Order Number 9020801

Communication during the transition to first words: A look at the autistic and normal dyadic process

Roberts, Elise Rosenberg, Ph.D.

City University of New York, 1990

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

A

COMMUNICATION DURING THE TRANSITION TO FIRST WORDS: A LOOK AT THE AUTISTIC AND NORMAL DYADIC PROCESS

By

ELISE ROSENBERG ROBERTS

A dissertation submitted to the Graduate Faculty in Speech and Hearing Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

1990

This manuscript has been read and accepted for the Graduate Faculty in Speech and Hearing Sciences in satisfaction of the dissertation and requirement for the degree of Doctor of Philosophy.

January 30, 1990 — Date

John Ward — Chairman of Examining Committee

January 29, 1990 — Date

Executive Officer

Katherine Harris

Elaine Silliman
Supervisory Committee

The City University of New York

Abstract

COMMUNICATIVE LOOPS DURING THE TRANSITION TO FIRST WORDS: A LOOK AT THE AUTISTIC AND NORMAL DYADIC PROCESS

by

Elise Rosenberg Roberts

Adviser: Professor John Dore

The purposes of this longitudinal research were: (1) to provide a methodological system for looking at routine interactions of autistic and normal groups of children with adults during the transitional period to first words and (2) to propose a theoretical model for understanding how the developmental progress of autistic and normal communication differ. This study treated the dyad as a unit and interactions were described in terms of participant's adaptations to and the specific consequences of the other's behaviors.

Two groups of dyads participated in this study. An autistic group consisted of four dyads of autistic children with their teachers. All of these children were rated at the severe end of autism on the Childhood Autism Rating Scale. A second group of four dyads consisted of normal infants and their mothers.

The model prescribed that the only child behaviors selected for analysis were those responded to by the adult. These behaviors occurred within a communicative loop, designated a Co-Adaptive Behavioral Sequence, which was described in terms of child initiatory, adult response, and child attending behaviors. The child's attending to the adult's response was identified as the critical moment for the child's potential benefit from participating in interactions.

The developmental progress of how communicative behaviors develop to a conventional symbol and become coordinated with communicative action was examined. It was proposed that communicative behaviors in synchrony with the other are

necessary for this progress. Findings indicated that the autistic and normal groups evidenced important differences despite similar means of child initiating behaviors. Most importantly, only the autistic child's communicative loops broke down and behaviors did not move in synchrony. These breakdowns were in the form of a failure to attend to the adult's response and signalled the autistic child's difficulty in coordinating monitoring systems. The consequences of these breakdowns were observed in the autistic child's adaptive behaviors and in later loops, both of which reflected limited organization and use of the adult's response. Findings of interactional breakdowns, creating asynchrony in interaction, were proposed to represent a failure of adaptation. This asynchrony mitigates developmental progress in the autistic child's communication.

Acknowledgements

There are many people to whom I am grateful for contributing to the completion of this dissertation.

First, I would like to thank John Dore, Elaine Silliman, Katherine Harris, Irving Hochberg, and Judy Duchan for their continued support and patience in my completion of this research project. To John for his constant intellectual challenging and calling upon my tenacity and determination...to Elaine for her initial push and then supporting me to the end...to Kathy for her most consistent and continued support without which the results would still not make sense...and to Irv, whose continued academic support enabled me to reach this end. And finally, to Judy whose comments on autism and methodology helped in many ways.

In addition, I would like to thank the many parents, teachers, and children who allowed my all too frequent intrusion in the course of their lives.

I would also like to thank Bill for allowing me the time to pursue this dissertation to its completion and for giving me the support to do so.

To my family, who taught me the meaning of persistence and determination.

To Geri, my friend, whose constant encouragement was a continued source of strength.

And last, but certainly not least, to my husband and fondest supporter, Ed, for his quiet support, acceptance, encouragement, and tolerance of my completion of this effort. But mostly, thank you for being there and "rallying" when I needed you to.

Table of Contents

List of Tables

List of Figures

List of Appendices

Introduction

The diagnostic criteria for diagnosis of the autistic disorder includes behaviors in the following three areas: "(1) qualitative impairment in reciprocal social interaction...; (2) qualitative impairment in verbal and nonverbal communication and in imaginative activity...; and (3) marked restrictive repertoire of activities and interests" (DSM-III- R, 1987, pp. 38-39). These behaviors have their onset in infancy or childhood. Various approaches have been proposed to understand the overall lack of developmental progress of autistic children and to develop individual strategies for this population. Most of these approaches have conceptualized the overall difficulties in terms of a primary deficit model. The problems of this population, specifically their communication, have been attributed either to a cognitive (Boucher, 1976; Rutter, 1978, Schuler, 1980) or social (Wing, 1981) deficit or to an overall language impairment (Hermelin & O'Connor, 1970; Ricks & Wing, 1975). However, in the past decade, Prizant (1983) criticized this research for producing information only on what autistic children cannot do when compared to normal children and for not attending to the possible unique strategies of the autistic population.

More recent approaches have shifted to examining ways in which the autistic child manages to participate in interactions. In particular, research in autism has paid close attention to the forms of echolalia due to its prevalent use in the autistic child's communication. Prizant (1983) has encouraged such research to assess the function not form served by echolalic utterances (Prizant & Duchan, 1981; Prizant & Rydell, 1984). Consequently, the focus of research in this area has shifted to evaluate the communicative functions served by echolalic utterances. These researchers have argued that although unanalyzed imitative routines of autistic children reflect cognitive and linguistic processing constraints, these patterns may provide these children with unique strategies of language acquisition. Results of the research in this area noted that

echolalia serves a variety of communicative functions, such as self-regulatory, turn-taking, and yes-answer functions (Prizant & Duchan, 1981; Prizant & Rydell, 1984).

Other research on the language and communication of autistic children focused on the development of intentional communication. This research attempted to determine the communicative functions served by these children's gesture and vocal behaviors. Findings for gesture behaviors indicated that autistic children develop limited use of gestures (Curcio, 1978; Loveland & Landry, 1986; Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Mundy, Sigman, Ungerer, & Sherman, 1986) and use primitive strategies for eliciting assistance from or making requests of another with lack of eye contact (Curcio, 1978). Curcio argued that children with these primitive strategies exhibit cognitive behaviors of children prior to sensorimotor Stage V and that a certain level of cognitive development is necessary for the development of intentional communication.

In a slightly different approach to examining the communicative functions served by autistic children's vocal and gesture behaviors, autistic children have been matched with normal children on gross language measures (for example stage and size of lexicon) or at similar mental ages. Results of these studies indicated that normal children develop a variety of communicative functions upon which they map more complex structures, whereas autistic children show uneven development. Autistic children develop skills for behavioral regulation but make limited social use of communication, for example, to show off or comment, and do not demonstrate attempts to achieve joint attention, for example, to attract and direct an adult's attention to self (Wetherby, 1984; Wetherby & Prutting, 1984; Wetherby, Yonclas, & Bryan, 1989). Some explanations of these results rely upon the literature on normal children which indicates these skills advance in parallel with cognitive skills. Other researchers proposed a more social-cognitive approach. For example, Wetherby and Prutting (1984) suggested that the autistic child initially acquires the notion of the intent to

communicate outside of the social context. Although the autistic child has severe limitations in social interactions, all communication occurs within a social context. A more plausible explanation may be that these children have difficulty attending to the social context and therefore are unable to adjust to the behaviors presented within it. Schuler (1980) explained the autistic child's restricted understanding as related to their understanding of the effects of human action. The autistic child's obliviousness to social stimuli may impede development of dynamic skills and s/he cannot learn from the social context.

A third approach to the study of autism examined the asynchronous behaviors found in interactions with autistic children. These studies described autistic children's behaviors in terms of their difficulty with modulating stimulation. One explanation of these children's behaviors in interactions was described as selective responding to multiple sensory input or stimulus overselectivity (Lovaas, Shreibman, Koegel, & Rehm, 1971). The autistic child cannot respond to multiple sensory input and therefore s/he responds to only one of multiple cues or to one part of a cue. On the other hand, Condon (1975, 1979) described autistic children's difficulty with synchronous movement as related to being overwhelmed by sound reverberations, particularly speech. These children's synchronous organization in response to human speech is disrupted in ways not found in normals. These approaches to examining the asynchronous behaviors of the autistic child have received limited recent attention and some of the findings have been difficult to replicate.

The common trend in all three of these approaches has been to examine individual child behaviors and to continue to explain these difficulties as consequent to a primary deficit, predominantly cognitive. I proposed that these approaches have not looked closely enough at the interactional context in which these behaviors occur and what gets left out is the fuller communication process. This insufficient attention to the interactional context in which these behaviors occur seriously hinders development of

potential theories and intervention strategies for the autistic population. Resolution of this issue first requires attending to the behavioral differences in the social interactions of autistic and normal children and constructing a model.

The primary purpose of my research was twofold. One purpose was to provide a methodological system, via a protocol form, for looking more carefully at the actual interactions of autistic and normal children. This study treated the dyad as a unit and interactions were described in terms of participant's adaptation to and the specific consequences of the other's behaviors. In this way, an ongoing account of interaction was constructed. From this, the second purpose of my research was to propose a theoretical model for understanding how the developmental progress of autistic and normal communication differs during child's transitional period to first words. This involved describing interaction and explaining the effects of interactional breakdowns on developmental progress.

This model was conceptualized in a social-interactional framework where meaning, intent, and conventional form were described as arising out of adaptive sequences between the participants. This model was derived from theories of intersubjectivity articulated by Stern (1977), Trevarthen (1977, 1980) and Trevarthen and Hubley (1978); theories formulated by Vygotsky, (1962, 1978); theories of symbol formation described by Werner and Kaplan (1963); and the social-interactional theories of Mead (1934) and Dore (1986). These theories differ in primary focus but essentially all attend to the dyadic unit as a unit for study. It is the other's consistent response to the child's behaviors that serves to assign communicative value to the child's behaviors. In this way, the infant's initial experience remains unarticulated until the adult gives it communicative form in the linguistic code (Dore, 1983, 1985, 1989).

In the present study, these constructs were applied to interactions between children and adults during the child's transition to first words. Here, the model to describe interactions prescribed that the only child behaviors selected for analysis were those

responded to by the adult. This model described adaptive sequences of behaviors that occurred within a communicative loop or Co-Adaptive Behavioral Sequence (designated as a CABS). This sequence is described in the following way: The child directs a set of behaviors to the adult. The adult responds to these behaviors by assigning communicative value to them in three important ways: fixing the linguistic form, interpreting the communicative intent, and assigning meaning to the form. This response signals how the adult interpreted the child's efforts, particularly which form and which function was understood. The response typically carries a full behavioral reflection of the child's behaviors, including gaze to the child and a conventional form. The child attends or tracks the adult's response. This tracking is critical for the child's potential benefit from participating in this process. During this moment, the child can make a connection between his/her own initial primitive behaviors in a particular form and their interpreted intent and meaning as assigned by the adult. The consequences of this tracking may be seen in the child's subsequent adjustment of his/her initial behaviors. In this view, it is the interactional context in which communication arises that allows for a set of behaviors to develop conventional form that becomes coordinated with communicative action.

The communicative process described is illustrated in the following example: An infant boy looks at his mother, extends his fingers to his belly, and vocalizes /dəe /. The mother looks to the child, extends her finger in a point to his stomach, and says That? That's your belly. The child monitors the mother's behavior and his own gestural and vocal behaviors have ceased. Subsequent to completion of the mother's behavior, the child extends his index finger to his belly and wiggles it around slightly, intensifying production of /dəe /. In this process, the child directs to his mother primitive vocal and gestural forms coupled with gaze behavior. The mother attends to the child's behaviors and assigns them communicative value. The child attends to this reflection of his behaviors. When the child directs his next set of behaviors, they are adjusted as a

consequence of attending to the forms of the adult's response. His gesture changes in form from extended finger to a wiggle and his vocalization is altered in intensity. When the child can coordinate gaze with appropriate and routine use of the gesture and the conventional form, that, we can say that he has conventional form, meaning, and communicative action. Describing interactions in this way in autistic and normal children is the focus of the present study.

In the literature, the unit of analysis used for examining children's behaviors is predominantly the individual child's utterance, identified either by an intentional communicative act or a communicative act. In the autistic literature, researchers have defined these terms as a "verbal, vocal, and/or gestural behavior initiated by the child" (Wetherby & Prutting, 1984, p. 369). Further, onset of an act was defined as the point the child initiates an interaction with the adult and offset, or termination, when the child's attentional focus shifts (Wetherby & Prutting, 1984; Wetherby, Cain, Yonclas, & Walker, 1988). This notion of termination is in line with the traditional way of looking at a vocal communicative act, with words of the linguistic code, under the control of the single individual. In my study, I examined the period before the child is able to use a vocal communicative act alone and the process by which this emerges.

During the period prior to first words, it is the mutual behaviors of the child and the adult which together convey the underlying meaning and concept of the child's particular behaviors. In this period, the child uses behaviors to which the adult responds with interpretation of meaning, assignment of functional intent, and provision of a linguistic form. It is not the individual child's primitive behaviors which carry the full propositional message. Therefore, in order to examine what is happening in interactions during this period, the unit of analysis used identified both the child initiating behaviors and the effect of these behaviors. This unit encompassed both the child and adult participants. This unit of analysis defined the onset point as the child's initiating behaviors and offset occurred after the child's tracking of the adult's response to these

behaviors. In this way, the child's behaviors were viewed within the dyadic context in which they occurred where the participants jointly contributed to the formation of a communicative act.

In the current study, what was examined was how communicative behaviors in the dyadic context develop a conventional symbol in the code and become coordinated with communicative action. The model proposed that the interaction between the child and adult permits development of a system of form-meaning relations or a code. Specific child behaviors elicit a certain adult response in the code. The adult response reflects the child's primitive behaviors, telling the child how his/her communicative behaviors fit into the code. The child's communicative behaviors in synchrony with the other provides opportunities for the child to view his/her own behaviors reflected by the adult. This experience provides a connection between the signifier, the child, and the signified, the adult's response. This union is necessary for the use of a sign. Saussure defined the sign as the "union of signifier and signified, a sound image and a concept" (in Barthes, 1982). When the child responds in a certain way in a later communicative loop, the model takes this as evidence of recognition. In other words, what was reflected for the child was used in a subsequent response. As a consequence of the child's monitoring, s/he recognized the connection between one's own behaviors and the adult's response and adapted.

In the previous example between the infant boy and his mother, the child vocalized and gestured and the adult responded. After the child's initial behaviors, he changed his gesture to a wiggle and intensified production of his wordform /dɔɛ/. These adjustments signified that the child made a connection between his/her own form and action and how these behaviors were reflected in the adult's response and the child adapted. In addition, in this example, the child's behavioral represented synchronized action organized in three ways. First, the gaze was coordinated with the gesture and vocal behaviors in the direction of the adult. Second, the child's use of both gesture and

vocal forms were related to the same intent. Here, the indexical form made reference and the gesture indicated to what. Finally, third, the combined use of a gesture and vocal form represented an efficient combination of behaviors to which the child was capable. This organization of behaviors signalled a full understanding of these behaviors as communicative.

Although we can speculate, we do not know how social dysfunction interferes in the interactional process. The autistic child's difficulties in social interactions present a plausible arena for examining how interactional breakdowns impact on communication. I proposed that communicative behaviors in synchrony with the other are necessary for developmental progress. The autistic child's attempts at interactions break down and their behaviors do not move in synchrony. These breakdowns are in the forms of a failure to attend to the adult's response and adapt. The consequences of these breakdowns are seen in how the child makes use of or adapts to the adult's response. This asynchrony mitigates developmental progress. Therefore, some autistic children may develop the rudiments of a code but forms in the code are not synchronized with communicative action. Other autistic children fail to develop a conventional linguistic code at all.

An Overview of the Study

Methodology

The present study used longitudinal data drawn from a group of autistic and a group of normal children during the period framing the transition to first words. The autistic group represented the severe end of autism. Here, the composition of the dyadic unit was children with significant adults. For the autistic group these adults were the children's teachers, and for the normal group these adults were the children's mothers. Behaviors produced within actual interactions were drawn from three sessions over the course of one year for the autistic group. For the normal group, these behaviors also were from three sessions drawn during the period from the onset of communicative loops used with

frequency, approximately at 9 months, and the emergence of five first words used with communicative action, approximately at 18 months. The dyads were engaged in routine games, for example "Peek-a-boo", nursery rhymes, such as "This little piggy went to market", and vocal play.

Two primary differences in methodology existed between this study and previous studies on autistic children. First, objects were not used and the focus of the interaction involved only the behaviors that occurred between child and adult. Second, the unit of analysis was the dyad as opposed to focusing only on individual child behaviors. These methodological differences should produce more specific information than has been previously identified about the interactional process in normal and autistic children and the lack of developmental progress in autistic children.

The analyses described and coded the participant's gaze, gesture, facial, and vocal behaviors and the timing of these behaviors. In addition, organization of the child's initiating behaviors were determined using three measures. These measures included whether: (1) gaze behaviors were coordinated or moved in the same direction as other behaviors; (2) verbal and gesture behaviors used were integrated or organized for the same intent; and (3) verbal and gesture behaviors were nonredundant or produced in maximally efficient, supplementary form. Analysis of the relation between child and adult behaviors evaluated the consequences of the adult behaviors and of participation in interactions. These methodological procedures gave opportunities to address three questions: (1) How can we map the ongoing behaviors in adult-child interactions?; (2) At what moment in the interaction does the child recognize that the adult's response is a reflection of his/her own behaviors, that they mirror for him an integrated array of his form, function, and meaning and how can we know this?; and (3) How does the methodology inform us about the developmental progress of communication behaviors in autistic and normal children?

Results

The interactional context presents important arenas for learning about developmental progress in autistic and normal children during the transitional period to first words. Results from longitudinal data indicated that the moment during which the child attends to the adult's response is crucial for developmental progress. However, interactional breakdowns in the autistic child's interactions interfere in his/her ability to attend to the adult's response, organize behaviors in synchrony with the adult, and adapt to the adult's response. This failure also limits the upgrading of behaviors to conventional form in the code that is coordinated with communicative action. Several examples provide an illustration of these results.

Example 1 was drawn from two communicative loops of an interaction between an autistic boy and his female teacher. These loops illustrate an extreme case of a child having rudiments of a code to which the adult can respond. However, the code used represents a primitive, limited, and invariant set of behaviors to communicate. The first loop can be described as follows: The child gazes to the teacher's mouth, extends his arm to her lips and swats at it repetitively, then returns his arm to his lap as he vocalizes production of a raspberry sound. The teacher watches the child, moves her head up and down, lips retract back and upward and eyebrows raise, and she says <u>You want me to do that</u>. Then, she makes the raspberry sound. During the teacher's response, the child shifts attention to an object away from the interaction and his hand remains on his lap. In a successive loop, he directs the same set of behaviors to the adult as the original set. He gazes to the adult's mouth, swats at it consecutively, and produces a raspberry sound.

In the first communicative loop, the autistic child demonstrated a gaze shift too soon from the dyad. This shifting limited the potential for the child to "see" how s/he affected the adult or to observe the meaning of his/her behavior in the representation provided by the other. The child did not synchronize visual regard and shifted gaze away too soon

to attend to the adult's response. In the next loop, the child repeated his prior behaviors. This repetition of behaviors without change was taken as evidence that the child's rudiments of a code, that is, that his form touching lips and raspberry sound meant to engage in vocal play, specifically making raspberries sounds. This form of code use reflected primitive resources to communicate. One may argue that the original child behaviors were directed with intent and assigned functional intent and interpretation by the adult and that the repetition of behaviors reflected a successful interaction. However, the child's forms were primitive and unchanging throughout the period studied. This lack of change was taken as evidence of a failure to attend to the adult's forms that represented both a sign in the code and an upgrade of the child's primitive means.

More adequate attending by the child during the adult's response is shown in the following examples of communicative loops. Example 2 represents two communicative loops drawn from an interaction between a 14 month old normal girl and her mother. The child was standing and mom was seated in front of her. The first communicative loop is described as follows: The child gazes to the mother, lips extend up and out, her arm extends out with index finger raised slightly above the others, and she says /dæɛnɚ/ and then lowers her arm. The mother monitors the child, nods her head up and down, lips extend out and up fully, then she says Dada, you always want your daddy. The child attends to the mother. Her gesture and vocalization have ceased but her lips remain in a retracted position. A subsequent communicative loop occurs after the adult's response. In this next loop, the child bounces up and down in a dancelike manner and her lips are retracted out and fully upward . Once again, her mother monitors the child, lips retracted upward and she says Oh, dance (and begins to sing) Dance. Come on everybody dance. The child attends to the adult, lips retracted out and fully upward and her movement continues.

