
<thead>
<tr>
<th>1</th>
<th>No evidence of difficulty or abnormality in relating to people • The child's behavior is appropriate for his or her age. Some shyness, fussiness, or annoyance at being told what to do may be observed, but not to an atypical degree.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Mildly abnormal relationships • The child may avoid looking the adult in the eye, avoid the adult or become fussy if interaction is forced, be excessively shy, or cling to parents somewhat more than most children of the same age.</td>
</tr>
<tr>
<td>2</td>
<td>Moderately abnormal relationships • The child shows aloofness (seems unaware of adult) at times. Persistent and forceful attempts are necessary to get the child's attention at times. Minimal contact is initiated by the child.</td>
</tr>
<tr>
<td>2.5</td>
<td>Severely abnormal relationships • The child is consistently aloof or unaware of what the adult is doing, or the almost never respond or initiate contact with the adult. Only the most persistent attempts to get the child's attention have any effect.</td>
</tr>
</tbody>
</table>

**Observations:**

### III. EMOTIONAL RESPONSE

<table>
<thead>
<tr>
<th>1</th>
<th>Age-appropriate and situation-appropriate emotional responses • The child shows the appropriate type and degree of emotional response as indicated by a change in facial expression, posture, and manner.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Mildly abnormal emotional responses • The child occasionally displays a somewhat inappropriate type or degree of emotional reaction. Reactions are sometimes unrelated to the objects or events surrounding them.</td>
</tr>
<tr>
<td>2</td>
<td>Moderately abnormal emotional responses • The child shows definite signs of inappropriate type and/or degree of emotional response. Reactions may be quite inhibited or excessive and unrelated to the situation; may grumble, laugh, or become rigid even though no apparent emotion-producing objects or events are present.</td>
</tr>
<tr>
<td>2.5</td>
<td>Severely abnormal emotional responses • Responses are seldom appropriate to the situation; once the child gets in a certain mood, it is very difficult to change the mood. Conversely, the child may show wildly different emotions when nothing has changed.</td>
</tr>
</tbody>
</table>

**Observations:**

### II. IMITATION

<table>
<thead>
<tr>
<th>1</th>
<th>Appropriate imitation • The child can imitate sounds, words, and movements which are appropriate for his or her skill level.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Mildly abnormal imitation • The child imitates simple behaviors such as clapping or single verbal sounds most of the time; occasionally, imitates only after prodding or after a delay.</td>
</tr>
<tr>
<td>2</td>
<td>Moderately abnormal imitation • The child imitates only part of the time and requires a great deal of persistence and help from the adult; frequently imitates only after a delay.</td>
</tr>
<tr>
<td>2.5</td>
<td>Severely abnormal imitation • The child rarely or never imitates sounds, words, or movements even with prodding and assistance from the adult.</td>
</tr>
</tbody>
</table>

**Observations:**

### IV. BODY USE

<table>
<thead>
<tr>
<th>1</th>
<th>Age-appropriate body use • The child moves with the same ease, agility, and coordination of a normal child of the same age.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Mildly abnormal body use • Some minor peculiarities may be present, such as clumsiness, repetitive movements, poor coordination, or the rare appearance of more unusual movements.</td>
</tr>
<tr>
<td>2</td>
<td>Moderately abnormal body use • Behaviors that are clearly strange or unusual for a child of this age may include strange finger movements, peculiar finger or body posturing, staring or picking at the body, self-directed aggression, rocking, spinning, finger wagging, or toe-walking.</td>
</tr>
<tr>
<td>2.5</td>
<td>Severely abnormal body use • Intense or frequent movements of the type listed above are signs of severely abnormal body use. These behaviors may persist despite attempts to discourage them or involve the child in other activities.</td>
</tr>
</tbody>
</table>

**Observations:**

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### V. OBJECT USE

<table>
<thead>
<tr>
<th>1</th>
<th>Appropriate use of, and interest in, toys and other objects • The child shows normal interest in toys and other objects appropriate for his or her skill level and uses these toys in an appropriate manner.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Mildly inappropriate interest in, or use of, toys and other objects • The child may show typical interest in a toy or play with it in an inappropriately childish way (e.g., banging or rocking on the toy).</td>
</tr>
<tr>
<td>3</td>
<td>Moderately inappropriate interest in, or use of, toys and other objects • The child may show little interest in toys or other objects, or may be preoccupied with using an object or toy in a strange way. He or she may focus on one insignificant part of a toy, become fascinated with light reflecting off the object, repetitively move some part of the object, or play with one object exclusively.</td>
</tr>
<tr>
<td>4</td>
<td>Severely inappropriate interest in, or use of, toys or other objects • The child may engage in the same behavior as above, with greater frequency and intensity. The child is difficult to distract when engaged in these inappropriate activities.</td>
</tr>
</tbody>
</table>