In the first communicative loop of Example 2, the child directed a vocal and gestural behavior to her mother. The mother assigned functional intent to these behaviors, interpreted them as a reference to daddy and provided not only a more conventional form but an extension of the child's form. In addition, she smiled to the child and nodded in affirmation. During the child's tracking, not only did the child have to attend to the adult's forms and make direct connections between the adult's behaviors and her own behaviors; but, the child also had to make indirect connections. These indirect connections included the child's own pointing gesture and vocalization and her mother's nod and verbalization. In the child's subsequent series of behaviors, she adjusted her original set of behaviors by making a nonverbal repair. This repair corrected the adult's interpretation of the child's vocal form and the repair demonstrated that the child had made some connection between the child's vocal form /dəɛnɚ/ and the adult's assignment of the conventional form daddy. The social context elaborated upon the child's code and she changed her gestural form to clarify her original intent. The child recognized some connection between form and meaning and the behaviors were modified because of it. Evidence for competence was determined by the consequence of the child's behaviors based upon the feedback received from the mother.

In the next example, competence is somewhat more sophisticated in the child's use of a linguistic form and communicative action. Example 3 was drawn from two of a longer series of communicative loops of an 18 month old boy with his mother. The first loop is described as follows: The child looks to his mother's face, moves his fingers rapidly on his stomach, his lips retract up and out fully, and then he says /tɪkɚ tɪk/. The mother watches the child's face, her lips retract up and out fully. Then, she imitates the child's vocal form /tɪkɚ tɪk/ and extends it with Does it tickle? The child visually monitors his mother's response by watching her face. His hand remains posed slightly above his stomach. Upon completion of the adult's response, a successive loop occurs. In this loop, the child maintains gaze to his mother's face, his index finger extends and

pushes down on his stomach as he says that. The mother gazes to the child, her lips retract up and out and she says That? That's your belly. The child watches the mother, his hand posed on his stomach, and his lips retract up and out. In the first communicative loop, the child directed gestural and vocal behaviors to the mother to which she assigned functional intent and interpretation and used the more conventional form tickle. The child awaited her response, evidenced by his visual attention and anticipatory gestural posturing. Subsequent to monitoring of the mother's response, the child once again directed behaviors to the mother. The child's gesture and vocal forms were changed from the prior loop. This altering of the child's behaviors was taken as evidence that the child attended to the adult's forms and possibly recognized a mismatch between the form-meaning relation he anticipated and the one he received from the adult. The system, or code, was not adequate and he changed it.

The adults in the autistic and normal groups responded similarly to the children's behaviors. The adults responded by assigning meaning, interpreting intent, and providing an upgrade to conventional words. However, the children's attending to the adult forms were markedly different. This difference in child behaviors during the adult response was reflected in the consequent child behaviors. In the communicative loops above, the normal child changed original forms, however the autistic child's primitive gesture did not change and there was no movement toward more conventional word use. The autistic child's interactions reflect breakdowns which interfere with his/her ability to make use of the adult's response. The consequences of these breaks are evidenced in subsequent behaviors. Although the normal child increasingly makes use of the mother's response, the interactions of the autistic child evidence difficulties in recognizing the particular response one's behavior calls out in others and in making use of this response. Therefore, the autistic process is characterized by mitigation of the communicative work.

Significance of the Study and Concluding Remarks

The social interactional context provides an important arena for examining developmental progress in communication. The extent to which children begin to use a conventional linguistic code and communicative action is related to the child's ability to make use of this context. This context specifically contains the adult's response to the child's initiatory behaviors. This response reflects how the child's behaviors fit into the code. In this study, interactions were described in this way and critical moments of attending were located which required participants to move in synchrony. During these moments, the child must fully attend to the forms of the adult's behaviors. It was during these moments that the child had the opportunity to connect his/her efforts with the adult response. The child's subsequent response to the adult demonstrated how the child made use of the adult's behaviors. Paul (1987) suggested that it is these contexts which provide the necessary "hook up" between the child's own forms in a code and the interpreted intent and communicative meanings assigned to them.

Evidence from the methodology employed highlighted how autistic and normal children's developmental progress differs. The methodology allowed us to look more carefully at the actual interactions and to identify interactional breakdowns in the autistic group's communicative loops. These breakdowns signalled the autistic child's difficulty in coordinating monitoring systems to adequately attend to the adult. The consequences of these breakdowns were observable in the autistic child's adaptive behaviors. These breakdowns interfered with the child's ability to adapt and mitigated progress. These breakdowns in social interaction interfere with the most basic aspect of language development that is essential to engage in interpersonal and communicative contexts. De Villiers and de Villiers (1987) noted "if the central deficit (in autism) is best conceptualized as a lack of motivation for social interaction, that speaks to the

question of the fundamental basis for language not only in the child but in the species" (p. 700). It is to this end that this research study was motivated.

Theoretical Framework and Review of Related Literature

The developmental progress of a conventional linguistic form used communicatively is an area of significant dysfunction in children diagnosed with infantile autism. Development of adaptive behaviors for communicating and the ability to change these behaviors as a consequence of dyadic interactions are important to this issue. Consideration of these issues requires a review of the literature relating to early communicative development in both populations. The following discussion is organized in five major sections: (1) operational definitions of children diagnosed with infantile autism; (2) language characteristics and communicative development in autistic children; (3) adaptive behaviors used in early communicative development, including intentional communication in autistic and normal children; (4) adaptive behaviors as a consequence of dyadic interactions, including temporal synchrony, gaze, eye contact, and nonverbal communicative behaviors; and (5) social-interactional theories presented for normal children with special reference to the autistic population.

Operational Definition of the Autistic Disorder

The Diagnostic and Statistical Manual (DSM-III- R) of the American Psychiatric Association (1987) defined the Autistic Disorder as a severe form of Pervasive Developmental Disorders with onset during infancy or childhood. The behaviors of the disorder are described in three sections. In order for a child to be diagnosed with autism, the child must evidence behaviors in at least eight of the following items and these include two items from Section A and one item each from Sections B and C. The Diagnostic and Statistical Manual (DSM-III-R, 1987) definition of the Autistic Disorder is as follows:

A. Qualitative impairment in reciprocal social interaction as
   (1) marked lack of awareness of the existence of feelings
   (2) no or abnormal seeking of comfort at times of distress
   (3) no or impaired imitation

(4) no or abnormal social play
(5) gross impairment in ability to make friendships

B. Qualitative impairment in verbal and nonverbal communication, and in imaginative activity, as manifested by the following:
   (1) no mode of communication, such as communicative babbling, facial expression, gesture, mime, or spoken language
   (2) marked abnormal nonverbal communication, as in the use of eye-to-eye gaze, facial expression, body posture, or gestures to initiate or modulate social interaction
   (3) absence of imaginative activity, such as playacting of adult roles, fantasy characters or animals; lack of interest in stories about imaginary events
   (4) marked abnormalities in the production of speech, including volume, pitch, stress, rate, rhythm, and intonation
   (5) marked abnormalities in the form or content of speech, including idiosyncratic use of words or phrases; or frequent irrelevant remarks
   (6) marked impairment in the ability to initiate or sustain a conversation with others, despite adequate speech

C. Marked restricted repertoire of activities and interests, as manifested by the following:
   (1) stereotyped body movements, e.g., hand-flicking or twisting, spinning, head-banging, complex whole body movements
   (2) persistent preoccupation with parts or objects
   (3) marked distress over changes in trivial aspects of environments, e.g., when a vase is moved from usual position
   (4) unreasonable insistence on following routines in precise detail, e.g., insisting that exactly the same route always be followed when shopping
   (5) marked restricted range of interests and a preoccupation with one narrow interest, e.g., interested only in lining up objects, in amassing facts about meteorology, or in pretending to be a fantasy character (pp. 38-39).

Language Characteristics and Communicative Development in Autistic Children

Tager-Flusberg (1988) suggested that autism presents asynchronies in language development due to disturbances in normally correlated aspects of language acquisition. De Villiers and de Villiers (1987) interpreted Tager-Flusberg's statements on the asynchronies of the autistic child's language as an "unravelling of the strands of semantic, syntactic, and pragmatic knowledge that are normally woven together" (p. 699). Participation in communication is central to pragmatic performance and, whereas the normal child develops the ability to participate in communication within a

social-interpersonal context, this ability is an area of major impairment in autism. Paul (1987) described that the autistic child's linguistic code essentially can be seen as syntactic and phonological systems that fail to "hook up" with their semantic/pragmatic counterparts.

Most descriptions of the autistic person's communicative, cognitive, and social functioning rely upon a primary deficit model which isolates individual child behaviors. Language and communication deficits have been attributed either to : (1) a manifestation of an impairment in the ability to code and manipulate symbols (Hermelin and O'Connor, 1970; Ricks and Wing, 1975); (2) a pervasive cognitive deficit or specific cognitive deficit in areas of sensorimotor functioning and/or symbolic play (Boucher, 1976; Rutter, 1978; Schuler, 1980b); or (3) a deficit in participating jointly in social interaction (Wing, 1981).

In order to fully understand the autistic child's difficulties as they relate to impairments in social interaction, it is first necessary to explore normal prelinguistic development with a focus on the notion of communicative intent. The assumption is that the relation between preverbal and verbal communication is continuous.

Adaptive Behaviors Used in Early Communicative Development

Intentional Communication in Normal Children

Intent is defined in the literature by the following features: (1) anticipation of an intended act, (2) selection among appropriate means for achievement of an end state, (3) sustained direction of behavior, (4) a stop order defined by some end state, and (5) some form of substitution rule whereby alternative means can be deployed for correction of deviation or to fit idiosyncratic conditions (Bruner, 1973 ; Bretherton and Bates, 1979). Persistence is sometimes added to define intentionality. Persistence, in the presence of the other features, occurs while striving for a goal (Dore, 1975; Harding, 1982; Miller, Galanter, Pribram, 1960; Ryan, 1974).

The definition of intention is conceptualized separately from communicative intention. Various researchers defined intentional communication by using either individual child behaviors or behaviors across participants as the unit for analysis and then used different research methods to mark onset, describe the process of emergence, identify changes over time, or differentiate intentional communication from other behaviors. These methods and approaches are described in the following section.

The emergence of intentional communication has been indexed by a constellation of specific behaviors identified in infants at or after nine months. These behaviors include: alternation of eye contact between the goal and an intended listener; augmentations, additions, substitutions of a signal until the goal is attained; and change in the form of a signal that is used appropriate only for achieving a communicative goal (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979a; Bretherton & Bates, 1979). Bruner (1975) noted that infants as young as six months use "cross-checking" behaviors. These were described as the mother and infant increasingly checking on whether their gesturing or marking is getting through to the other..." (Bruner, 1975, p. 271). Harding (1981) suggested that knowing that communication can be a goal may develop through the effectiveness of these early behaviors, particularly their effectiveness in causing the mother to react. When these abilities develop, the infants are able to direct social behaviors to adults because they want the adults to perform particular behaviors (Lamb, 1981). It is only at this point that infants laugh during social play in anticipation of the adult's behavior (Sroufe and Wunsch, 1972).

Sugarman (1984) proposed that the intention to act on things and people are initially mutually exclusive. Coordination of these two schema into one is judged as an indice of the intent to communicate and evidence of this coordination occurs prior to the emergence of first words. A coordinated person-object schema could involve the infant gazing to the adult followed by reaches toward a desired object.

Wetherby, Cain, Yonclas, and Walker (1988) provided a qualitative measure of intentional communicative behaviors displayed by normal prelinguistic children over the course of one year. (Definitions of a communicative act are provided on p. 6 of this text.) Intentional communicative acts were measured in terms of function (frequency of acts, categories used, and percent of specific functions used), discourse structure (child initiated versus responsive acts), communicative means (gestural versus vocal), and syllabic shape. Developmental changes were found in all areas examined and included: increases in the rate of communicative functions used and the number of different functions served, tendencies for children to be more initiative than responsive, the use of more verbal than gestural communicative means, and increases in vocal behaviors resembling forms of conventional words.

On the other hand, several researchers argued that, for a child to engage in a communicative interaction, another must be involved and the child must recognize two things. First, the child must realize that the mother can act as an independent causal agent who is capable of independent action or reaction and is different than an object that gets set in motion (Bates, Benigni, Bretherton, Camaioni, & Volterra,1979a; Golinkoff, 1981; Harding & Golinkoff, 1979). Second, the child must view communication as a means to engage the "other" in enacting his/her intention. Harding (1981) proposed that, only when the child recognizes the other as a means to enacting his/her intention, does the infant begin to form a plan for communication. In turn, the mother consistently reacts to the child's behaviors that later become communicative. It is the mother's interpretation of and ability to respond to the infant's attempts that affect the child's knowing. With the child's increasing organization, the mother becomes more aware of the infant's specific capacities and she keeps pace with the child's changing abilities. Harding hypothesized that this sets up a necessary "disequilibrium " or "perturbation" for further development (Harding, 1981,1982; Langer, 1969).

Greenfield (1976) argued for a further distinction in intentional communication, that termination of communication occurred when a specific interpretation occurred; therefore, identification of an intention depended on knowing what happened after intentions were expressed. For example, under appropriate circumstances, relaxing and smiling might serve as behavioral indices that an intention has been realized. In young children, the adult carries the major role in managing the sharing of intention (Greenfield, 1976).

Furthermore, speech act theory makes intention intrinsic to language use (Greenfield,1976). In speech act theory, intentionality was defined with two necessary behavioral characteristics: directedness and presentation or representation of conditions of satisfaction (Searle, 1969; Dore, 1975). Directedness can be defined as sustained direction of the behavior in enactment of means toward a goal. Representation of conditions of satisfaction refer to the terminal requirements necessary to cease the activity when the features of the desired state are achieved (Bruner, 1981).

Dore (1983) differentiated between intent to act and intent to convey. He called the period in between these two a transitional phase of intentionality. Within this period, the infant becomes capable of both intending in expressing and intending to express. In intending in expressing, two modalities are incorporated but integration of both does not occur. For example, either the infant vocalizes in accompaniment to an action or gazes at an object. Intent to express is a move closer to intention to convey words. In this type, the child directly expresses to someone using gaze to indicate. This type of expression is found when the child can integrate three modalities "synchronized across persons, movements and objects. That is, the infant can alternate between acting on an object and vocalizing to someone about it, the behaviors therefore ensembled within a single theme" (Dore, 1983, p. 176). Although these phenomena have been described prior to emergence of words, they have not been "isolated for study" (Dore, 1983, p. 176).

The primary difference in these descriptions of intentional communication is that some of them examined the child's behaviors isolated from the responding context (that is, the adult). Others, like Grice (1969), included the response of the other as essential to defining whether or not an intention existed. Grice tried to distinguish between the incidental transfer of information and communication proper. Grice defined intentional communication, or "meaning nn", in terms of the speaker (S), the receiver (H), and the response (r) with respect to the utterance (U). Communication consists of the speaker intending to cause some effect on the recipient and this intention is achieved simply by the recipient recognizing it. What the speaker means by the utterance may not be conventional or related to the meaning of the utterance at all. This allows for some aspects of language change. Examining the response to the utterance would answer what the speaker meant when s/he produced the utterance.

In a similar line of thinking, Dore (1986) stated that "the study of communicative performance must deal with the actual interpretation of speech across persons in a concerted activity ...and the projected consequences of speech are what motivate its production" (p. 6). Levinson (1983) supported this construct by suggesting that communication is a complex kind of intention that, through verbal and nonverbal behaviors, can be achieved or satisfied just by being recognized by the recipient. In the communication process, a speaker's intention becomes the mutual or shared knowledge of the speaker and the listener. Successful communication requires achieving this state of mutual knowledge of a communicative intention. The issue is the degree to which autistic persons achieve this state.

Intentional Communication in Autistic Persons

The predominant research on intentional communication in autism has focused on the individual child's behaviors without specific reference to the importance of the adult's response. Specifically, investigations of the autistic person's language have targeted communicative functions as an area of relevance. Prizant (1983) referred to these

investigations as identifying the product of the autistic person's behaviors, such as, a restricted set of communicative functions; predominant use of instrumental functions rather than social functions; and lack of eye contact coupled with primitive request strategies. Prizant argued against this type of approach for two reasons: first, the approach limits information only to what these children cannot do when compared to their normal counterparts, second, it does not provide an understanding of the autistic individual's unique strategies associated with the processes of learning.

Much of the research on development of communicative intent has used a strictly cognitive model. The theoretical basis of this research is an interdependence between cognition and language. Various sensorimotor skills are proposed to form prerequisites for intentional communication (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979a; Bates, Camaioni, & Volterra, 1979b). Specific component skills hypothesized to contribute to symbolic capacity in normal children may fail to develop and consequently disrupt the emergence of language in autistic children. These component skills include: communicative intent, tool use, play, and imitation. Conventional communication and symbolic communication are not equivalent. For conventional communication to be called symbolic, it must be inferred that the child has:

> the comprehension or use, inside or outside the communicative situation, of a relationship between a sign and its referent, such that the sign is treated as belonging to and /or substitutable for its referents in a variety of contexts; at the same time the user is aware that the sign is separable from its referent, that is not the same thing (Bates et al, 1979b, pp. 42 - 43).

The reference to substitutability and awareness seems to distinguish significant symbol use from "quasi-symbolic" language use; however, these distinctions do not sort out why the autistic child fails to develop communicative use of a conventional code.

Qualification of these quasi-symbolic forms may be found in the definitions of "indexical expressions" (Dore, 1983) or "phonetically consistent forms" (Dore, Franklin, Miller, & Ramer, 1976). Indexicals have a defined shape, are capable of

being isolated and bounded by a pause, occur repeatedly, and are correlated with specifiable, recurring conditions. However, these forms are idiosyncratic, not conventional, and are not quite as stable as words. Bates et al (1979b) argue that a conventional signal is characterized by a stable form, used regularly, and predictably. On the other hand, vocalizations are a more primitive use of the vocal channel. Vocalizations are amorphic in shape, reflexive, consistent or systematic, and lack similarity to conventional symbols. Frequently, vocalizations involve vocal sounds, laughter, grunts, squeals, vocal play (Dore, Franklin, Miller, & Ramer, 1976).

The recent research on the communicative skills of the autistic population has concentrated on whether the linguistic code used served communicative function. This research relies primarily on speech act theory (Searle, 1969) which described conditions wherein knowledge of linguistic conventions is necessary for the performance of speech acts. For example, use of conversational devices (variations in word order, stress, intonation contour, and verb mood) and certain performative verbs (words like apologize, persuade, promise), (Searle, 1969). Research on normal preverbal speech applied similar theoretical constructs (for example, Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979a; Bates, Camaioni, & Volterra, 1979b) and used performative structures, such as imperatives and declaratives, to describe preverbal speech. For example, Bates, Camaioni, and Volterra determined if such structures had a developmental history prior to speech. They identified these structures as protoimperatives and protodeclaratives. A protoimperative was defined as the child's intentional use of an adult to achieve a desired object, where a protodeclarative was defined as the use of an object to gain the adult's attention.

Dore (1979) argued that the lack of "structure" of preverbal speech contradicts use of these performatives since performatives require an understanding of grammatical mood and the structure to code this. Further, normal development theories did not distinguish between the actual structure, such as presence of grammatical categories to

code mood, versus the adult's interpretation of the child's functional intent (Dore,1979); therefore, application of these constructs either to normal or autistic preverbal speech may be erroneous. In the present study, it was presumed that neither the autistic child nor the normal infant alone produce a vocal communicative act with words of the linguistic code. Therefore, to examine these children's speech with the notion of sophisticated knowledge of speech act use is not applicable. In this study, the premise of a stage prior to the development of speech was used and the unit of analysis was the combination of the child-directed behaviors and the adult's interpretation of functional intent was the unit of analysis.

In investigations of the development of intentional communication in autistic children, the theoretical constructs of speech act theory have been applied as they have with normal children. In these studies, when autistic children are compared to either normal children at similar mental ages or language delayed children at similar language levels, the following results have been demonstrated for the autistic: (1) absence of protodeclaratives (Curcio, 1978; Wetherby & Prutting, 1984); (2) limited use of gesture (Curcio, 1978; Loveland & Landry, 1986; Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Mundy, Sigman, Ungerer, & Sherman, 1986; Ricks & Wing, 1975; Wetherby, Yonclas, & Bryan, 1989); (3) primitive strategies for eliciting assistance or making requests with lack of eye contact (Curcio, 1978); (4) a greater number of communicative acts to regulate others and an increased proportion of initiated rather than responsive acts (Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Wetherby, Yonclas, & Bryan, 1989); and (5) no significant differences in the number of verbalizations used (Loveland, Landry, Hughes, Hall, & McEvoy, 1988).

Other researchers examined both the instrumental (means-end) and social communicative functions served by the use of vocal and gestural behaviors. Findings indicated that autistic children develop a limited range of communicative functions which

are primarily used to acquire things from others and that the functions that develop often emerge in a specific context with limited application to other contexts (Wetherby, 1986; Wetherby & Prutting, 1984). Specifically, comparisons of autistic children with normal children at similar mental ages, or language delayed children at similar language levels have revealed that autistic children demonstrate: (1) a restricted set of communicative functions with evidence of function evolving from a unitary (serving only one primary function) to a multidimensional level (Wetherby, 1986; Wetherby & Prutting, 1984); (2) delayed development of social communication in the presence of more advanced use of communication to achieve an environmental end (Wetherby, 1986; Wetherby & Prutting, 1984); and (3) independent development of interactive and noninteractive functions develop independently with communicative functions emerging from contextually-restricted to contextually-flexible forms (Wetherby, 1986). On the other hand, in a case study, Sugarman, (1984) found similarities between an autistic and normal child in the appearance of object-person coordination prior to the emergence of first words.

These studies inform us about the communicative functions of autistic children; however, reliance on speech act theory is insufficient to examine the communicative development of autistic children. Autistic children's word use typically reflects the less conventional use of linguistic forms that more closely resembles indexical forms. Specifically, these forms most often are restricted in contextual use. In addition, the autistic child does not use conversational devices such as stress, intonation contour, and grammatical categories to code verb mood. Use of conversational devices is implied in speech act theory; however, the autistic child's failure to use these devices further suggests that using speech act theory as a basic construct may be inadequate for examining preverbal forms. Therefore, in order to avoid potentially erroneous theoretical assumptions, the unit of analysis in the present study focused upon child initiatory behaviors and adult response to these behaviors.

Wetherby and Prutting (1984) provided a slightly different interpretation. They suggested that studying the autistic population allows for viewing the effects of cognitive influences on language acquisition in the relative absence of social influences. The discrepancy enables the autistic population proficiency in figuring out how things work in the environment, but deficiency in sharing their knowledge with or acquiring knowledge from others. It was speculated that the autistic child's initial acquisition of the intent to communicate emerges outside the context of social interaction in order to achieve an environmental end (Wetherby & Prutting, 1984). Although the autistic child has severe limitations in social interactions, it is impossible to consider acquisition of intent to communicate outside of a social context. All communication arises within a context. The argument may be that these children gain limited benefits from attending to and integrating the behavioral array presented in a social context. An aspect overlooked by Wetherby and Prutting was the importance of identifying where the interactional breaks occur for the autistic population.

A more interrelated approach to examining autistic children's deficits in communicative intent was chosen by Prizant and his colleagues (Prizant, 1983; Prizant & Duchan, 1981; Prizant & Rydell,1984; Prizant & Schuler, 1987; Prizant & Wetherby, 1985). This research focused less on the linguistic form of autistic children's utterances and more upon their communicative performance. The role of immediate and delayed echolalias in relation to intentional communicative development was specifically examined. Echolalia is the most frequently cited characteristic of verbal autistic children (Prizant & Duchan, 1981) and is used by three-quarters of those that develop verbal means (Rutter,1978; Wing,1981). The major issue in Prizant's work was to identify where, when, and how the child's echolalic form fits into an intentionally communicative and creative frame. Previous research examined the relation between communicative intent and the autistic echo by focusing on the underlying form of intent. Echolalia and creative language use stood at two dichotomous

points with echolalia defined as automatic speech lacking in communicative intent and creative language defined as fully intentional. Prizant proposed a continuum that ranged from echolalia to creative language with communicative intent present in varying degrees throughout. This continuum focused on function and allowed for marking developmental change toward more creative language (Prizant, 1983).

Prizant and Rydell (1984) used this continuum and the definition of intentional communication provided by Bates, Camaioni, and Volterra (1979b) to describe the role of delayed echolalia in autistic children's speech and its relation to intentional communication. (For information on the categories used in these studies, refer to Prizant & Rydell, 1984.) Degree of interactiveness was measured in terms of paralinguistic and linguistic behaviors. Behavioral evidence for intentional communication included: alternation of the child's gaze between the adult and the desired object, repetition of the request until the adult complied, physical prompt of the adult to comply, and occasional acts of aggression when frustrated by the adult's failure to comply (Prizant & Rydell, 1984).

In this perspective, a major contributing factor to communication patterns in autism is related to expressing intent in a conventional and acceptable manner (Prizant & Wetherby,1985). Intentional communication lies "at the crossroads of social relatedness, social-cognitive understandings, and communicative knowledge" (Prizant & Wetherby, 1985, p. 21). Comparisons of preverbal autistic and normal children identified three predominant patterns of communication: qualitative differences between profiles of communicative intents, more frequent unconventional means of communication, and a unique pattern of language development with echolalic behaviors central to this process (Prizant & Wetherby, 1985).

Inherent in Prizant's position is that the autistic child's aberrant social and communicative behaviors are reflective of an overall cognitive impairment (Prizant, 1982, 1983; Prizant & Schuler, 1987). The autistic persons' reliance on "memorized

unanalyzed segments" (Peters, 1983) reflects a gestalt style of language processing and use. This style parallels their inflexible behavioral patterns and may represent an alternative language acquisition strategy. Autistic and normal children use these patterns similarly for functional and structural purposes to aid participation in conversational exchanges while circumventing processing demands. However, there is pathology in the autistic child's use of echolalia in the degree to which these patterns remain inflexible and the length of time they continue as part of the individual's communicative repertoire (Prizant, 1982, 1983; Prizant & Schuler, 1987). A question posed by this research is, whether the autistic child's heavy reliance on gestalt form is a by-product of his/her difficulty in fully monitoring communication as it occurs in dyadic interactions? If so, does the autistic child learn a primitive code without adequate integration of the adult's response and therefore have limited resources to communicate? Or, do limited resources themselves serve as a catalyst for their lack of developmental progress? In the present study, responses to the last two questions were attempted.

Duchan (1987) described Prizant and Schuler's view (1987) of autistic individuals as a cognitive functionalism approach where communication is defined by linguistic and cognitive knowledge structures. Inherent in this construct is that the adult imputes intention in the child's behavior even without it having a conventional form and the outcome of a behavior is determined by the adult. This theory requires a grounding in meaning which Duchan (1987) proposed can be provided by examining the structure of the event in which these behaviors occur. Communicative functions need to be examined within events in order to better explain how autistic persons "understand what is going on around them and how these understandings inform their intents" (Duchan, 1987, p. 708).

The significance of echolalia for the autistic population remains an unresolved issue. Prizant's research looked for the rudiments of code use in communicative intent where

the code use was echolalic language. In normal children, communicative intent develops prior to the emergence of a linguistic code. In order to investigate intent, we need to look at the more fundamental aspects of communication. In addition, although the production of directed nonverbal and verbal behaviors to convey intent may be internally motivated, communicative intent is realized via an interaction. Within this context, the listener responds to these behaviors and the child attends and makes use of this response. Therefore, during the child's transition to first words, we need to integrate our knowledge of intent into the context.

In summary, researchers have viewed the development of intentional communication in normal and autistic children as an important area on which to focus. Research in normal children has primarily examined individual child behaviors using a speech act theory analysis. Results indicate that intentional communication has a history prior to the development of intentional communication and that achievement of the use of intentional communication parallels cognitive achievements. Further, early in development, normal children use behaviors to serve a wide array of communicative functions Research on autistic children has used similar constructs and approaches. Primarily, the results of such research has indicated that the development of intentional communication in the autistic population may follow a course similar to normal children's development. However, the autistic child's use of conventional behaviors in fully intentional ways is more restricted than the normal child's use of these behaviors. Further, autistic children demonstrate limited means to convey intent. These limitations seems to affect developmental progress of the conventional use of linguistic and gestural behaviors for communicative purposes. Therefore, specific identification of these limitations as they occur in interactions requires further attention.

The research on the development of intentional communication presumes that prelinguistic communication arises during the joint performances between the caregiver and the infant where there is synchronous movement between the participants

in the dyad. Evidence for this synchrony has been found in the normal population, whereas limited investigation of the autistic population demonstrated that the autistic child's movements may be asynchronous. The effect of this asynchrony is important for describing interactions of autistic children. Synchrony and congruence in dyadic interactions in the normal and autistic populations are described in the following sections.

Adaptive Behaviors as a Consequence of Dyadic Interactions

Temporal Synchrony in Dyadic Interactions

Development in normal individuals. Several researchers described the joint performance between mother and infant as having a sequence and temporal structure that strongly resembles conversation (Bateson, 1975; Condon, 1977, 1979; Condon & Sander, 1974a, 1974b). Condon (1977, 1979) used the term "responsive entrainment" to describe the interactional synchrony between mother and infant. This synchrony enables individuals to move in synchronized organization with each other's speech and may facilitate participation in interactions. Synchrony to speech patterns has been found across listener and speaker talk in adult-adult conversations. In addition, three month old infants demonstrate hand movements closely entrained with facial expressions, vocalizing, and prespeech (Condon, 1979). Condon concluded that self-synchrony, the synchronized movement of different body parts, is present at birth, but the synchronization of movement to speech is developmental.

Condon and Sander (1974a, 1974b) examined interactions between neonates and their mothers. They found that neonates as young as 12 hours old exhibit body movements that are timed to the adult's speech patterns, even at the level of phonemic structure. Synchrony at the phonemic level was established at units of 1/30 of a second. These findings of synchronization in young infants have been challenged on methodological grounds. Rosenfeld (1981) criticized that spectrograms were not used

for measuring phonemic boundaries. In addition, it was questioned whether phonemic boundaries could be identified at units of 1/30 of a second. McDowall (1978) argued that there is poor interobserver reliability found at intervals of less than intervals of 1/8 of a second.

In order to determine if the findings for synchrony are valid at the phonemic level, greater use of instrumentation is required. However, in adult-child conversations, the temporal regularity found above the phonemic level has not been challenged and evidence of a sequence and temporal structure of mother-child "protoconversations" remains upheld. The importance of this temporal synchrony for development of communication needs additional exploration. A viable methodological approach may involve videotapes with on-line timers that can isolate frames. Temporal synchrony can be noted via paralinguistic features such as body movements and articulatory postures.

Hayes (1984) offers another argument for exploring the relevance of synchrony for communication. Hayes described this synchrony in terms of the organization of turns in communicative interactions of mothers and infants. Specifically, these interactions involve the mother's adaptation and the participants' monitoring. The necessary synchrony of monitoring, interspersed with periods of co-orientation, is important in these interactions to provide the foundation for the infant to realize the relevance and meaning of his/her experiences with another. The synchrony between the child and the adult provides information about perceptual input to the infant and the infant's behavioral output, enables coordination of meanings, and gives feedback to the infant that helps him/her determine an emerging definition of self (Hayes, 1984). Hayes questioned the methodological basis upon which an observer can decide on the relevance of an action to another. Here, it was argued that the form and function to which a listener responds can be determined by examining the relation between the adaptive behaviors of the participants rather than isolating members of the dyad. Newson (1974) stated that it is only by the action and reaction of more and less experienced

human communicators that shared meanings can occur. An additional factor is that examining the child and the adult can determine how the dyad functions together and how the context impacts on the child.

Development in autistic persons. There has been limited experimental research on synchronous patterns in the autistic persons' interactions. However, some studies have alluded to these asynchronous of autistic children by noting they have in maintaining themselves in interactions, in organizing directed behaviors or achieving stimulus control.

Schuler (1980b) interpreted the autistic child's deficits in behavior and communication as a failure to direct their behavior by social cues. Social cues are considered as transient rather than as static. While normal children learn to attend to and interpret such cues within the context of joint attention and action, autistic children may not be able to learn within these contexts. One theory attributed these difficulties to "stimulus overselectivity" (Lovaas, Schreibman, Koegel, & Rehm, 1971). Much of the autistic children's processing difficulties in social interactions were explained by deficits in overselective responding which causes the children to respond to only one of multiple cues or only one part of a cue.

This overselectivity of stimuli has been found in various experimental conditions when autistic persons were presented with either multiple components (Lovaas, Schreibman, Koegel, & Rehm, 71); auditory and visual stimuli (Lovaas et al, 1971), a complex visual stimulus (Koegel & Wilhelm, 1973; Schreibman & Lovaas, 1973), or multiple auditory stimuli (Reynolds, Newson, & Lovaas, 1974). Lovaas et al (1971) reported that this overselective responding was not specific to autistic children and it may account for certain behavior in children with lower mental ages.

Condon (1975, 1979) looked specifically at synchrony in interactions. Condon described temporal synchrony as reflective of integration or organization that is manifested in the timing of behavior both within the individual and across the

participants. In an experimental test with normal and dysfunctional children, the dysfunctional children were overwhelmed by sound reverberations and demonstrated multiple responses to each sound presented. These children showed post-sound stimulus body motion in ways not found in normals. Although the organization of the normal infant's body motion is sustained in parallel with the length of speech, dysfunctional children, including the autistic, may have difficulty moving synchronously with sound, including human speech. These children's movements may be dyssynchronous with the actions and speech of others so that, the greater the sound disturbance, the greater the autistic-like isolation from people (Condon, 1975, 1979).

Oxman, Webster, and Konstantareas (1978) conducted an experiment to replicate Condon's findings (1975) on multiple entrainment and asynchronous behavioral organization in autistic children. Three autistic and two normal children between the ages of 5 years 3 months and 12 years 5 months participated in this study. Pure tones of 250, 500, 2000, and 4000 c.p.s. and white noise were presented for approximately .25 decibels. The results of this study indicated that multiple entrainment to sounds was not found for the autistic children. However, the autistic children did display awkward, jerky movements. These dyssynchronous patterns in the autistic children gave only marginal support for Condon's results.

In sum, researchers in normal development have found a temporal synchrony in conversations between mothers and young infants. Synchronous movement may aid participation in interactions. There is a small body of research that suggests that synchrony may be dysfunctional in the autistic population; therefore, their movements in conversation may be disrupted. These studies have not been adequately replicated. The impact of this difficulty on developmental progress has not been examined.

A brief overview of research on the development of nonlinguistic behaviors in social interaction is provided in the following section. These behaviors are considered important for communicative development. This research focuses on development of gaze

behaviors and use of gaze in adult-adult and adult-child interactions and their coordination with talk.

Gaze, Eye Contact, and Nonverbal Communicative Behaviors

The normal population. Stern (1981) argued that the presence of nonverbal behaviors, such as gaze, head and upper and lower body orientation, spatial positioning, and posture and distance, develop in infancy and are biologically determined, species-specific behaviors. Their presence determines whether communication can proceed. In particular, gaze behaviors and head orientation attain voluntary control within the first six months of life. At about the same time, these behaviors are available for interactional use and the infant has a mature signal system for initiating, maintaining, and avoiding interactions (Stern, 1971, 1974). These signals of mutual readiness to communicate also act as "interpersonal contexts with shared attentional focus in which information about objects is exchanged" (Stern, 1981, p. 54). These behaviors regulate the "momentary relationship between the participants and provide information mainly about: status, motivational state, affective state, and immediate intentions" (Stern, 1981, p. 47). Mutual manipulation of readiness to interact within mother-infant interactions is the predominant feature of early communication. The function and meaning of a mother's communicative act differs depending upon the infant's state of readiness to interact.

Specific to these nonverbal behaviors, eye contact and its relation to social interaction has been explored by researchers from many fields. Gaze behavior, eye contact, and eye-to-face gaze all refer to the visual behavior that a participant directs toward the face of another (Mirenda, Donnellan, and Yoder, 1983). Mutual gaze in humans: (1) acts as an indicator of interest in the other person (Exline & Winters, 1965); (2) indicates attentiveness (Argyle & Cook, 1976); (3) acts as a reinforcer (Argyle & Cook, 1976); and (4) is an important aspect in mother-infant attachment, with visual, not physical, contact at the basis of human sociability (Rheingold, 1961).

In adults, gaze serves a monitoring function and regulates the pacing and sequencing of talk. Kendon (1967) focused on functions of gaze during adult talk. Gaze direction primarily signals three turn-taking behaviors. Looking away from the listener provides for planning speech and insuring maintenance of a turn in the conversation. Next, at the completion of a turn, gaze to the listener gives the listener the floor as speaker. Finally, when the listener takes his/her turn, s/he looks away prior to beginning to talk. In addition, smiling and amount of gaze are inversely related (Kendon, 1967), i.e., the more smiling, the less gaze or the more gaze, the less smiling.

Child studies explored gaze patterns as part of the development of social behavior. Eye contact with the mother, as well as face-to-face positioning, are important aspects of attachment behaviors and are significant for formation of early mother-infant bonds. At about six weeks, the infant demonstrates development of deliberate, visual orienting to the mother's eyes. At the start of communication, mothers are most aware of this orienting (Wolff, 1963; Robson, 1967). Even blind infants are said to orient to faces. Conversely, a mother's initiation of eye contact elicits widening of the eyes, stilling of body movements, vocalization, and smiling by the infant (Argyle & Cook, 1976; Mirenda, Donnellan, & Yoder, 1983; Vine, 1973).

By the second month, infants have improved focus and their eye movements communicate the changing direction of their visual attention. Eye movements are toward or away from the hands and face of a partner, especially to the eyes or mouth. These are important signs for person to person interactions (Caron, Caron, Caldwell, & Weiss, 1973; Mauer & Salapatek, 1976). Infants tend to focus on body parts used for expression (eyes, mouth, hands). This suggests that looking is a preadapted response to particular signal patterns.

Several studies focused on the gaze patterns between mothers and their three to four month old infants (Jaffe, Stern, & Perry, 1973; Stern, 1971, 1974; Stern, Jaffe, Beebe, & Bennett, 1974). Results indicated that, by the third month of life, the infant

is able to exert control over his/her visual system . This development enables regulation of social contact with the mother. Stern et al (1974) suggested that the onset of gaze signals readiness and intent to engage in interaction. On the contrary, gaze aversion signals termination of or reduction in the intensity of the interaction. Non-readiness to interact can be signalled via gaze aversion, turning away of the head or body, and moving backwards. Chase argued that these behaviors "undo" the full readiness display, mitigate the full impact of the interaction, and allow a compromise between complete termination and full engagement (cited in Stern, 1981). Therefore, eye control "is among the first acts of the infant that are both intentional and subject to its own control. Vision is the only modality which...is constructed as an 'on-off' system that can easily modulate or eliminate sensory input, sometimes at will, within the first few months of life" (Robson, 1967, pp. 13 -14). In an analysis of the intrapersonal integration of gaze and gesture in mother-child dyads, Murphy and Messer (1977) described the precise synchronization of gaze with pointing. The mother's onset of a point was accompanied by a look at the target toy. This coordination was consistently followed by a look back at the baby, presumably to monitor the baby's response to the mother's gesture. In addition, 14 month old infants also synchronized pointing with gaze to an object but infrequently followed this with gaze back to the mother (Murphy and Messer, 1977).

Only a few studies have examined gaze coordinated with talk (Jaffe, Stern, & Perry,1973; Schaffer, Collis, & Parson, 1977; Schieffelin, 1983). Coordination between infant gaze behavior and later communicative behaviors is a precursor of later gazing patterns and both systems require this co-occurrence (Jaffe, Stern, & Perry, 1973). Three to four month old infants with their mothers exhibit a high incidence of simultaneous vocalization. This "coactional" vocalizing occurred most often during mutual gaze (Stern, Jaffe, Beebe, & Bennett,1974). These early interactional

behaviors are "primary forms of communication ...available to infants almost immediately" (Bloom & Lahey, 1978, p. 94).