**Observations:**

### VI. ADAPTATION TO CHANGE

| 1 | Age appropriate response to change • While the child may notice or comment on changes in routine, he or she accepts these changes without undue distress. |
| 2 | Mildly abnormal adaptation to change • When an adult tries to change tasks the child may continue the same activity or use the same materials. |
| 3 | Moderately abnormal adaptation to change • The child actively resists changes in routine, tries to continue the old activity, and is difficult to distract. He or she may become angry and unhappy when an established routine is altered. |
| 4 | Severely abnormal adaptation to change • The child shows severe reactions to change. If a change is forced, he or she may become extremely angry or uncooperative and respond with tantrums. |

**Observations:**

### VII. VISUAL RESPONSE

| 1 | Appropriate visual response • The child's visual behavior is normal and appropriate for his age. Vision is used together with other senses as a way to explore a new object. |
| 2 | Mildly abnormal visual response • The child must be occasionally reminded to look at objects. The child may be more interested in looking at scenes or lighting than objects, may occasionally stare at the same object, or may avoid looking people in the eye. |
| 3 | Moderately abnormal visual response • The child must be reminded frequently to look at what he or she is doing. He or she may stare into space, avoid looking people in the eye, look at objects from an unusual angle, or hold objects very close to the eyes. |
| 4 | Severely abnormal visual response • The child consistently avoids looking at people or certain objects and may show extreme forms of other visual peculiarities described above. |

**Observations:**

### VIII. LISTENING RESPONSE

| 1 | Age appropriate listening response • The child's responses to sounds vary; the child responds appropriately to his or her age. Listening is used together with other senses. |
| 2 | Mildly abnormal listening response • There may be some lack of response, or mild overreaction to certain sounds. Responses to sounds may be delayed, and sounds may need repetition to catch the child's attention. The child may be distracted by extraneous sounds. |
| 3 | Moderately abnormal listening response • The child's response to sounds vary, often ignores a sound the first few times it is made; may be startled or cover ears when hearing some everyday sounds. |
| 4 | Severely abnormal listening response • The child overreacts and/or underreacts to sounds to an extremely marked degree, regardless of the type of sound. |

**Observations:**

### IX. TASTE, SMELL, AND TOUCH RESPONSE AND USE

| 1 | Normal use of, and response to, taste, smell, and touch • The child explores new objects in an age-appropriate manner, generally by feeling and looking. Taste or smell may be used when appropriate. When reacting to minor, everyday pain, the child expresses discomfort but does not overreact. |
| 2 | Mildly abnormal use of, and response to, taste, smell, and touch • The child may be more or less fearful than is typical even for a younger child in a similar situation. |
| 3 | Moderately abnormal use of, and response to, taste, smell, and touch • The child may avoid touching, smelling, or tasting objects or people. The child may either react too much or too little. |
| 4 | Severely abnormal use of, and response to, taste, smell, and touch • The child is preoccupied with touching, smelling, or tasting objects or people. The child may completely ignore pain or react very strongly to slight discomfort. |

**Observations:**

### X. FEAR OR NERVOUSNESS

| 1 | Normal fear or nervousness • The child's behavior is appropriate both to the situation and to his or her age. |
| 2 | Mildly abnormal fear or nervousness • The child occasionally shows too much or too little fear or nervousness compared to the reaction of a normal child of the same age in a similar situation. |
| 3 | Moderately abnormal fear or nervousness • The child shows either quite a bit more or quite a bit less fear than is typical even for a younger child in a similar situation. |
| 4 | Severely abnormal fear or nervousness • Fear persists even after repeated experience with harmless events or objects. It is extremely difficult to calm or comfort the child. The child may become extremely agitated and show inappropriate regard for hazards which other children of the same age avoid. |

**Observations:**
XI. VERBAL COMMUNICATION

1. Normal verbal communication, age and situation appropriate.

2. Mildly abnormal verbal communication: Speech shows overall retardation. Most speech is meaningful, however, some echolalia or previous reversal may occur. Some peculiar words or phrases may be used occasionally.

3. Moderately abnormal verbal communication: Speech may be absent. When present, verbal communication may be a mixture of some meaningful speech and some peculiar speech such as argot, echolalia, or previous reversal. Peculiarities in meaningful speech include excessive questioning or preoccupation with particular topics.

4. Severely abnormal verbal communication: Meaningful speech is not used. The child may make incoherent speech, weird or animal-like sounds, complex noises approximating speech, or may show persistent, bizarre use of some recognizable words or phrases.