Bloom noted that coordination of gaze and utterance units in the second year of life demonstrates changes from earlier patterns and the patterns of gaze depend upon the communicative nature of the exchange (cited in Stern, 1981). However, Stern (1981) argued that gaze at partner depends on linguistic complexity. Gaze at partner would diminish with increasing complexity and gaze might be fixed at some distant part of the environment rather than on the conversational partner. Stern attempted to clarify these differences by suggesting that he and Bloom were focusing on two separate things. Bloom's focus was related to interpersonal aspects, whereas Stern's focus was related to communicative content (Stern, 1981).

Schaffer, Collis, and Parson (1977) reported on the vocal and verbal behaviors and gaze patterns of "preverbal" (12-15 months) and "verbal" (23-27 months) children. For the verbal group, looks to their mothers were associated with vocal and verbal forms. These looks tended to begin during or immediately following the child's utterance and served two functions: to monitor the effects of the speech signal and to signal to the mother the "other-directed nature" of the vocal behavior (Schaffer et al, 1977). These gaze functions were different than the function of regulating speaker/listener roles in adults described by Kendon (1967).

Schieffelin (1983) also investigated the relation between looking and talking in a longitudinal study of one child from 16 months, 3 weeks to 22 months playing with her mother. Supporting the Shaffer et al study, frequency of looks to the mother increased as the child became older and language abilities developed. Specifically, Schieffelin examined the onset and offset of two patterns of gaze shifts: within-speaker turn (WST) and across-speaker turn (AST). WST was defined as gaze that is terminated within a child or adult speaker's turn. AST was defined as including at least one speaker turn for both mother and child. Three findings suggested correlations between conversation and

socially directed speech: (1) there was a proportional decrease in occurrences of WST and an increase in AST as a function of time; (2) the child's eye contact tended to cluster within speech events and topics as a function of age; and (3) gaze shifts AST were associated more often with wholistic, successive single-word utterances (Bloom, 1973) rather than chained, successive single-word utterances. Bloom (1973, 1978) used the terms chained and wholistic successive single-word utterances to describe the child's transition from single-word to multiword utterances. Use of these two types of utterances revealed two possible event structures. These were: (1) events that occurred with chained, successive single-word utterances where the child's word production was connected to the child's actions and (2) wholistic successive utterances which were not tied to particular movements and were more related to the child having the whole idea in mind (Bloom, 1978). In reference to the Schieffelin (1983), Schieffelin concluded that the ability to use gaze shifts AST reflects both the child's ability to hold an idea in mind and his/her intent to share the idea with someone else.

Autistic persons. Gaze aversion has long been cited as a cardinal feature of the autistic syndrome (Hutt & Ounsted, 1966; Kanner, 1946; Rutter, 1978). This lack of eye contact with significant others has been identified as one of the measurable and easily observable manifestations of the autistic child's "withdrawn" or "detached" social behavior (Mirenda, Donnellan, & Yoder, 1983; Tiegerman & Primavera, 1984). Noting an avoidance of eye contact is too simplistic to explain how the autistic child participates in or uses the social interactional context. The avoidance of eye contact or eye-to-face behavior in normal infants seems to develop later. It becomes more noticeable toward the end of the first year as the infant is expected to engage in social interactions (Richer, 1978). If autistic infants do not make eye contact in the ways that normal infants do, then the functions that this behavior serves are not available to them. These functions are used in social interactions for the understanding and use of language and for judgements of communicative competence (Mirenda, Donnellan, & Yoder, 1983).

Many hypotheses have been suggested to account for the autistic person's avoidance of eye contact. These hypotheses have included: anxiety and parental pressure in the interruption of social bonding (Tinbergen & Tinbergen, 1972); an attempt to diminish the high level of arousal in autistic children (Hutt & Ounsted, 1966); and absence of a mechanism to understand the environment. The distress caused by this absence leads to arousal and avoidance (Wing, 1978).

Tinbergen and Tinbergen (1972) suggested that the social disabilities observed in autistic persons is related to overarousal. Research has not supported this notion. The social unresponsiveness of autistic individuals is likely attributed to a failure in information processing which is related more to cognition than to high levels of arousal (Volkmar, 1987).

Mirenda, Donnellan, & Yoder (1983) conducted a pilot study on the frequency and duration of gaze in normal and autistic children, ages 6 to 15 years. The children engaged in monologue (only the child was an active participant) and dialogue (child and adult were active participants). Despite variability in the autistic children, the mean length of the individual gazes were comparable. The two patterns that emerged suggested qualitative differences in the way eye gaze was used by autistic children. First, during monologues, the autistic looked longer and more frequently than the normal children. Second, in dialogues, where turn-taking was involved, the autistic children looked for shorter periods of time and less frequently. None of these differences were statistically significant. Mirenda et al (1983) asked whether eye contact is an essential attending behavior and whether autistic persons gain so little information through gaze that they can just as effectively attend without it?

Studies on adaptive behaviors as they occur in dyadic interactions have found clear distinctions between autistic and normal children. When comparing autistic to normal children prior to verbal communication use, the autistic children are less able to organize behaviors to create temporal synchrony or to make use of the adult's nonverbal

communicative behaviors. However, these studies have rarely examined these features in the ongoing context of a social interaction. The information is relative only to the intrapersonal perspective of the child and does not account for the interpersonal context in which these behaviors occur. The following section lays out the social and social-interactional theories as they relate to this issue.

Social and Social-Interactional Theories

Application to Normal Development

The theories described in the following section formulate development in terms of an interactional framework. Behaviors are examined within a social-interactional framework as they occur in the context of an interaction. This context, including the responses of the other, are important determinants in the emergence of meaning, intention, and symbol formation. Intersubjectivity theories are discussed first.

The intersubjectivity theories of Stern (1977) and Trevarthen (1977,1980) are grounded in the notion that the attachment behaviors between infant and caregiver are of utmost importance. Stern (1977) proposed that the attachment behaviors of the mother and infant help the child develop schemas and representations of others which begin at approximately nine months with the sharing of intention. The infant's acts directed to the "other" symbolize that the infant has attributed to another the capacity to satisfy the infant's needs. Activities to which the infant and mother engage occur only with the combined behavior of each participant. This can be seen in the early peek-a-boo games.

Trevarthen (1977,1980) further described the concept of mutual intentionality and a sharing of mental state. However, Trevarthen (1980) attributed the material basis of intention to an innate human capacity that unfolded during the first nine months. Trevarthen described this period as primary intersubjectivity where both partners generate a pattern of intention together and engage in social expression. Two achievements are identified during this period. These include the initial sharing of

intention between mother and child and participation in reciprocally sustained conversation where the mother continually interprets the child's efforts. The period of primary intersubjectivity prepares the child for a later time when s/he can share knowledge about things. Trevarthen and Hubley (1978) called this later period secondary intersubjectivity.

Prior to secondary intersubjectivity, the infant shares himself/herself with others, but does not share knowledge of intention about things. At about 10 months, changes occur in the child's ability to coordinate person and object schemas. For example, the child looks back and forth at the mother to direct her to pull at a string toy. In general, changes occur in his/her ability to: give and take objects, consistently use eye contact in response to the mother, solicit help from the mother with objects, take pleasure in mastery (demonstrated by smiling), participate in joint activity, and be attracted by the mother's talk. At this time, the child smiles at the mother when they are engaged in joint activities. The mother acts adaptively to the child, imputes meaning, and becomes the "tutor" of the child's communicative intentions (Trevarthen and Hubley, 1978).

These theories stress the importance of the developing attachment between mother and infant. Within this relationship, the infant learns about his/her ability to first share him/herself with others and then share knowledge with others. Although these studies offer an important theoretical construct relative to development, they do not provide a means by which to conduct an empirical study. Although we can speculate, we do not know the effect of the difficulty in establishing relationships on development. The autistic person's difficulty in social interaction presents a plausible arena for examining the impact of this difficulty on developmental progress in communication.

Vygotsky's theory (1978) does not specifically emphasize attachment behavior between mother and child. Rather, Vygotsky focused on the notion of meaning as established by others. Here, for example, the internal reconstruction of the external behavior of pointing is internalized through the mother's intervention. The child makes

unsuccessful attempts to grasp at something beyond his/her reach prior to using pointing as a gesture. When the mother comes to the child's aid and intervenes in this reach, for example, gives the object to the child, the meaning of the baby's grasp is established by the mother. When the child can make the connection between his/her unsuccessful grasp movements to an object and the mother's intervening behavior, we can say that s/he begins to understand his/her movement as pointing. Then, the movement to grasp becomes aimed at the other person and can be called a point. When the movement becomes simplified to the actual form of a point, then it is a true gesture. This process is called internalization where an external activity begins to occur internally and an interpersonal process becomes an intrapersonal one (Vygotsky, 1978).

Both Mead (1934) and Dore (1986) further defined the dyadic unit and described meaning as emerging within an adjustive activity. The unit was specified as one in which participants adapt to and complete the other's behavior. Mead described the adult's response to the child's gesture as an adjustive one that interprets the gesture with meaning. The child's subsequent response to the gesture's interpretation completes the act. In this engagement process, the activity of the other marks the beginning of conferring meaning on the infant's acts. Meaning arises within this social experience and does not represent private meaning. At this point, according to Mead, the child is not thought of as consciously communicating. The vocal gesture, which is the origin of communication proper, becomes a symbolic form only when it has the same meaning for the child as for the adult (Mead, 1934). For these "symbols" to upgrade themselves to significant ones, the individual must be conscious of what s/he is about and be able to interpret for him/herself the meaning that his/her gesture calls out in others. When these concepts are achieved, communication becomes genuine language and the individual is said to have acquired a mind (Mead, 1934). For example, the infant vocalizes /ʌ / with his/her hands outstretched. The adult responds with Yes, up, raises her hand

in gesture, and picks up the baby. The child watches the baby and gathers an auditory and visual representation from the behavioral array of "up" as a direction. We can say that the child has developed a conventional, linguistic form for up that has the same meaning for the child as for the adult when the child's use of up meets several criteria. These criteria include appropriate and routine use of the gesture with arms outstretched and the conventional form up to the mother and use of it contrastively with down. This process in autistic and normal children during the transitional period to first words was the focus of the present study.

Dore's theory (1986) aligned with Mead's social view of language; but, Dore added the notion of co-operative effort. Intent emerges out of a co-constructed and collaborative effort between the dyad's participants. Dore argued that cognitive theories consider representation as the primary source of behavior and development as relatively autonomous and regulated from within (Dore, 1986). However, the phenomena of intentional and symbolic aspects of speech, their functions in conversation, and their consequence for participants are "social, dynamic and dialectical" (Dore, 1986, p. 5).

Dore applied Stern's attunement hypothesis to the origins of language development (Stern, Hofer, Haft, & Dore, 1985). This application is essential to the current research project. Stern (1985) described the concept of attunement as follows: Attunement was incorporated into the development of affect. The mother orients to the child's internal state rather than the child's external behaviors and she attunes to the child's affective state by matching it. Dore proposed that attunement occurs when the mother responds to a child's behavior by matching it and providing an external form for marking that state. For example, the child vocalizes when the mother picks him/her up. The mother attributes to this behavior a meaning, such as joy, and matches it for the child. Also, she perhaps uses an additional channel, as in verbalizing that the child is happy. The child has been provided the opportunity to observe a connection between his/her internal state and an external sign for it. Then, the child can adapt to the

caregiver's form. Within these interactions, the child has the opportunity both to become aware of his/her own state by finding a form for his/her internal expression and to acquire conventional forms (Dore, 1986). The infant's initial experience remains unarticulated until the adult gives it linguistic form in the code (Dore, 1983, 1985, 1989).

Vygotsky (1962) provided a further descriptions of meaning arising out of a dyadic context. Vygotsky stated that the child's ability to communicate through language is directly related to his/her differentiation of word meanings in speech and consciousness. Therefore, the transition from thought to words evolves through meaning. For communication to be achieved, thought first must pass through meaning and then through words. The relation between thought and words changes throughout development and the connection between the two is a continual process of back and forth movement.

Although Werner and Kaplan (1963) stated that symbols primarily emerge from cognitive oriented operations, they also viewed the other participant as the one who completes meaning. The symbolism found in gestural and postural movement lies in the the meaning these movements have for the interpreter and not in the gesture as a symbol. The meaning of verbal symbols requires that connotations evoked occupy a similar position within each individual. Symbols emerge from an "intimate, interpersonal context" (Werner & Kaplan, 1963, p. 49). Within these contexts, the distancing between the "addressor" and the "addressee" is important for transformation in the development of symbols. The two forms of the symbol proposed are the internal sensori-motor pattern and the external cognitive schema. These two forms become increasingly differentiated over time, but never lose their relation between each other except in pathological conditions (Werner & Kaplan, 1963). This distancing principle is related to Vygotsky's "zone of proximal development" (1978), which Vygotsky (1978) defined as "the distance between the actual developmental level as determined by

independent problem-solving and the level of potential development as determined through problem-solving under adult guidance" (p. 86).

These theorists present a different position than do cognitive, or the more conservative, social theories. These social and social-interactional theories orient the focus of development to an interpersonal perspective. In order to examine child behaviors, they require that the researcher examine the context of the interaction and assume that only in this way can we determine how the child's development of meanings, intentions, and symbols proceed. Although cognitive constructs remain applicable to the child's development, the interpersonal world in which the child develops is an essential ingredient for developing theories about communication.

Application to the Autistic Population

The most primary distinguishing feature that differentiates infantile autism from other diagnostic groups is "the lack of social relatedness..." (Dahl, Cohen, & Provence, 1986, p. 178). All autistic children demonstrate dysfunction in their social relatedness but some children do develop the rudiments of a linguistic code. If word use develops, it reflects primitive means with limited resources to communicate. Therefore, the autistic population is an important one in which to evaluate the social and social-interactional theories of the communication process. However, this application has received limited empirical study.

One of the reasons for a lack of investigation into the social disturbance in autism is that there is little agreement on whether this symptom is primary or secondary to the syndrome. However, the social development in autism is qualitatively and quantitatively different from other childhood disorders and examining these differences is important for understanding the role of social factors in relation to overall development. These deviances often are apparent early in life as these infants fail to develop reciprocal eye contact or the social smile or be interested in the human face and social interactions. In addition, powerful influences of social motivational features do

not appear on schedule. Specifically, social attachments do not develop when expected in contrast to normals or retarded, nonautistic children (Volkmar, 1987).

There is speculation that if the basic elements of social interaction are not as meaningful to autistic as they are to normal children, then children with autism may take in less information or different information than others (Lord, 1985). However, even if one posits "....very basic social deficits where autistic children would be seen as lacking prelinguistic species-specific responses to human behavior (which could be the case), one still needs to examine why autistic children do not have similar meanings as others to begin with" (Lord, 1985, p. 75). The autistic person's difficulties in social meanings can best be explained by basic deficits in attention and responsiveness to social behaviors and higher-order problems in determining social goals and knowledge about social relationships (Lord, 1985). It is possible that the "responses to human behavior" to which Lord referred is the shared state of intersubjectivity that researchers in normal development have discussed (Stern, 1977; Trevarthen,1980; Trevarthen & Hubley, 1978). If this is the case, one might attempt to understand what it is about the autistic child's early interactions that interferes with development of these relationships. Further, one might ask what the consequences of these interruptions are in the process by which the autistic child responds to social behaviors.

Schuler (1980a) also described the autistic child's problems as indicative of restricted understanding of the effects of human action but attributed these difficulties to the cognitive-interactional nature of means-end. Support for this position is found in distinctions made between static and dynamic aspects of cognition in normal development (Bates et al, 1979a, 1979b). Dynamic skills are related to the ability to coordinate person and object oriented action sequences. In normal children, these sequences occur after the first nine months (Sugarman, 1984). The idiosyncrasies of the autistic population maybe related to development of these dynamic skills where impairments in imitation, communication, and symbolization are the visible effects (Schuler, 1980a).

Children learn to attend and interpret social stimuli within the context of early social interactions. The autistic infant's difficulty in dealing with social stimuli may impede the development of interrelated dynamic skills which normally develop in these contexts (Schuler, 1980a). Schuler and Bormann (cited in Prizant & Schuler, 1987) noted that autistic individuals had more difficulty with the transient stimulus input involved in judgements about the impact of their own or another's action. Understanding of this kind of social causality requires processing of cues that are organized temporally and sequentially.

Wing (1981) also focused on the autistic person's difficulty internalizing the social context. She proposed that the distinction for children with developmental disorders should be according to whether they are sociable or socially impaired. Sociable children demonstrate the following skills: the capacity to produce and monitor the normal species-specific preverbal sounds, the drive to explore the environment and form concepts to explain experiences, and the ability to recognize that other human beings are of special interest and importance. Lack of development of these achievements has major effects regardless of diagnosis. Socially impaired children demonstrate limited development of two-way social interactions, comprehension, the use of verbal and nonverbal communication, and symbolic and pretend play. Limitations in language include more repetitive behavior than creative utterances and difficulties grasping abstractions. The child becomes reliant upon "using" language that is prefabricated to fit his/her needs (Wing, 1981). Implications are that limitations in dyadic interactions interfere with the child's ability to understand the significance of behaviors and their communicative value. In the present study, this notion was considered as well as how the adult intervenes in the child's behaviors and how the child uptakes.

Lord (1985) included the social environment in the definition of comprehension. Comprehension was tied to the context in which it occurs and defined as the end result of both cognitive and social skills, specifically social meaning. Therefore, the minimal

unit of analysis for comprehension should be the sentence plus the context. However, this unit did not include the other participant and therefore excluded discourse. In addition, Lord argued that deficits in social meaning alone cannot account for the autistic person's comprehension difficulties. Social meaning includes both the ability to make sense of social information (e.g., facial expression) and to respond to situations involving interpersonal relationships. Chapman (1978) identified nonlinguistic response patterns and strategies in normally developing infants which enable them to participate early on in conversations. Lord (1985) speculated that these may not occur in autistic individuals.

In summary, "the study of social development in autism remains in its infancy" (Volkmar, 1987, p. 55) Researchers need to investigate directly the social behaviors of autistic children (Sigman & Ungerer, 1984; Volkmar, 1987). Volkmar (1987) urged future research to focus on the study of language within the social context of its use. Here, this issue was investigated by focusing on the developmental progress of communication in autistic and normal children.

The Study

The purpose of this longitudinal study was to gain information relative to actual interactions through a model that describes interaction and explains the effects of interactional breakdowns. During the transition to first words, severely impaired autistic children with their teachers and normal infants with their mothers were followed longitudinally. The participants were observed as they interacted in social interactions. Gaze, gesture, facial expression, and vocal behaviors of the participants were described within a framework of communicative loops. Comparative analyses were performed relative to the timing of behaviors (onset, offset, and duration), the child's behaviors as a consequence of the adult's response and participation in the interaction, and adult behaviors as a consequence of the child's behaviors. Additionally

examined were child behaviors along three dimensions of organization: coordination, integration, and nonredundancy.

There are two methodological differences between this work and previous studies that attempted to examine the communication process. The first difference was concerned with the fact that objects were not included in the adult-child interactions. The "goal" of the interactions was whatever action was accomplished by the participants; therefore the collaborative efforts during a communicative loop involved only the adaptive behaviors used and the child and adult's responses to them. The second difference between this study and previous ones reflected the unit of analysis used to describe interaction. Most studies rely upon the individual child behaviors as the unit for analysis. Here, in order to describe actual interactions, the unit of analysis was the dyad. Participants' efforts were examined in relation to the adaptive behaviors of the other. These methodological changes should produce more specific information about the communication process than has been described in previous studies.

Research Questions

The primary issue in the present study pertained to the specific data that signified that the child recognized the adult's recognition of the child's intent. Four research questions were generated from this basic issue:

1. What are the behaviors that constitute the moves of autistic and normal communicative loops? How are these behaviors organized by the participants? How do these behaviors change during the transition to first words?
2. What is the pattern of these communicative loops with respect to the onset, offset, and duration of the participants' behaviors and how are they different for autistic and normal children with adults during the transition to first words?
3. What are the consequences of the adult's response and participation in the

interaction on autistic and normal children's behaviors?