Observations:

XII. NONVERBAL COMMUNICATION

1. Normal use of nonverbal communication, age and situation appropriate.

2. Mildly abnormal use of nonverbal communication: Immature use of nonverbal communication; may only point vaguely, or reach for what he or she wants, in situations where same-age child may point or gesture more specifically to indicate what he or she wants.

3. Moderately abnormal use of nonverbal communication: The child is generally unable to express needs or desires nonverbally and cannot understand the nonverbal communication of others.

4. Severely abnormal use of nonverbal communication: The child only uses bizarre or peculiar gestures which have no apparent meaning, and shows no awareness of the meanings associated with the gestures or facial expressions of others.

Observations:

XIII. ACTIVITY LEVEL

1. Normal activity level for age and circumstances: The child is neither more active nor less active than a normal child of the same age in a similar situation.

2. Mildly abnormal activity level: The child may either be mildly restless or somewhat "lazy" and slow moving at times. The child's activity level interferes only slightly with his or her performance.

3. Moderately abnormal activity level: The child may be quite active and difficult to restrain. He or she may have boundless energy and may not go to sleep readily at night. Conversely, the child may be quite lethargic, and need a great deal of prodding to get him or her to move about.

4. Severely abnormal activity level: The child exhibits extremes of activity or inactivity and may even shift from one extreme to the other.

Observations:

XIV. LEVEL AND CONSISTENCY OF INTELLECTUAL RESPONSE

1. Intelligence is normal and reasonably consistent across various areas: The child is as intelligent as typical children of the same age and does not have any unusual intellectual skills or problems.

2. Mildly abnormal intellectual functioning: The child is not as smart as typical children of the same age: skills appear only slightly retarded across all areas.

3. Moderately abnormal intellectual functioning: In general, the child is not as smart as typical children of the same age; however, the child may function nearly normally in one or more intellectual areas.

4. Severely abnormal intellectual functioning: While the child generally is not as smart as the typical child of his age, he or she may function even better than the normal child of the same age in one or more areas.

Observations:

XV. GENERAL IMPRESSIONS

1. No autism: The child shows none of the symptoms characteristic of autism.

2. Mild autism: The child shows only a few symptoms or only a mild degree of autism.

3. Moderate autism: The child shows a number of symptoms or a moderate degree of autism.

4. Severe autism: The child shows many symptoms or an extreme degree of autism.

Observations:
SOCIAL INTEREST INVENTORY

Child's Name: ___________________  Today's Date: ________________

Date of Birth: _________________  Completed by: ________________

Please circle the rating for each item that describes the child's most likely behavior when opportunities for these behaviors arise in the child's daily life.

Rating scale: 0 - Behavior is rarely or never observed when expected.
              1 - Behavior is sometimes observed when expected.
              2 - Behavior is often observed when expected.
              3 - Behavior is nearly always observed when expected.

1. Does the child watch the activities of peers or adults as if interested in what the others are doing? 0 1 2 3

2. Does the child spontaneously request desired items or activities:
   a. by pushing an adult's arm or hand to the item? 0 1 2 3
   b. by pointing to the desired item? 0 1 2 3
   c. by verbally requesting the desired item? 0 1 2 3

3. Does the child make eye contact with another person and smile during social interactions? 0 1 2 3

4. Does the child actively seek an adult to indicate when they need help with something? (eg. fasteners, food packages) 0 1 2 3

5. Does the child look directly at a person's face as if seeking information when given a new toy or something else they do not recognize, do not understand, or do not want? 0 1 2 3

6. Does the child join another person in looking at an object and then look back at that person as if to share an interest in the object (not just to obtain the object)? 0 1 2 3

7. Does the child bring toys, flowers, or other interesting objects to an adult as if to share their interest or just show the object to the adult? 0 1 2 3

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8. Does the child point to pictures while looking at an adult in an effort to share their interest in the picture or to get more information about it? 0 1 2 3

9. If an adult points at an interesting object across the room and says, "Look!" does the child look to see the focus of the point? 0 1 2 3

10. Does the child respond to questions such as "Where's the ball?" or "Show me the ball!" by pointing with his/her index finger at the ball? 0 1 2 3

11. Does the child ever seek an adult to "show off" something they can do or something they have made? 0 1 2 3

12. Does the child comment on an object or activity for the benefit of another person (e.g. "Look!" or "It's pretty!") or for the sake of conversation - not just to make requests? 0 1 2 3

13. Does the child laugh or repeat an action if their action is immediately imitated by an adult? 0 1 2 3

14. Does the child imitate the actions of others in new activities that have not been taught before? (e.g. using a new toy, hand motions for a song) 0 1 2 3