4. What are the consequences of autistic and normal children's behaviors on the adult's response?

Operational Definitions

The following are definitions of the terms used in this study:

Co-Adaptive Behavioral Sequence (CABS). A communicative loop, or CABS, characterizes a structural schema depicting brief moments of time in interactions. In this schema, there are two hypothetical slots within which three behavioral moves are possible. A move represents a functional unit for a participant to adapt to the behaviors of the other. Each move has the potential for a multi-channel display composed of four primary behaviors: gaze, gesture (including manipulation), facial expression, and vocal. These behaviors may co-occur and/or shift on and off during the moves. A description of optimal occurrences of the moves of a CABS is described in the following section and a CABS schema is depicted in Figure 1(see page 52):

SLOT I: INITIATORY PHASE

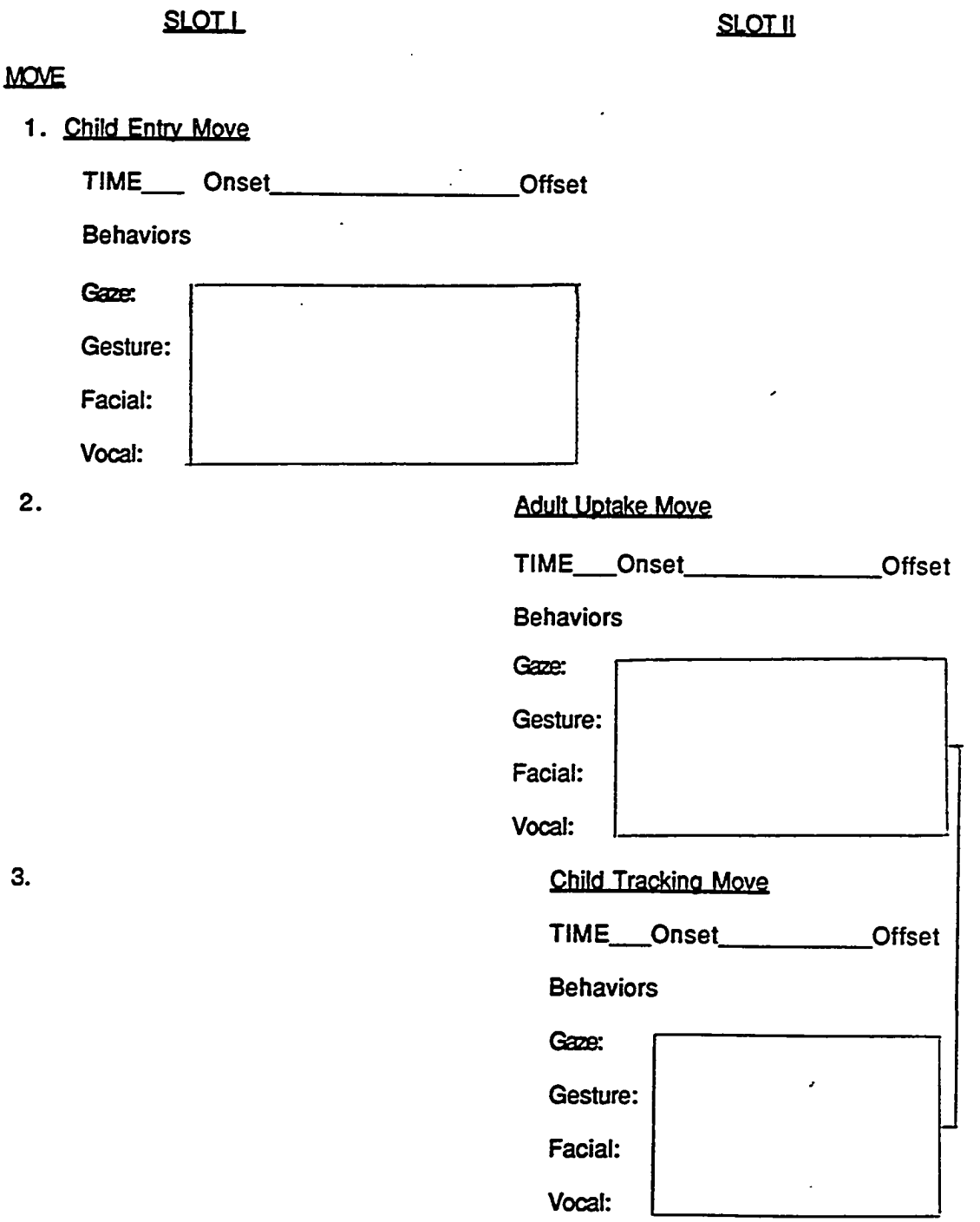
Move 1 is called the Child Entry Move. In this move, the child follows through to some peak behavior involving not just gaze but a combination of gesture, facial, and/or vocal behaviors;

SLOT II: RESPONSE/ACKNOWLEDGE PHASE

Move 2 is called the Adult Uptake Move. In this move, the adult assigns communicative value to the child's behaviors by fixing the child's form, interpreting functional intent or assigning meaning. In addition, the adult's response provides input; sustains the child's communicative efforts, potentially elaborating upon the behaviors and/or upgrading them to more conventional form; and/or offers feedback relative to the effects of the child's behaviors on the adult.

Move 3 is called the Child Tracking Move. In this move, the child monitors the

Figure 1. Schema of a Co-Adaptive Behavioral Sequence



Note. Critical Moment (⌉) is defined by the interval between the onset of Adult Uptake and Child Tracking Moves.

adult's response, possibly adjusting his/her behavior for a repeated round of a CABS.

The end of Slot II marks the end of a communicative loop. After this, the child may again initiate an array of behaviors to the adult. If the adult responds to these child behaviors, then the adjusted child behaviors mark the onset of a successive loop. Any communicative loop may be succeeded by another loop. The Child Entry Move in this successive loop may be a further adjustment to the adult's uptake behavior.

Communicative loops occur either as a First or Successive Loop, designated as FL or SL, respectively. An FL was defined as the first communicative loop that occurs when the child behaves in a specific way and the adult responds. An FL could occur either in isolation or with another communicative loop immediately following another it. When a communicative loop immediately followed another, it was called an SL. An SL could occur without additional solicitation (beyond that expressed in the Adult Uptake Move) and could be either the second, or beyond that number, in a series of communicative loops or the last in a series.

In any communicative loop, the moment during which the child tracks the adult's response is important. This interval was called the Critical Moment (CM). Within it, there is available to the child a display for what goes into using linguistic behaviors coordinated with communicative action. This moment is bracketed in Figure 1 and can be described as follows: The Critical Moment encompasses the second slot of Adult Uptake and Child Tracking Moves. The CM is defined as the moment when the child tracks the adult's uptake behavior. Within this moment, the Adult Uptake Move can occur either during, immediately following, or with a latency period from the offset of the Child Entry Move.

An example of a CABS from a normal dyad (9 month infant boy and mother) is provided in Example 1 of Appendix A. In this example, Slot I is the child's initiatory phase and the only move involved is the Child Entry Move. In Slot I, a series of child

behaviors occur simultaneously as the Child Entry Move. The onset of this move is marked by the onset of the child's shift in gaze from the adult's mouth to the adult's whole face and placement of the child's tongue between his lips. Several frames later, the child produces an audible raspberry sound. Slot II immediately follows Slot I. Slot II involves two moves- Adult Uptake and Child Tracking Moves. In Slot II, the adult gazes to the child and smiles to him. Several frames later, the adult interprets the child's behavior of a raspberry sound as indicative of "to play raspberries" and thus assigns it functional intent. She imitates the sound, wipes the child's chin and adds a verbal comment. During the adult's response, the child attends to the forms of the adult's response. The child maintains gaze on the adult's face and his production of a raspberry sound has ceased but his tongue remains postured (potentially in anticipation of the adult's response). This completes the end of the communicative loop. This example of a CABS meets the most minimal requirements, especially within the child tracking move. Here, the behavioral description of Move 3 involved a child look to the adult's face with a posturing of the tongue. This may seem trivial but this research project looked both for the child's tracking of adult uptake behaviors and the child's adjustment of his/her initial entry behaviors as a consequence of the adult response and participation in a communicative loop. An example of this second point is when, in addition to merely gazing to the adult's response, the child adds a vocalization. Interruption in this process would occur if gaze shifts away too early or onsets too late. Then the child does not have the opportunity to see the impact of his/her own behaviors on the adult.

Adaptive behavior. An adaptive behavior refers to a behavior which responds to a prior behavior by modification. Examples of adaptation include: noncommunicative gaze changes to communicative gaze; a gesture changes to reflect the response by the other rather than it being repeated; or a vocal behavior changes in form to become clearer, louder, or closer to a more conventional form. When multiple adaptive behaviors occur within the same move, we can talk about the behaviors in terms of the child's ability to

organize them by coordination, integration and nonredundancy. Coordination involves organization of gaze with gesture, facial, and/or vocal behaviors synchronized and moving in the same direction. For example, vocalization and manipulation of the adult's mouth co-occur with gaze to the adult. In addition, when adaptive behaviors include both the gesture and vocal channels, we can talk about them in terms of two other aspects of organization. These include the child's ability to produce both integrated and nonredundant moves. Integration and nonredundancy signal a degree of understanding of the word as a symbol, or referent, of communication. Integration refers to multiple behaviors that are temporally organized for the same intent to act as a unit in the code. For example, when the child makes circular movements in the adult's palm and vocalizes /ɹəʊn ɹə/ (round, round, robin) it means to sing the song Round, round robin. However, if the child makes circular movements in the adult's palm but vocalizes /dɪ ə pɪgɪ/ (this little piggy) then the vocal and gesture behaviors used are not related. The gesture behavior refers to the song "Round, round robin" but the vocal behavior refers to the song "This little piggy went to market". The two behaviors are related to separate things and are therefore unintegrated. On the other hand, Nonredundant refers to the child's ability to produce multiple behaviors in a maximally efficient way so that the behaviors are supplementary not repetitive. For example, the child vocalizes /dəɛ/ and points to the buttons on the adult's shirt. The vocal behavior acts as a referent to indicate but the gesture behaviors specifies the particular referent. The form and meaning is made clear only by the combination of the two behaviors and these behaviors act in supplementary ways, therefore, they are nonredundant. However, if the child gestures the rhyme movement of a song, for example, makes circular movements in the adult's palm, and also vocalizes the name of the song, for example, "Round, round robin", the vocal and gesture behaviors represent redundancy because they both mean the same thing and signify to play the game.

Dyadic unit. Dyadic unit refers to the unit formed by the two participants of an interaction.

Code. Lahey (1988) defined a code as "a means of representing one thing by another and language is a means of representation" (p. 5). A code is a system. A primitive system would be one of form-meaning relations which enables a communicator to know which form counts as which meaning. The code mediates between the form and meaning (Dore, 1983, 1985, 1989). For example, a baby hides his eyes (form) and it means "peek-a-boo". In a primitive system, both the form and the meaning of the elements of the system are negotiated by the participants, whereas in a conventional code, the meaning and form are known by the members of the community.

Recognition. When the child responds to the adult behaviors in a certain way in a later loop, the model takes this as evidence of recognition. This recognition may be expressed nonverbally or verbally and literally can be defined as a "knowing again", that is, knowing that the adult's behaviors are a response to one's own behaviors. In order to do this, the child must monitor and attend to the forms of the adult's behaviors. During the child's transitional period to first words, this recognition is important for learning about how conventional, linguistic forms can be used communicatively. Shields (1978) made reference to this notion of recognition in the following statement:

> The child's image of the world is mirrored twice, once directly and again as a representation of the representation of others. His image of himself is also mirrored twice, once with direct knowledge of internal states and again by is representation in the eyes of others. Each image modifies and extends the other (Shields, 1978, p. 556).

The most primitive evidence for behaviors in this recognition process occurs when the child adapts to the adult's movements simply via cessation of activity. During the tracking moment in the communicative loop, the child can attend to the adult's behaviors and determine the relation between the adult's and his/her own behaviors. This is illustrated in Example 2 (see Appendix A) which provides two consecutive communicative loops which were drawn from an interaction between a normal boy at 14

months and his mother. In the Child Entry Move in the first loop, the child gazes to the adult, extends his arm out with his index finger posed above the others. The mother monitors the child's behaviors and during the Adult Uptake Move, she gazes to the child's face and extended arm, moves her head up and down, and says that's your juice cup. During the Child Tracking Move, the child attends to the forms of the adult's response. Specifically, he maintains gaze to the adult and his arm and index finger lower during her response. This lowering of the child's hand, which originally acted as his signalling behavior, signifies the beginnings of recognition via adjustment to the adult's behaviors. During the Child Entry Move in the successive loop, the child gazes to the adult, leans slightly forward, his arm extends out again and he vocalizes /dəe/. The child attended to the forms of the adult's behaviors, specifically, her nod and verbalization, and he adjusted his original entry behaviors. This adjustment involved an extension of his hand and use of the wordform that. In order to make this adjustment, the child connected his gesture of a point and his communicative gaze behaviors with the adult's feedback, signalled both by communicative gaze and a nod and assignment of meaning and interpretation of functional intent of the child's gestural form, signalled by a conventional word. Although use of the adult's linguistic form was not a requirement for adjustment, the child's use of the adult's vocal form improved the quality of his adjustment. In this model, the child's adjusted behaviors of extension of his/her hand and his vocal behavior with gaze to the adult was taken as evidence for recognition that the child has made the connection between his own and the adult's behaviors involved in the communicative process.

Hypotheses

The proposed model identified changes over time in the adaptive behaviors of communicative loops. Within these loops, group differences were predicted between the autistic and normal groups. Additional predictions were made for developmental differences between the normal group at earlier and later times. Differences in the

autistic child's communicative loops were predicted because these loops contain interactional breakdowns which interfered with the ability to attend to the forms of the adult's response and consequently to adjust one's behaviors. These differences will be found within the individual child behaviors and for the adaptive behaviors across both participants in the dyad. Furthermore, the adults with the autistic group were not predicted to be able to compensate fully for the child's asynchronous behaviors and were predicted to have difficulty maintaining synchrony, via communicative gaze. On the other hand, developmental differences were predicted for the normal group because early difficulties in organization create some interactional breakdowns which interfere in the synchrony of the normal child's communicative loops. Finally, differences in behaviors were predicted across first and successive loops because participation in communicative loops was considered to favorably affect child behaviors.

The child behaviors are described in the Within-Person Hypotheses. The child's abilities during communicative loops were evaluated in terms of four dimensions: (1) sustained participation in rounds of communicative loops, and (2) coordination, (3) integration, and (4) nonredundancy of behavioral moves. In addition, the adaptive behaviors of the participants are described in the Across-Person Hypotheses. The focus of these hypotheses are the the dyad's adaptive behaviors in terms of the dimensions of temporal synchrony and adaptation. The critical assumption was that disruptions found in the autistic child's CABSs seriously impact on this child's ability to develop a conventional, linguistic form and one used communicatively. The hypotheses are as follows:

Within-person hypotheses.

1. Compared to the normal group, the autistic group will have:
   a) Proportionately less successive loops than first loops for each session;
   b) Difficulty coordinating communicative gaze with gesture, facial, and/or vocal behaviors during Child Entry and Tracking Moves;

c) Greater lack of integration of gesture and vocal behaviors toward the same goal during Child Entry Moves; and

d) Greater redundancy in their Child Entry Moves so that gestural and vocal behaviors will be merely repetitive, not supplementary, behaviors.

2. For the normal group, across comparisons from earlier to later times:

a) The proportion of successive loops per session will increase.

b) Coordination of communicative gaze with co-occurring behaviors will increase during Child Entry and Tracking Moves.

c) Integration and nonredundancy of behaviors used during Child Entry Moves will increase.

3. For the autistic and normal groups, from first to successive loops:

a) Communicative gaze alone or coordinated with other behaviors will increase in Child Entry and Tracking Moves and

b) Integrated and nonredundant behaviors in Child Entry Moves will increase.

Across-person hypotheses.

4. Compared to the normal group, for the autistic group:

a) The length of communicative loops will be longer. Specifically, the intervals will be longer between the Child Entry and Adult Uptake Moves and the Adult Uptake and Child Tracking Moves.

b) Across Child Entry and Tracking Moves, there will be less adaptation as observed by: less monitoring and attending via communicative gaze; absence of both anticipatory posturing of behaviors used (for example, gesture) and changes in facial expression.

c) Across prior and successive Child Entry Moves, there will be less adaptation between the child's own behavior and the adult's response. This will be evidenced by: noncommunicative gaze; repetition of a signal

unchanged from prior use (not fully relating the adult's uptake behaviors to one's own); absence of change in facial expression to display recognition; and lack of stability in the use of conventional words.

5. For the normal group:
   a) The length of communicative loops will decrease from earlier to later times. Specifically, the intervals between the Child Entry and Adult Uptake Moves and Adult Uptake and Child Tracking Moves will decrease from earlier to later times.
   b) Across Child Entry and Tracking Moves, adaptation will increase from earlier to later times as documented by increases in: communicative gaze, anticipatory posturing of the gesture used and changes in facial expression.
   c) Across prior and successive Child Entry Moves, adaptation will increase from earlier to later times as evidenced by increases in: communicative gaze; changes in gesture, facial, and vocal behaviors; and stability in the use of conventional words.
6. For the autistic and normal groups, the adult's synchronization of communicative gaze coordinated with other behaviors will differ. Adults with the autistic children will use communicative gaze coordinated with other behaviors less consistently than will be evident for the normal group.

Limitations of the Study

Several limitations prevent general application of the study's findings. First, generalizability is limited by the selection process for the autistic and normal groups. The sample size for both groups was extremely small. In addition, the autistic group used represented the severe end of the continuum for the autistic syndrome. Both of these factors limit the degree to which the results can be applied to either autistic or

normal populations in general. However, statistical analyses were accomplished by aggregating the number of observations across each group as a whole. Therefore, quantitative, rather than purely qualitative data, were obtained. In order to generalize these results, this study must be replicated with additional groups of autistic and normal children interacting with adults during the transition period to first words. In addition, selection of a larger autistic group needs to cover the broad range of functioning that is present in the autistic population. This procedure would alleviate the possible selection effect.

Further limitations for generalization are reflected in the methods used for obtaining the data. These limitations can be described as a failure to control for selection of five factors: (1) significant adults, (2) setting type, (3) socio-economic standards, (4) experience of special education teachers, and (5) variability in the routines used by the children and adults. First, selection of the significant adults was based upon which participants would demonstrate maximal opportunities for communicative loops. For the autistic group, these adults were determined to be their teachers whose more distant attachment to the children than their mothers could maximize performance. These teachers were significant adults to these children. They were important to and familiar with the children and responsible for many of their primary needs. Although these teachers often functioned in ways similar to a mother, they were not the children's primary caretakers. In contrast, the significant adults with the normal group were the children's mothers and their primary caretakers.

Additionally, the setting for the interactions was different for the autistic and normal groups. Selection of the setting was determined to be the one most familiar to the dyadic unit and one that afforded some isolation from other activities going on in that setting. For the autistic group, the setting was a familiar office in the school they attended and for the normal group, the setting was a room in their home. Although the differences in

the significant adults and setting reflect inconsistencies, these factors should not affect the results of this study. However, they do limit the generalizability of the results.

The fact that selection of the autistic and normal groups did not include controlling for socio-economic levels was another factor affecting generalization of the results. The autistic children came from white, middle, and upper middle, class class families, whereas the normal children all came from white,upper middle class families. In order for the results of this study to be generalizable to either of the two populations, replication of the study would need to be performed on children from a more normal distribution of socio-economic levels.

A fourth factor that was not controlled for in this study was the amount of experience of the special education teachers. The teacher with three of the autistic children had three years of experience in special education, whereas the teacher with only one of the autistic children had four years of experience. These differences in experience may have contributed to the results and may be a facto to be controlled for in future research.

The final factor affecting generalizing of results concerns the adults in this study who chose the routine activities. When preliminary piloting efforts were made to control the specific activities used or the order of presentation of these activities, the adults were not comfortable because it often meant the children became distressed when adults would not comply with the child's initiating behaviors. Therefore, the experimenter did not make stringent efforts to control these activities during the actual study and the interactions that occurred were more naturalistic. Although there were similarities in the actual activities performed, differences occurred across the groups and even within the individual dyads across the time period studied. Some of these activities varied in the degree of flexibility involved in performing them and these differences may have contributed to differences in the behaviors that were found. Future research may choose to control more stringently which activities occur and to maintain consistency across the groups and across time.

Methodology

The present study examined interactions between adults and children during the period surrounding the transitional period to first words. Eight dyads participated in this investigation. Four dyads were composed of autistic children with their teachers. A second group of four dyads consisted of normal infants with their mothers. Subject descriptions are presented in the following sections.

Subjects

Autistic Group

A diagnosis of autism for the four children in the autistic group was provided by medical reports and designation by the local Committee on Special Education (CSE). These children all met the DSM-III- R (1987) criteria for diagnosis of autism, (see pp. 16-17 for these criteria). The diagnosis of autism covers children with a broad range of functional levels. The present study sought to use the most severe end of the continuum. The Childhood Autism Rating Scale (CARS) was administered to the four autistic children by an independent source both to confirm the diagnosis and to identify the severity of the disorder. This diagnostician was a child psychiatrist who was familiar with the children.

The CARS has been used to screen children for autism and to distinguish children with autism from children with other diagnoses. The test rates behaviors across a continuum of 15 different areas and offers a compiled score which, the authors suggest, reveals the presence and severity (mild to severe) of autistic behaviors (Schopler, Reichler, & Renner, 1985).

The CARS confirmed that the four children selected demonstrated severe autistic behaviors. The CARS scores ranged from 41 for Bob, designated as Autistic Child 4, and

55 for Jake, designated as Autistic Child 1. (CARS scores of 37 to 60 indicate the severe range.) The mean score was 48.4.

In addition, all of the autistic children: (1) resided with their natural parents since birth; (2) attended the same private day treatment program for severely emotionally handicapped children, having been placed their by their local CSE; (3) participated in highly individualized, structured, psychoeducational settings with a small adult-child ratio; (4) received intensive speech and language therapy for at least two years; and (5) were involved in conjoint parent-child therapy focusing on attachment behaviors between the parent and child.

The four subjects were three males and one female, all of whom were white. They ranged in age from 9 years to 11.3 years with a mean age of 9.9 years. The four autistic children had been in special education since preschool. All came from white, middle class families. The parents of the autistic children completed at least a high school degree, whereas the parents of Jake and Richard (Autistic Children 1 and 3, respectively) achieved more advanced degrees. The mothers of the autistic group held a part-time job since their individual child was two years old. The fathers of this group maintained involvement with their children's program. However, Bob's parents were divorced and his father was absent since Bob's birth. In addition, Jake and Bob were only children; but, Amy (designated as Autistic Child 2) and Richard (Autistic Child 3) had older, normal functioning siblings.

A profile of the subjects' chronological age and CARS and intelligence quotient scores is provided in Table 1 (see p. 65).

In the next section, the individual autistic children will be described in terms of social skills (including language and play), levels of academic achievement, and management and behavioral needs.

Table 1. Age, diagnosis, intellectual functioning, and socre on Childhood Autism Rating Scale (CARS) for the autistic group.

Autistic Child	Chronological Age	Diagnosis	I.Q. Score (Mental Age)	CARS Score
1- Jake	9.2 years	Autistic/ Emotionally Disturbed	M. A.= 12 months	55
2- Amy	9 years	Autistic/ Emotionally Disturbed	M. A.= 2 years; 11 months	52.5
3-Richard	11.3 years	Autistic/ Emotionally Disturbed	M. A.= 3 years; 6 months	45
4- Bob	10 years	Autistic/ Emotionally Disturbed	M. A.= 3 years; 6 months	41

Note. All scores on the CARS placed the autistic group within the severely autistic range. I.Q. scores were undetermined for the autistic group. However, mental age was obtained by using the Merrill Palmer Scale of Mental Tests. Jake's mental age was obtained by using the Bayley Scales of Infant Development.

Autistic child 1: Jake. Jake was 9.2 years at the onset of the study. Socially, Jake was withdrawn, manifested gaze aversion, and used rocking and self-stimulatory behaviors. In the year previous to the study, he had shown some improvement in his availability.

Also, in this time period, Jake showed improved willingness to interact with significant adults, although his ability to tolerate comfort from others was limited. Jake's vocal behaviors were restricted to a small variety of vocalizations, some of which resembled linguistic forms. For example, sometimes he said his name. Immediate repetitions made up 20% of Jake's recognizable wordforms. He did not used delayed repetitions and had not acquired any words. The tone, pitch, and volume of Jake's speech frequently changed. Sometimes his speech was almost inaudible, while at other times it was harsh and shrill and his vocal forms were infrequently at a volume appropriate for conversational speech. His vocalizations usually were not accompanied by gaze to the listener. Jake showed some recognition of pictures and his name and would grab at them when asked to point. His primary means of obtaining his needs was to either dart to the area or object he wanted, manipulate an adult's hand for things, or drag the adult to where he wanted to go.

Similarly, Jake's play was primitive and during it Jake frequently placed himself in situations that were unsafe. He had particular interests in favorite toys, for example, stacking rings, jack-in-the boxes, and music toys. However, without adult assistance, this play was often undirected and perseverative. He enjoyed vocal play with an adult or getting an adult to sing to him. At these times, Jake insisted upon one's undivided attention and when this was not possible, Jake expressed discontent by shrieking, turning the adult's face back to him, or throwing himself carelessly about the area.

During lessons, Jake needed adult assistance to remain in his chair. He had not acquired the basic readiness skills for learning. When called, he inconsistently came to

lessons, responded to simple routine directions (for example, go to your desk), and halted an activity when told no.

Jake was completely dependent upon adults for all activities of daily living. He was not toilet trained and did not dress or undress himself; however, he was beginning to feed himself with a fork or spoon. Overall, Jake required intense adult supervision both at home and in school to remain engaged in any interactive activity.

Autistic child 2: Amy. Amy was 9 years old at the onset of the study. Socially, she showed brief periods of interest in interacting with adults. She was highly aware of other children but did not choose to engage them. Amy was frequently involved in self-isolated and self-absorbed activities. Sometimes these periods were accompanied by perseverative vocalizations that were unclear even to a familiar listener. During the two years prior to the onset of the study, Amy had developed less than 10 linguistic forms which indicated things she desired, for example cookie, juice. Despite this development, most of Amy's speech was not self-initiated. She required prompting to ask for things she wanted. In addition, the greater part of Amy's verbalizations were composed of repetitions. Of the total number of linguistic forms Amy used, 25% were immediate repetitions and 40% were delayed repetitions. In addition, Amy loved music and had learned the words to many songs. She frequently vocalized the first line of a song which was interpreted as meaning she wanted an adult to sing to her. Amy frequently danced around a room when music was playing. Like Jake, her means of engaging or soliciting an adult was by physical manipulation of the adult. However, unlike Jake, Amy showed clearer recognition of several pictures and objects and would inconsistently point to them upon request. Her play was primitive and she showed limited interest in objects other than dangling them in front of her face.

Academically, Amy had developed a limited amount of readiness skills. She had learned to write her name, say the numbers to five, and match some familiar pictures. She showed little interest during learning times and often cried in an effort to have

herself removed from a lesson. Her preference was to be outside running or inside dancing or playing with water.

Amy had developed some independence in activities of daily living. She could dress and undress herself with supervision, and also, she could feed herself without utensils. She was toilet-trained but some periodic regression in this area was noted. She required a highly structured classroom as well as close supervision to remain available and focused.

Autistic child 3: Richard. Richard was 11.3 years at the onset of the study. Socially, he was highly aware of others although he generally refused to interact with them, especially when the activity was other initiated. Richard's predominant means of interacting was by opposition. He refused to comply with any adults direction, resisting their assistance by whining, pushing away, and/or butting his head. Richard had developed some linguistic forms. He had a repertoire of 10 - 15 single words (such as, cookie, no, chocolate chip) and early combinations (for example, no juice) which he used inconsistently. Most of the time, these were used in response to a situation in which he became agitated. For example, he yelled no when he did not want to do what was requested. Much of Richard's words were repetitions. Approximately 20% of his speech was composed of immediate repetitions and 25% of his speech was composed of delayed repetitions. His delayed repetitions were mostly songs and phrases from television game shows. These appeared to be predominantly self-directed. That is, Richard frequently engaged in talk to himself as he moved through a variety of contexts. At these times it was difficult to intrude on him. He inconsistently sang with an adult. Furthermore, Richard's play was limited. He frequently selected toy people to hold during the course of the day, but rarely played with them. However, in the year prior to the onset of the study, he began to vocalize while holding these dolls and these vocalizations resembled those used by adults during events in his day.

Academically, Richard had learned some basic skills. He had a large sight word vocabulary and could perform basic counting and addition facts. When requested, he could point to several familiar pictures.

Richard also was dependent upon adults for activities of daily living. He did not dress or undress himself but was beginning to cooperate during these activities. He was toilet trained only during the daytime. He was highly idiosyncratic in his eating, choosing a limited and invariant array of foods. He showed limited tolerance of undesired foods near his vicinity. Due to Richard's strong tendency to remain isolated and self-absorbed, he required close adult supervision to maintain his availability and motivation.

Autistic Child 4: Bob. Bob was 10 years old at the onset of the study. Socially, he showed awareness of and limited interest in others. He sometimes sought out adults but demonstrated little contact once they were available. For the most part, he appeared unrelated to peers despite a keen awareness of them. Bob had developed about 20-25 single words (such as, his teacher's name and words like school bus, goodbye) and about 5-10 early word combinations (for example, say goodbye, go home). However, Bob was the most repetitive of the four autistic children. Approximately 35% of his speech involved immediate repetitions and 35% involved delayed repetitions. Delayed repetitions were frequently lengthy phrases of re-enactments from a prior conversation with a significant adult. Eye contact during these times was at best fleeting. In addition, Bob's speech was variable. At times it was clear, distinct, and audible to a listener. Most of the time, it was extremely rapid with long streams of words produced in compressed speech so that the listener could not understand. Bob also had learned some Spanish from a local television station. At times, he mixed Spanish and English words so that his talk was almost totally unintelligible. Bob frequently smiled when a listener expressed confusion. Without structure, Bob was often self-absorbed in talk to which there did not seem to be an intended listener. Play also was limited. He picked up

various people and animal toys when directed, but soon after dropped them. He frequently wandered aimlessly around the classroom.

Like Richard, Bob had developed some basic readiness skills for learning. He had a large sight word vocabulary for words found in basic primer books. He loved numbers and could count to 100. At times, he could perform simple addition facts, seemingly without the necessary conceptualization. However, performance was highly variable and dependent upon his emotional state on a given day.

Bob participated in most activities of daily living but required an adult's supervision to help sustain his focus. He was toilet trained and dressed, undressed, and fed himself. Overall, Bob required intense adult supervision to maintain relatedness and focus during most activities. He often required an adult next to him to help move him through everyday routines.

The selection process for finding comparative samples. Several researchers remarked that selecting a measure of language development with which to compare other samples with autistic children poses a particular problem (Wetherby & Prutting, 1984; Yule, 1978). Wetherby and Prutting selected gross stages of grammatical development and size of lexicon as measures to match autistic and normal children. Here, matching subjects at gross stages of language development would have been problematic. The goal of the present investigation was to examine the communication processes of autistic and normal children during the period when children first learned to use linguistic forms communicatively. For the normal child, "gradually, preverbal signals become 'conventionalized' into recognizable gestures and verbal expressions. For the autistic child, matters are less clear....Even when signals become conventionalized in the form of intelligible speech, the intended message ...may be difficult to discern" (Loveland, Landry, Hughes, Hall, & McEvoy, 1988, p. 602). Therefore, matching autistic and normal children at levels based purely on the existence of linguistic forms would have been erroneous. On the other hand, mental age also was

not used because the four autistic children in this study were evaluated as having mental ages between 12 and 42 months. Normal children matched by mental age with this group of autistic children would have a much greater command of linguistic forms used communicatively than these autistic children. Because the four autistic children in this study were essentially nonverbal, the criterion for selection of the normal group was to identify preverbal infants. These preverbal infants were in the transitional period of developing use of their first conventional forms and coordinating these forms with communicative action. The data from the normal infants were used as a source of comparison for the autistic group.

Normal Group

All of the infants in the normal group met developmental milestones as reported by their pediatrician and parent. None of the normal children had any known motor, sensory, emotional or behavioral disturbances or a familial history of any of these handicapping conditions. At the onset of the study, the normal group of children were nine months of age (+/- seven days), the age which coincided with the reported beginnings of communication in normal children (Bates, Camaioni, & Volterra, 1979b; Bruner, 1975; Harding, 1982, 1983).

The normal group was composed of four infants, three females and one male. William and Sandy, designated as Normal Children 1 and 2 respectively, had older siblings of the same sex. Leslie and Angela, designated as Normal Children 3 and 4 respectively, were only children. Distinctions for sex or birth order were not made since the purpose of the study was to describe interactions at a given point in time and not to pinpoint the time of emergence or mastery. The four infants came from intact, white, upper middle class families who resided in the suburbs of Long Island, New York. The infants and mothers attended the same play group during the child's first two years. The parents had at least a Bachelor of Arts degree. None of the mothers of these children were working outside the home, although two mothers did work at home part-time.

Significant Other

The significant other in this study was defined as an adult who was acquainted with the child for at least three months and who normally interacted with the child on the average of at least 20 hours a week. The significant other for the autistic child was his/her teacher. In the initial piloting, attempts were made to videotape autistic children with their mothers. However, this procedure was discontinued. For these mothers, the child's minimal responsiveness was a key factor inhibiting the dyadic interaction and this aspect affected the mother's ability to remain consistently motivated. The nature of this study was to examine interactions at their most ideal level and not the nature of mother-child interactions. Therefore, the child's teacher was considered a workable alternative for examining the potential role of the adult in these interactions. These teachers were responsible for all daily living activities of the autistic children and performed a great deal of caretaking and nurturing normally not found in regular classrooms. In addition, it has been found that parents of dysfunctional children, for example Down's syndrome, tend to structure their interactions with children in more managerial teacher roles than parents of normal children (Konstantareas, Mandel, & Homatidis,1989). This fact also made the selection a sensible choice.

Three children in the autistic group, Amy, Richard, and Bob, were in the same classroom and had the same teacher. Only Jake's teacher was different. Therefore, only two teachers were used in this study. Both teachers were female and held state certification in Special Education. The teacher with Amy, Richard, and Bob had worked in special education for three years and was in the process of obtaining her Master's degree in Special Education. The teacher with Jake had worked in special education for four years and held a Master's degree in Special Education. Both teachers had experience in working with emotionally disturbed and autistic children.

The significant adult for the normal group was the infant's mother.

Procedures

Identifying the Social Context

The autistic and normal dyads were videotaped in social play which was defined as an activity that involved only the two participants in the interaction (adult and child) without any objects. Therefore, the goal of the activity was the interaction between the participants and this was accomplished by the dyad. The activities were ones the child and adult frequently played together.

Although the original notion of this study was to eliminate toys completely, having them within the vicinity provided opportunities for breaks from the interaction. It was noted by all the mothers of the normal infants that long periods of play together without toys was not a typical means of interaction. Conversely, the teachers were more comfortable with social play activities because the teachers frequently attempted to help the autistic child maintain relatedness and avoid fixation on objects. For the normal and autistic groups, any object play that did occur was not used for analysis. On the other hand, often a part of the body, for example, a mouth or hand, was involved in the activity and the interaction around it was subjected to analysis.

Data Collection

Equipment. A Panasonic portable VHS/VCR (Model Number A6-2400) or hand held compact videocamera (Panasonic Model Number WV-3240 or JVC, Model Number GZ-S5) were used for all videotapings. All videotaping was done on Standard Play (SP) and focusing was manual and automatic. Both close range and wide angle shots were used at the discretion of the experimenter. The camera was placed at the closest vicinity to the dyad and best attempts were made to capture the child's exact gaze direction and behaviors. In addition, all videotapings were done with on-line time superimposed to measure time in minutes, seconds, and frames. Each frame represented a time interval

of 1/30 of a second, totalling 30 frames per second. Slow search and stop frame methods were used to aid transcription of the data.

Instructions to the adults. The teachers and mothers were told similar information about the focus of the study. The teachers in the autistic group were informed that the focus was to see how the adults and children interacted and if changes occurred over time. The mothers of the normal children were informed that the primary interest of the investigation was on how children and adults interacted in the first two years prior to the development of verbal language.

Before videotaping, the adults were asked to list routines that each adult and child preferred to do together and to briefly explain why these routines were selected. Then, the adults were instructed to orient the child to what they were going to do, to enact the activities they had listed, and to tell the child that s/he could have more if the child wanted. The experimenter requested that the adults give the child opportunity to respond without doing all of the activity for him/her. In general, the routines in which the dyads engaged were usually chosen by the adults; however, the adult's frequently adapted to the child's initiation of another activity.

Types of routines. The activities chosen for the videotapings were routines or games. Research by Bruner (1978) indicated that early language comes in the forms of routinized games, such as "pat-i-cake" and "peek-a-boo". Autistic children frequently engage in such routines in particular (Duchan, 1987; Prizant & Schuler, 1987) and do better in these formats because of the predictability and consistency of them. Therefore, the adults in this study were instructed to select specific routine games that they tended to play with their individual child.

The routines engaged in by the adults and the children in the autistic and normal groups in this study varied from routines with tightly ritualized events to those with looser scriptal structures. In general, activities followed two formats which varied in predictability and flexibility. These formats were either tightly woven, predictable

frames, as in a "peek-a-boo" format (Type 1) or activities with looser structure, such as I'm gonna get you, variations of "peek-a-boo", and tickle games (Type 2). Activities varied for each type. The activities for Type 1 included filling in lines to nursery rhymes and children's songs (for example, "Pat-i-cake"; "Itsy bitsy spider", "The wheels on the bus", "Round, round robin") and games (such as "peek-a-boo"). The activities for Type 2 included other games (such as vocal play and tickle games) and protoconversations and conversational sequences (including requests for recurrence of activities or for activities in general, and yes/no and wh- requests). Although Type 2 activities were less scriptal, they still involved a basic and predictable schema.

Observations. Each dyad was videotaped for 30 minutes per session as they were engaged in playing routine games. The games were familiar to both participants and the routines were not ones the child could re-enact entirely on his/her own. For the autistic group, videotaping was performed in the experimenter's office which was a familiar place to all of the children. The children were seated face-to-face with the adult. Videotaping for the normal group took place in the child's home. The mothers were told to use the location most convenient and familiar to the child. Most often the mother's chose a playroom or the child's room. Toys were placed out of reach of all of the children, but, not removed entirely.

Observation Schedule

The autistic and normal groups were followed longitudinally. In total, data analysis focused on three sessions per dyad but the observation schedule for each group reflected the different purposes of the data. Videotaping of the dyads in the autistic group occurred at three separate times for 30 minute each over a one year period: an initial session, a six month interval, and a final session at one year after the initial session. The exact date of the second and third session was at a six month interval from the prior session (+/- seven days).

Observations of the normal group took place monthly over a period beginning when the child was nine months old and continuing until the emergence of first words. All videotaping sessions were performed for 30 minute intervals on the anniversary of the child's birthdate for that month (+/- seven days). The criterion for baseline data was the month (nine months old or older) where at least 30 communicative loops occurred (child behaviors interpreted by the adult). This was roughly the equivalent of one communicative loop per minute. The criterion was based on evidence from these data that when communicative loops occurred, they did so with rapid frequency. The baseline data were designated as Session 1. The final taping session was identified as the month when, over the course of the taping session, the child used five conventional, linguistic forms that were coordinated with communicative gaze. This observation period was designated as Session 3. The definition of a linguistic form coordinated with communicative gaze was a self-initiated, conventional, nonimitative use of an adult form that was used routinely and was coordinated with communicative action to the adult. The other observation was the intermediary session. It took place for each child in the month that was midway in time between the baseline data and use of first words. The intermediary session for each child was determined retrospectively. The midway point for each child was identified after the individual child achieved use of five conventional forms and the month for Session 3 was determined.

Data Analysis

The analyses performed on the collected data were not the traditional methods used to examine conversation. In this investigation, interactions of autistic and normal groups of children with significant adults (teachers or mothers) were examined using a structural schema called a communicative loop. The moves within this schema were described in terms of adaptive behaviors used and the unit of analysis was the child and adult moves. Communicative loops were coded in four ways: the adaptive behaviors that

occurred, the timing of these behaviors, ratings performed on Child Entry Moves, and the consequences of behaviors. The procedures for these analyses are described below.

Equipment. All playback of the videotape data was done on a General Electric Video Cassette Recorder (Model Number 6011B). This machine was equipped with special playback effects, such as: slow motion to obtain slow motion pictures at up to 1/30 normal speed, frame-by-frame advance to advance the picture one frame at a time, and freeze frame to freeze the action of the videotape and get a still picture. These features allowed for good picture quality of the videotape to identify the precise timing of behaviors and the specific behaviors involved in each move.