15. Does the child imitate sounds, words, or songs immediately after hearing them for the first time? 0 1 2 3

16. Does the child spontaneously engage in pretend play:

   a. by using objects to act out scenes? (e.g. action figures having a battle, preparing a meal with plastic food) 0 1 2 3

   b. by using nonexistent things? (e.g. drinking pretend tea or fighting with a pretend sword) 0 1 2 3

   c. by using objects in ways other than they are intended? (e.g. using a stick as a gun, riding a broomstick pony) 0 1 2 3

   d. in interaction with another child? (e.g. acting out battle scenes or tea parties with a peer) 0 1 2 3
SII SCORING

Name:_______________________ Date:_______

Social Referencing
_____1 onlooking
_____3 eye contact
_____5 seeking guidance Total:_____

Joint Attention
_____6 looking at object & person
_____7 bringing objects (protodeclarative)
_____8 pointing to share an interest (protodeclarative)
_____9 following point to share an interest Total:_____

Pointing
_____2b requesting (protoimperative)
_____8 showing pictures/objects (protodeclarative)
_____9 responding to "Look"
_____10 responding to "Where's the . . ." Total:_____

Imitation
_____13 repeat an action
_____14 motor imitation
_____15 vocal imitation Total:_____

Protoimperative
_____2a motor requests (score 3 if pointing or verbal are used instead)
_____2b pointing requests
_____2c verbal requests
_____4 seeking help Total:_____

Protodeclarative
_____7 bringing objects
_____8 pointing to share interest
_____11 showing off
_____12 commenting on activities/objects Total:_____

Pretense
_____16a actual objects
_____16b nonexistent objects
_____16c other objects
_____16d with peers Total:_____

TOTAL SII SCORE: ________
Dear Parents,

I am conducting a research study and would like to ask for your participation. This research will evaluate the relationship between selected social skills and the language and cognitive abilities of children who may have characteristics of autism or pervasive developmental disorder. Data is needed for children who have been recently evaluated by the SECEP evaluation team.

You can participate in the study by completing a brief questionnaire about your child. Additional questionnaires will be completed by your child's teacher and classroom support staff. Your child will not have to do anything to have their results included in the study! Your cooperation in completing the attached questionnaire is estimated to take from 15 to 30 minutes of your time.

If you are willing to participate, simply complete the attached permission form and return it with the completed questionnaire in the enclosed, stamped envelope within the next week. Your participation is completely voluntary. If you do not wish to participate, you can indicate your refusal on the permission form and return the packet in the envelope to avoid follow-up contacts.

Your child's name is listed on the questionnaire to help in collecting the data. After the data is collected, your child's scores will be assigned a code number and your child's name will be deleted from the record. Any record of your child's participation in the study will be destroyed and not even I will know which scores belong to your child after they are coded. If you would like your responses to be shared with your child's teacher for classroom use, separately from the use of the scores in the research, please indicate this choice on the permission form and the questionnaire will be forwarded to your child's teacher.

Your participation in this study and willingness to share your child's test results with others for research purposes is very gratefully acknowledged. The results of the study should be ready for publication before the end of the year. It is my hope that this study will contribute to the improvement of social skills interventions for children with autistic spectrum disorders. Thank you in advance if you choose to participate. Please feel free to call me if you have any questions.

Sincerely,

Linda Bourdon
Permission form

I give my consent for data to be collected about my child for use in the research study described by Linda Bourdon. I understand that this data will be collected from my child's testing records and from questionnaires to be completed by myself and members of my child's SECEP staff. My child's direct participation in the research study is not required. The data collected will be coded to ensure my child's privacy. I understand that my participation is voluntary and can be withdrawn at any time.

____________________________
Child's name

____________________________  ____________
Parent or Guardian's signature   Date

Please initial here if you would like your responses to the questionnaire to be shared with your child's classroom staff before it is coded for privacy.

If you choose to participate, please complete the top of this form and return it with the completed questionnaire in the enclosed envelope within the next week. This form and all references to your child's name will be destroyed after the study is complete.

____________________________
Child's name

____________________________  ____________
Parent or Guardian's signature   Date

OR, if you choose not to participate, please complete the bottom of this form and return it with the blank questionnaire in the enclosed envelope. In either case, thank you very much for your cooperation!

I do not wish to participate in the study as described above.
References


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Vita

Linda Sue Bourdon

Birthdate: February 15, 1955

Birthplace: Edinburg, Scotland

Education:

1978-1981  The College of William and Mary
            Williamsburg, Virginia
            Master of Education

1973-1977  Old Dominion University
            Norfolk, Virginia
            Bachelor of Science

Professional Experience:

1991-1999  Southeastern Cooperative Educational Programs
            Norfolk, Virginia
            Coordinator
            Liaison/School Psychologist

1981-1991  Virginia Beach City Public Schools
            Virginia Beach, Virginia
            School Psychologist