Coding Adaptive Behaviors in a Communicative Loop

The videotaped data were examined using slow tracking and stop frame selection. This procedure identified behaviors which occurred within a communicative loop, called a Co-Adaptive Behavioral Sequence, (CABS). This sequence represented a structural schema optimally composed of three possible moves identified as Child Entry Move, Adult Uptake Move, and Child Tracking Move (see Chapter 2, pp. 51-54). A CABS could be coded as a First Loop, designated as FL, or a Successive Loop, designated as SL.

For each videotaping session, a total of 10 CABSs were first identified. The purpose of this procedure was to have an entry point into the taping session. Then, the next 20 CABSs from each videotaping session were collected and these were used for data analysis. In total, 480 CABSs were analyzed (240 for each subject group).

Each move in a CABS was described in terms of gaze and three other behaviors that occurred. These behaviors occurred in the gesture, facial, and/or vocal channels. Several behaviors could occur simultaneously, as in the first Child Entry Move of Example 2 (see Appendix A), where gaze, gesture, and vocal behaviors took place at the same time. Behaviors could also occur in a more sequenced order, for example, the adult smiles then vocalizes to the child.

Gaze behavior. The type of gaze was defined by the direction of gaze during the specific moves of a communicative loop. Gaze direction could be either to a person, a body part, or physical context area. The context area was defined as the physical area surrounding the participants. Gaze behaviors occurred as one of three types: communicative, intermittent, or noncommunicative. Communicative gaze was defined as gaze to person, body part used for expression, as in hands clapping, or context related to the CABS. For example, if the participant directed a point or other gesture to the physical context and looked in the same direction, gaze was considered related and designated as communicative gaze. Noncommunicative gaze was defined as gaze to an unrelated body part or context area. For example, if the participant's gaze shifted to the physical context, but a gesture and/or vocal behavior was directed to the other participant, the physical context was not considered related and gaze was considered noncommunicative. Intermittent gaze was marked by a shift in any direction (for greater than five frames or 5/30 of a second), from communicative gaze to an unrelated body part or context area (such as the ceiling).

Gestural behaviors. Gestural behaviors involved movement of any part of the body. For example, a gesture involved an index finger extended, as in a point, or a hand that pushed directly at an adult's mouth. Slight leaning of the body or movements to straighten or stretch the body were not counted as a gesture.

Facial behaviors. Facial behaviors involved open, overt expressions, for example, lips retracted back and upward or mouth and/or eyes wide open. Lips simply placed loosely together were not counted as a facial behavior.

Vocal behaviors. Vocal behaviors involved vocalizations, immediate and delayed imitations, wordforms (indexical) or phrases of a song, or conventional words. The generally accepted definitions in the literature were used to code vocal behaviors. Vocalizations involved vocal sounds, vocalized laughter, grunts, squeals, or vocal play sounds. These behaviors were the most primitive use of the vocal channel and were

amorphic in shape, reflexive, consistent or systematic, and lacked similarity to conventional symbols. Immediate and delayed repetitions as well as wordforms and routine phrases as parts of songs were all considered in the category of wordforms. Wordforms were considered "indexical expressions" (Dore, 1983) and were defined as vocal forms which had a definite shape, capable of being isolated and bounded by a pause, occurred repeatedly, and were correlated with specifiable, recurring conditions. These forms were idiosyncratic, not conventional, and are not quite as stable as words (Dore, Franklin, Miller, & Ramer, 1976). Conventional words were defined as stable forms that were self-initiated, conventional, nonimitative use of adult forms used routinely. This definition of conventional words was used to code all vocal behaviors. However, in order to determine when the normal group had used five linguistic forms communicatively, another criterion was added. This criterion specified that a word must co-occur with communicative gaze.

There was one differentiation made between child and adult vocal behaviors. When a child used a phrase from a song, it was coded as a wordform not a conventional word. The assumption was that the phrase for the child was used only within the context of that song and length of the utterance usually exceeded the child's utterance complexity. However, an adult's use of that same phrase was coded as a conventional word. It was presumed that the adult used the phrase communicatively, had an understanding of the grammatical relations within the phrase, and each word had a known referent for it. For children, during the transition to first words, these principles were not applicable.

Differences between Child Entry, Adult Uptake, and Child Tracking Moves. Moves occurred in artificial slots which were to be filled. The requirement for a Child Entry or Adult Uptake Move was that more than just gaze behavior was present. However, Child Tracking Moves were slightly different. The model did not predicate requirements for behaviors in this move. Therefore, the Tracking Move was sometimes represented by a moment in the slot in which there was only noncommunicative gaze.

This could not occur in a Child Entry Move. In addition, one other difference existed between Child Entry and Child Tracking Moves. If a behavior occurred in the Child Tracking Move that was not present in or was changed from the Child Entry Move, it formed the beginning of another loop only if the adult responded to it. If there was not adult response to this behavior, then it existed for that part of the slot represented by the Child Tracking Move. In Example 3 (see Appendix A) the adult did not respond to the child's vocal behavior in the Tracking Move and this loop ended.

Coding behaviors. The experimenter coded behaviors in terms of whether they were present or absent and the coding received a quantitative score. Value assignments for adaptive behaviors are provided in Appendix B. A dashed line in the description (---) identified a behavior coded as absent. This is illustrated by the dashed line for gesture behavior in the Child Entry Move in Example 1 (see Appendix A).

Timing of a CABS

The experimenter also identified the onset and offset times of communicative loops and the moves within each loop.

Onset of a CABS or Child Entry Move. The premise for selection of a child behavior analyzed for a communicative loop was based upon two criteria: (1) whether the adult responded to the child initiatory behaviors and (2) that a gesture, facial, or vocal behavior was included in the child's behavioral array. Child behaviors meeting these criteria were called the Child Entry Move. These behaviors marked the onset of a CABS and the entry point for analysis. After identifying the behaviors for the Child Entry Move, the exact time of onset was identified by repeated visual scanning at slow speed and stopping the videotape on the identified frame. This process continued until the most accurate time for onset of each move was identified. The first behavior marked the onset of a communicative loop, or of a move. In Example 1 (see Appendix A), the child's shift in gaze to the adult's mouth and the tongue placement between the child's teeth were simultaneous behaviors which marked the onset of the Child Entry Move. The vocal

behavior of a raspberry sound occurred during this move, but it occurred several frames subsequent to the onset of the gaze and gesture behaviors. Therefore, multiple behaviors of gaze, gesture, and vocal constituted this move but onset of the move was determined by the first behaviors to occur. In this case, both gaze and facial behaviors had simultaneous onset. If the first behavior to occur in the move was a vocalization, the moment closest to when the child's mouth postured for the vocal behavior was the time of onset for that move (as visible on the videotape).

Offset of a CABS or move. Offset of a move, or of the communicative loop, was the moment where all of the identified behaviors came to rest. Offset of the move was the frame during which the last behavior demonstrating any movement came to a halt. If behaviors were not simultaneous, then the behavior that came to rest last was the offset of the move. This is illustrated in Example 1 (see Appendix A) where the last behavior to end was the vocal behavior.

When multiple behaviors were used, then the behavioral movement completed last marked the offset of the move. The onset of the Child Entry Move in Example 4 (see Appendix A) was marked by simultaneous onset of several behaviors. This communicative loop was drawn from an interaction between an autistic boy and his teacher. The behaviors involved were gaze to the adult's mouth coordinated with a gesture to the adult's mouth and the facial expression of lips pursed. The child produced a raspberry sound several frames after this moment of onset. Offset of the move was marked by the last moving behavior. Here, offset occurred when the child's hand returned to the boy's lap. The offset of the gesture of a swat to the adult's mouth was not until the hand returned to the child's lap. This moment of offset was determined because there was not a pause in the gesture action between the time it was directed to the adult and the time it returned to the child's lap. If the child's hand remained posed at the adult's mouth, as if anticipating a response, offset of the move instead would have been the onset of this pause.

Offset of the communicative loop was somewhat less precise than was offset of the individual moves. The frame closest to the time the adult completed a response to the child marked loop offset. The adult response may have occurred in the time for completion of one sentence or may have involved a longer period. Therefore, the frame closest to the end of the adult's response marked the offset of the loop and, consequently, it also marked the offset point for a Child Tracking Move.

Rating the Child Entry Move

The experimenter also rated Child Entry Moves individually for integration and nonredundancy. These ratings determined the relation between co-occurring behaviors within the move and instances of integrated and nonredundant moves represented the child's understanding of these behaviors as communicative.

Integration. The definition for integration was whether or not the gesture, facial expression, and vocal behaviors of a move were temporally synchronized to act as a unit for the same intent. In Example 4 (see Appendix A), the behaviors of the child's move acted as a unit and the move was integrated. The child's hand to the adult's mouth and the raspberry sound represented behaviors related to playing raspberries. On the other hand, the behaviors in the Child Entry Move in Example 5 (see Appendix A) were unintegrated. This example was drawn from an interaction between an autistic girl and her teacher. The Child Entry Move in this example consisted of gaze to the adult's face and the accompanying behaviors were a vocalization, gesture, and facial expression. The vocal behavior was /dɪ ɔ pɪgɪ/ and the gesture behavior was a circular hand movement in the adult's palm. However, these two child behaviors were related to two different songs. The gesture behavior of a circular hand movement in the partner's palm was related to a song where the words of the first line are round, round robin. The vocal behavior, this little piggy, was related to the first line of the song called "This little piggy went to market". Therefore, the two behaviors were not organized toward the same purpose and the child's move was rated unintegrated.

Nonredundancy. The second rating of Child Entry Moves was Nonredundancy which was defined as orchestration of the adaptive behaviors such that overlap did not exist across channels (gesture, facial expression, vocal). Specifically, this means that the gesture and vocal behaviors complemented, not repeated, each other. Example 6 (see Appendix A) is an example of a nonredundant move. This example was drawn from an interaction between a normal boy at 14 months and his mother. Here, the child used conventional linguistic and gestural forms. In this example, the deictic term that acted to refer, but the gesture specified the object to be identified. Therefore, the behaviors complemented each other and did not represent superfluous information.

The move was redundant when gesture and vocal behaviors duplicated the information conveyed by the individual behaviors alone. Redundancy is illustrated in Example 7 (see Appendix A). This move was drawn from a communicative loop between an autistic boy and his teacher. This loop immediately followed another one where the child and the teacher engaged in vocal play and the teacher made vocal sounds. In this example, the child's gesture replicated the behavior in the vocal channel. Here, the child vocalized a relatively clear production of more. It is implicit in this interaction that more referred to the preceding activity. In addition, in this child and adult's code, the child's touch to the adult's mouth means to continue or repeat a prior behavior, such as to engage in vocal play where the participants make sounds raspberries. Therefore, the two behaviors replicated each other without either behavior specifying additional information. Redundancy is also demonstrated in Example 4 (see Appendix A). In this example, the gesture of the child's hand to the adult's lips and the vocal behavior of a raspberry sound represented duplicate information. In this child and adult's code, the gesture to the adult's mouth meant do or say something and the raspberry noise meant play raspberries, therefore, the raspberry sound alone was sufficient.

The experimenter scored Child Entry Moves as either one of the individual ratings for integrated and nonredundant. Because of the definitions specified for these two

ratings, a move could not be both unintegrated and redundant. That is, a move could be only one of three possible choices: integrated and nonredundant, integrated and redundant, or unintegrated and nonredundant. (Value assignments for integrated and nonredundant behaviors are provided at the end of Appendix B.)

Coding Consequences of Behaviors

The previous sections dealt with examination of the individual moves within a CABS. Additional analyses were performed for comparisons of behaviors across moves. There were three comparisons in total which measured the degree of adjustment in behaviors. These analyses involved comparisons between: Child Entry and Adult Uptake Moves, Child Entry and Tracking Moves, and Child Entry Moves across Prior (FL or SL) and Successive Loops. The first two comparisons measured the consequences of Adult Uptake Moves, and the third comparison measured the consequences of interactions as well. The comparison of behaviors revealed two categories: Continued or Shift. These categories described the status of a behavior across any two moves.

Continued behaviors. The relationship between behaviors in two moves was Continued when the status of a behavior remained the same across the moves. There were two types of relationships for the category of continued behaviors. The first type, designated as C^{+}, described a behavior that occurred across moves. The second type of continued behavior was for a behavior that did not occur in either of the moves and this relationship was termed C^{-}. These descriptions differed slightly for gaze, gesture, facial, and vocal behaviors. The category descriptions for gesture and facial behaviors were similar because these behaviors either occurred or they did not occur. For instance, Example 1 was drawn from an interaction between a normal infant at nine month old and his mother (see Appendix A). In this example, a comparison of the facial behaviors across Child Entry and Tracking Moves revealed that, in both moves, the child postured his tongue over his lips and between his teeth. Therefore, the relationship between the two facial behaviors in Example 1 was designated as C^{+}.

For types of continued behaviors designated as $\underline{C}^{+}$, the possibilities for gaze and vocal behaviors were more diverse. Gaze behavior continued to occur when the child used communicative gaze across both the Child Entry and Tracking Moves or the child and adult used communicative gaze across Child Entry and Adult Uptake Moves. In Example 7 (see Appendix A), the autistic child and adult held communicative gaze and relationship between their gaze behaviors was continued. Vocal behaviors continued to occur across moves when both the participants used either a similar vocalization, wordform or imitation, or conventional word.

On the other hand, the experimenter gave the designation of $\underline{C}^{-}$ when a behavior did not occur for either of the moves compared, in other words, when the absence of a behavior continued across moves. In Example 1 (see Appendix A), neither of the child moves contained a gesture and the coding was $\underline{C}^{-}$. The identification of whether gesture, facial, or vocal behaviors did not occur across moves was simple. Gaze behaviors were slightly different. In all loops, gaze was never absent (eye blinks were brief and some form of gaze existed around these eye blinks). The coding $\underline{C}^{-}$ was used when the gaze behaviors in two moves were either both noncommunicative gaze or both intermittent gaze.

In addition, there was a subtype for the relationship between behaviors that occurred across moves. Sometimes, a behavior continued to occur across the moves being compared, but, there was a change in form, specified as $\underline{C}^{+F}$. A form change involved a behavior that was altered in intensity, frequency, or type. This subtype was not used for gaze behaviors. Example 7 (see Appendix A) is an illustration of a form change in the gesture behaviors of the Child Entry and Adult Uptake Moves. This example was drawn from an interaction between an autistic boy and his teacher. The child's gesture behavior was a hand extended to the adult's mouth and the adult's gesture was a nod. Both participants used different forms for their gestures.

Shift in behaviors. The other category for coding behavioral relations was a Shift. When the behavioral coding was different across the moves being compared, it marked a Shift in behaviors. There were three types of shifts: S ON, S OFF, S CHANGE. The first type, S ON, occurred only when a behavior was absent in the first move and present in the next move. This description for this type of shift occurred only for gesture and facial behaviors. In addition, a gaze behavior that went from noncommunicative gaze to communicative gaze also was coded as an S ON. Finally, there were three possibilities for vocal behaviors. A shift on occurred when a vocal behavior that did not occur shifted to either a vocalization, a wordform or imitation, or a conventional word. This relation is illustrated in Example 8 which was drawn from an interaction between an autistic boy and his teacher (see Appendix A). In this example, there was a shift on in the vocal behaviors across the Child Entry and Adult Uptake Moves. The child did not use a vocal behavior in his move but the adult used a vocal behavior in her move.

The second type of shift was S OFF. This was directly opposite an S ON. In a shift off, the behavior occurred in some form for the first move but did not occur in the second move. In Example 8, the relationship between the gesture behavior for Child Entry and Child Tracking Moves was considered an S OFF. In the Child Entry Move the child used his hand to push at the adult's chin; but, in the Tracking Move, this behavior no longer existed. For the gaze category, a shift off was designated when communicative gaze changed to noncommunicative gaze. In the category of vocal behaviors, a shift off occurred when either a vocalization, a wordform or imitation, or a conventional word changed to no occurrence.

Finally, the third type of behavioral shift was S CHANGE. This type of shift only occurred for gaze and vocal behaviors. A shift of this type involved a change in the category coding of the behavior but the change was other than from on and off categories. An S CHANGE for gaze behavior occurred when there was a shift, in either direction, from intermittent to communicative gaze or from intermittent to noncommunicative

gaze. An S CHANGE for vocal behavior occurred when there was a shift, in either direction, in any of three ways: vocalization to wordform or imitation, vocalization to conventional word, or wordform or imitation to conventional word. Example 3 (see Appendix A) illustrates an S CHANGE for the vocal behaviors across Child Entry and Adult Uptake Moves. This example was drawn from an interaction between a normal boy at 18 months and his mother. Here, the adult recoded the child's wordform /tɪkə tɪk/ to the more conventional word tickle. (The coding system for the Continued and Shift categories of behaviors is described in Appendix C.)

Inter-rater Agreement

Both pre- and post-test agreements were performed.

Pre-test interobserver agreement. The pre-test interobserver agreement used 30 CABS of one videotaped recording each for an autistic and normal dyad. The experimenter trained a Master's student in Speech-Language Pathology for two, four hour sessions. This student coded the CABS for: (1) recognition of occurrence of a CABSs, (2) timing of the onset of child and adult moves, (3) timing of the offset of the Child Entry Move, and (4) specific behaviors occurring within the moves of a CABS. The experimenter and trainee's time codes were in agreement if the two times were within +/-10 frames. Best attempts were made to reconcile differences. This study used the following formula for agreement: number of responses agreed upon/total number of responses x 100%.

The results of the pre-test interobserver agreement were: 95% for identification of a CABS, 94% for the timing of the onset and offset behavior, 94% for agreement of the specific behaviors of a CABS. Differences in timing never altered the specifics of an actual move and the disagreements in behaviors only were in terms of gaze.

Post-test interobserver agreement. An ASHA certified speech-language pathologist performed the post-testing on the coding of continued and shift categories. The experimenter trained this person for two hours. Then, the experimenter gave the

written original descriptions of 40 CABS to the speech-language pathologist to code for the continued and shift categories. There were 100 codings involved in these 40 CABS and these codings were concerned with the comparisons of Child Entry and Adult Uptake Moves, Child Entry and Tracking Moves, and Prior and Successive Child Entry Moves. Post-test interobserver agreement was 92% (across continued and shift categories).

Statistical Treatment

This study represented a mixed 2 x 3 x 2 ANOVA design with repeated measures. There were three variables: Group (Autistic and Normal), Session (1, 2, 3), and Loop Type (First and Successive). Group was a between-subject factor and both Session and Loop Type were within-subject factors. Dyads were not a factor in the ANOVA. The statistical analyses involved aggregating across groups, dyads, sessions, and loop types. Only loops of a particular type had valid scores for the comparisons of prior and successive Child Entry Moves. Therefore, the model for these comparisons was a two-way ANOVA where loop type was not a variable.

The proportions for all ANOVAs used arc sine transformations to normalize the distribution. The transformed proportions may be greater than 100.

Post hoc testing using the Newman Keuls procedure for pairwise contrasts established if there were significant differences between the means for the within-factor session or for any of the interactions. When the Newman Keuls did not provide significant results, the follow-up analysis involved the more conservative Scheffe test of multiple comparisons.

Results

Viewing the videotapes of autistic and normal children with adults revealed the occurrence of a number of communicative loops, or Co-Adaptive Behavioral Sequences. Microinteractional analyses of the CABSs focused on the individual behaviors in the three moves of these loops and the relations between them. Results are reported for the autistic and normal groups for the three variables group, session, and loop type, according to the following areas: (1) Description of Co-Adaptive Behavioral Sequences, (2) Features of Slot 1- Initiatory Phase, (3) Features of Slot 2- Response-Acknowledge Phase, (4) Consequences of Adult Uptake Moves, and (5) Consequences of Participation in Interactions.

Description of Co-Adaptive Behavioral Sequences

A total of 480 communicative loops were identified for the autistic and normal groups across three sessions. The transformed values and proportions were subjected to a three factor Analysis of Variance (ANOVA) with repeated measures. Findings are presented for types of routines, the ability to participate in communicative loops, and timing of the moves of communicative loops. Several hypotheses are related to these results. Within-Person Hypothesis 1 predicted that the autistic group will experience difficulty sustaining participation in successive communicative loops and, therefore, out of the total number of communicative loops, the proportion of successive loops will be less than first loops. In addition, Within-Person Hypothesis 2 predicted that, for the normal group, the proportion of successive loops will increase from earlier to later times. Across-Person Hypothesis 4 asserted that the length of the autistic group's communicative loops will be longer when compared to the normal group. Specifically, for the autistic group, the intervals between the Child Entry and Adult Uptake Moves and the Adult Uptake and Child Tracking Moves will be longer than those of the normal group.

Finally, Across-Person Hypothesis 5 predicted that, for the normal group, developmental differences will occur in the overall length of communicative loops and in the length of two of the intervals within the communicative loops. Specifically, the intervals between the Child Entry and Adult Uptake Moves and the Adult Uptake and Child Tracking Moves will decrease from earlier to later times.

Types of Routines

The types of routines in which the autistic and normal groups participated varied. The autistic group preferred Type 1 formats more than the normal group. These Type 1 activities were scriptal formats that involved highly structured and predictable formats with almost no variation. The autistic group less often participated in Type 2 activities where the child's behaviors were interpreted by the adults as either do more or repeat a routine. On the other hand, the normal group preferred the Type 2 activities where the format varied slightly. These activities involved activities such as variations of the game "I'm gonna get you". Some routines for the individual dyads appeared to have idiosyncratic forms which were specific to the adult-child dyad, whereas others were more general (see section on Individual Differences in Chapter 5).

Ability to Participate in Communicative Loops

The transformed proportions for the number of first and successive loops were subjected to an ANOVA for repeated measures. The results are shown in Table 2 (see p. 91). An inspection of Table 2 indicates a significant main effect only for loop type ($p < .05$). For the autistic and normal groups, SLs occurred more frequently than did FLs.

Figure 2 (see p. 92) shows the interfactor relation of session and group for the use of successive loops. This figure illustrates that the cell means for successive loops of the autistic group decreased across sessions. For the normal group, the incidence of SLs increased. However, the interaction of group and session was not significant.

Table 2. Mean differences in and SD for successive and first loop occurrence for each group by session and loop type and summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	71	10	59	13	65
	First	36	8	47	12	41
2	Successive	60	23	70	18	65
	First	47	19	37	16	42
3	Successive	50	12	73	14	61
	First	56	13	35	10	45
	Marginal	53		53		53

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	13.63	1	13.63	63734.06
Group	0.00	1	0.00	0.35
Error	0.00	6	0.00	
Session	0.00	2	0.00	0.29
Session x Group	0.00	2	0.00	0.64
Error	0.01	12	0.00	
Loop Type	0.52	1	0.52	12.42*
Loop x Group	0.06	1	0.06	1.34
Error	0.25	6	0.25	
Session x Loop	0.01	2	0.01	0.14
Session x Loop x Group	0.24	2	0.12	2.82
Error	0.54	12	0.04	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$.

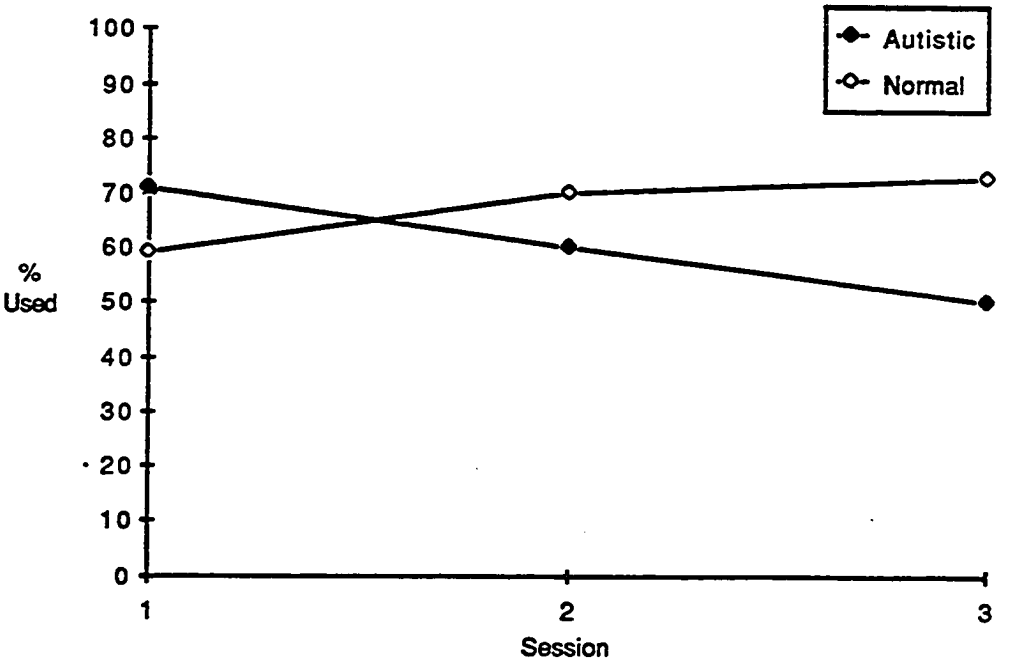


Figure 2. Mean differences in occurrence of successive loops for the interaction of group and session.

These findings only partially support Within-Person Hypotheses 1 and 2. Successive loops occurred more frequently for both the autistic and normal groups. However, the autistic group demonstrated inconsistency in participating in successive communicative loops across the three sessions, whereas the normal group's ability to participate in successive communicative loops increased steadily.

Vocal Channel

The Table 3 distribution (see p. 94) indicates that the autistic and normal groups were different in the types of vocal forms they used. The autistic group predominantly used wordforms for the vocal channel. Most of these were lines from songs, for example, wheels on the bus, this little piggy. These were considered wordforms or indexicals. Indexicals have a defined shape, are capable of being isolated and bounded by a pause, occur repeatedly, and are correlated with specifiable, recurring conditions. Additionally, these forms are idiosyncratic, not conventional, and are not quite as stable as words (Dore, Franklin, Miller, & Ramer, 1976). The autistic group's wordforms resembled conventional words; however, these forms existed only within a restricted format. In addition, the autistic group's use of these wordforms did not change across time toward a more stable linguistic form used communicatively. More often, the form of these wordforms were not as stable as words and their shape was more amorphic like vocalizations. For example, although there was variation in the wordforms the autistic group used, the forms /mɔɹ/ (more), /pæ ɚ kə/ (pat-i-cake), /reɪz ə hæ/ (raise your hand), and /tɪkl/, (tickle) were common throughout the one year period. These forms remained amorphic and highly tied to a specific context. Also, for the autistic group, the number of types and tokens of wordforms exceeded vocalizations and conventional words and tokens increased over the three sessions.

The normal group's wordforms conformed to the definition of indexicals, that is, they lacked the stability of linguistic forms and were more amorphic in shape. The

Table 3. Distribution of vocal behaviors (vocalizations, wordforms, and conventional words) for the autistic and normal groups across session and loop type.

	Vocal Behaviors					
Autistic Group	Vocal		Wordform		Conventional Word	
	Type	Token	Type	Token	Type	Token
Session						
1	11	18	27	32	5	11
2	14	17	18	28	14	26
3	11	12	34	45	8	12
N=	36	47	79	105	27	49

	Vocal Behaviors					
Normal Group	Vocal		Wordform		Conventional Word	
	Type	Token	Type	Token	Type	Token
Session						
1	29	54	3	7	0	0
2	20	31	9	11	2	6
3	11	16	11	13	13	34
N=	60	101	23	31	17	40

Note. Wordforms include repetitions and lines and phrases from songs.

normal group's use of these indexicals was not tied to a restricted format, although use was context specific. The development of these forms toward linguistic forms used communicatively was apparent for the four children in the normal group across the three sessions. For example, the forms / ð dæ /, /d ɔ/, and /g æ/ first occurred consistently with a gesture before the word that was used. Similarly, vigorous headshakes sometimes accompanied by intense vocalizations preceded the word no. Also, various high pitched vocalizations, inconsistently accompanied by directed gaze, preceded forms such as / ɔm/, /mɔ/ and / əmɪ /. And, both vocalizations and wordforms came before the linguistic form mommy coordinated with communicative action. By Session 3, the normal group's vocal forms changed in three ways: vocalizations were laughter only, there were no instances of wordforms, and conventional words increased in number. Examples of conventional words used by the normal group included: that, more, mommy, this, and no. Figure 3 (see p. 96) shows the changes across the three sessions in the number of conventional words used by the autistic and normal groups.

Timing of the Moves of the Communicative Loops

Four aspects of timing were subjected to Analyses of Variance (ANOVAs): (1) length of communicative loops, (2) interval between onset of Child Entry and onset of Adult Uptake Moves, (3) interval between onset of Adult Uptake and onset of Child Tracking Moves, and (4) interval between onset of Child Entry and onset of Child Tracking Moves. Similarities between the two groups were remarkable.

Length of communicative loops. The overall length of a communicative loop depended upon several additive factors. These included how long a child's behaviors were observable during the loop, how long it took for the adult to respond to the child's behavior, and how long it took for the child to cease his/her behavior and attend to the adult's behavior. When the transformed values for mean length of a communicative loop

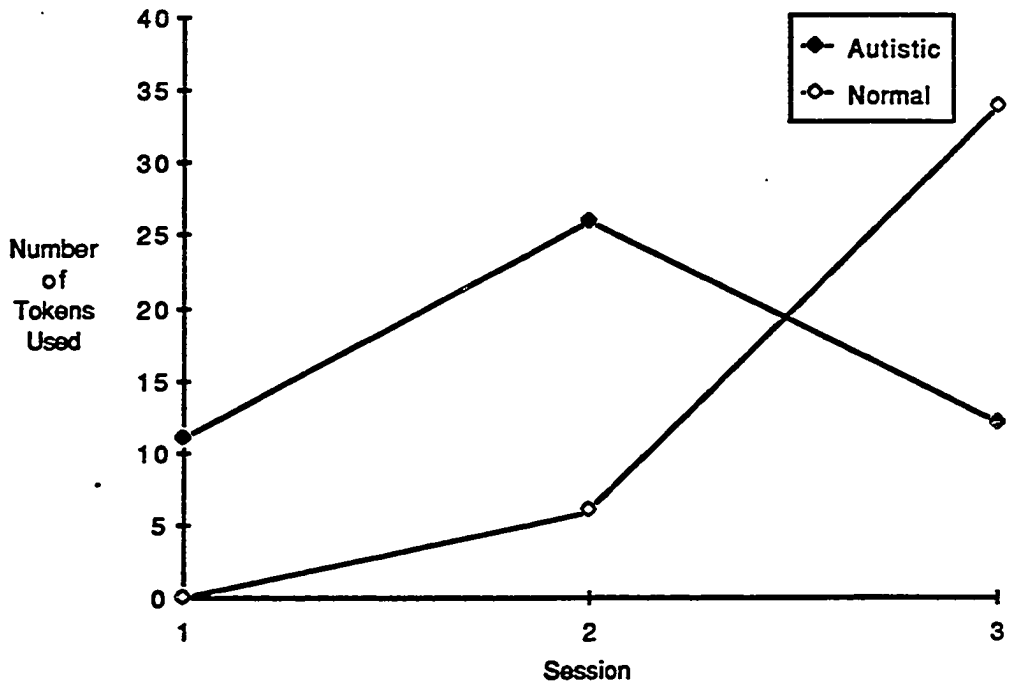


Figure 3. Tokens of conventional words used by the autistic and normal groups across the three sessions.

were subjected to an ANOVA, no significant differences were observed for the main effects of group, session, or loop type. However, significant differences were observed for the interaction of session and group ($p < .05$). Table 4 (see p. 98) indicates these results.

Figure 4 (see p. 99) shows the interaction between group and session for mean length of communicative loops. A follow-up analysis using the Newman Keuls procedure for pairwise contrasts revealed that the length of communicative loops for the autistic at Session 3 was significantly higher than the normal group at Session 3. These changes may be accounted for in the specific intervals.

Interval between the onset of Child Entry and onset of Adult Uptake Moves. Our expectations were that the autistic group over the one year period, and the normal group at the earlier time, would use primitive behaviors and further, because primitive behaviors were more difficult to read, onset of the adult response would take longer. However, when the transformed values for the mean length of this interval were subjected to an ANOVA, no significant differences were found (see Table D-1 in Appendix D for nonsignificant results). For both groups, the average length of this interval was 34 frames.

Interval between the onset of Adult Uptake and onset of Child Tracking Moves. The length of the interval between behaviors for Adult Uptake and Child Tracking Moves is dependent upon the child's attending to the adult's response. The most primitive adjustment involves cessation of activity and focused attending. Table 5 (see p. 100) shows the transformed values for this interval and a summary of the ANOVA. Significant differences were observed for the interaction of group and session ($p < .05$).

Figure 5 (see p. 101) illustrates that the mean length of the interval for Adult Uptake and Child Tracking Moves for the autistic group varied and was longer than the normal group at Session 3. However, when a Newman Keuls test of contrasts was performed as a follow-up analysis, significant pairwise differences were not found.

Table 4. Mean differences in and SD for length of communicative loops for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	125.56	23.52	133.82	8.79	129.79
2	Successive] First	133.98	25.00	119.00	25.58	126.49
3	Successive] First	149.66	50.50	115.32	24.47	132.49
	Marginal	136.40		122.72		129.56

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	805674.04	1	805674.04	279.39
Group	2246.39	1	2246.39	0.78
Error	17302.12	6	2883.69	
Session	288.79	2	144.40	0.38
Session x Group	3640.19	2	1820.09	4.78*
Error	4566.75	12	380.56	
Loop Type	1987.51	1	1987.51	2.06
Loop x Group	239.46	1	239.46	0.25
Error	5793.45	6	965.58	
Session x Loop	76.04	2	38.02	0.07
Session x Loop x Group	14.29	2	7.14	0.01
Error	6170.45	12	514.20	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100. Length of communicative loop presented in frames with 30 frames per second.

*$p<05$.

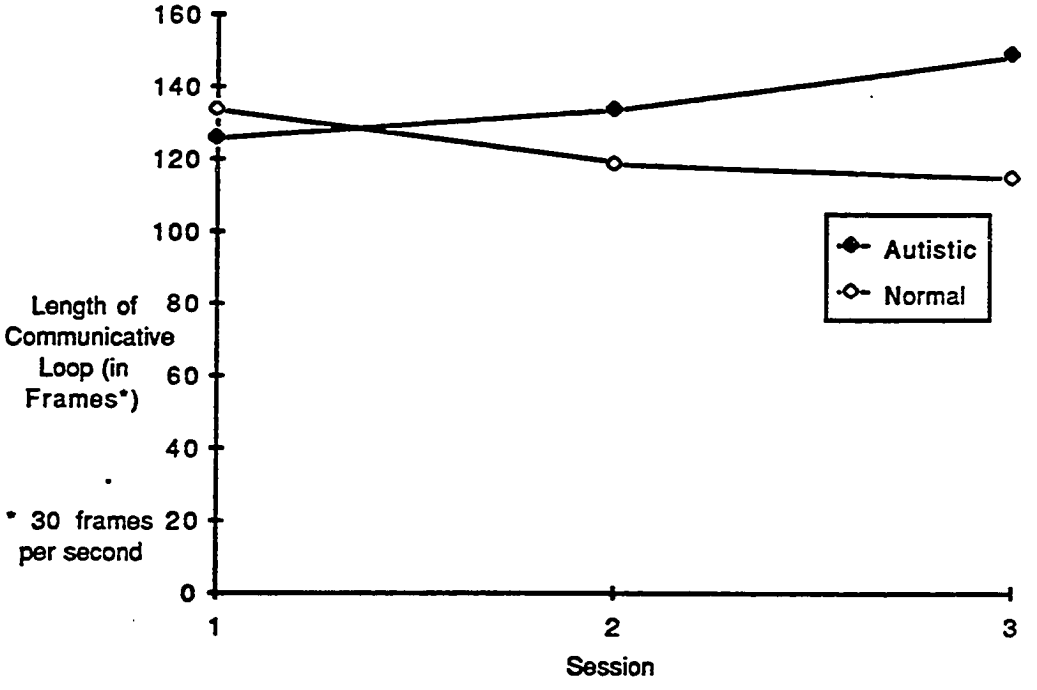


Figure 4. Mean differences in the length of communicative loops for the interaction of group and session.

Table 5. Mean differences in and SD for length of interval between Adult Uptake and Child Tracking Moves for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	20.86	6.94	31.42	15.12	26.14
2	Successive] First	13.03	7.92	14.41	5.78	13.72
3	Successive] First	27.83	22.34	10.52	7.88	19.18
	Marginal	20.57		18.79		19.68

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	18588.94	1	18588.94	66.53
Group	38.41	1	38.41	0.14
Error	1676.42	6	279.40	
Session	1240.40	2	620.20	3.16
Session x Group	1614.85	2	807.43	4.11*
Error	2354.72	12	196.23	
Loop Type	514.96	1	514.96	1.52
Loop x Group	544.32	1	544.32	1.60
Error	2036.34	6	339.39	
Session x Loop	120.06	2	60.03	0.48
Session x Loop x Group	329.37	2	164.68	1.31
Error	1506.72	12	125.56	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100. Length of communicative loop presented in frames with 30 frames per second.

*$p < .05$.

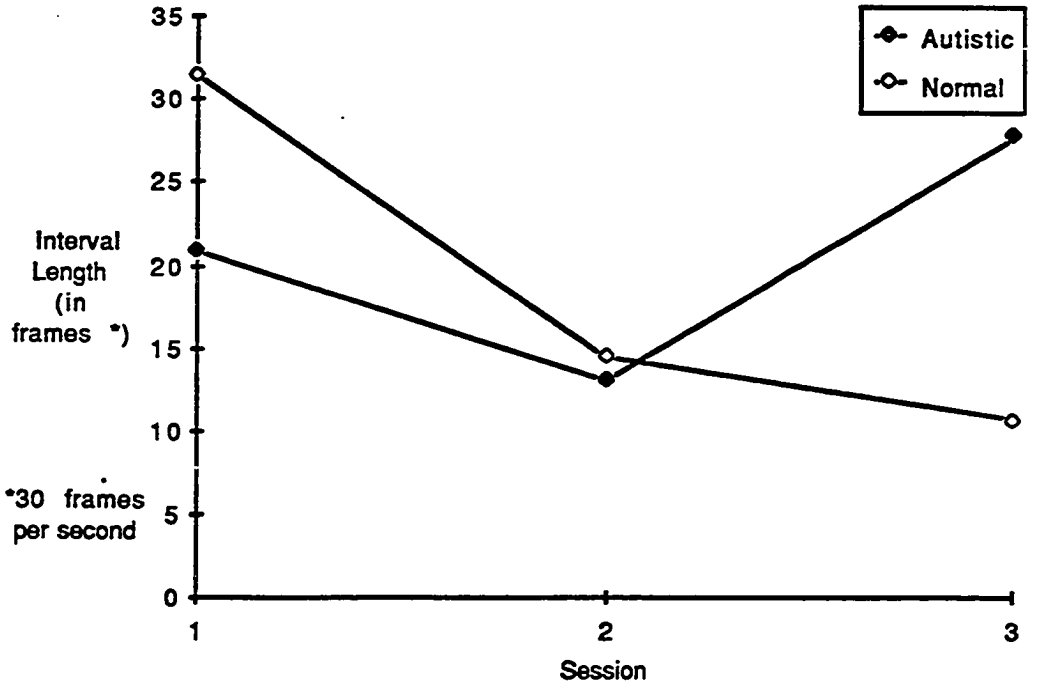


Figure 5. Mean differences in length of the interval between Adult Uptake and Child Tracking Moves for the interaction of group and session.

Interval between the onset of Child Entry and onset of Child Tracking Moves. The length of time between the child's entry move and his/her tracking behaviors is dependent upon two factors: the time it takes for the adult to read the child's behavior and overtly respond to it and the time it takes for the child to attend to the adult's behavior and prepare to respond. When the transformed values for the mean length of the interval were subjected to an ANOVA, no significant differences were found (see Table D- 2). For both the autistic and normal groups, the average length of this interval was approximately 53 frames.

The autistic and normal groups were similar for the aspects of timing in which the adult's adaptive behaviors could compensate for the child's abilities. However, differences were found when adaptation was more influenced by the child's behavior, as in the interval between the adult's behavior and the child's tracking of that behavior (see Table 5, p. 100). Across-Person Hypotheses 4 and 5 are supported only for the length of communicative loops and the interval between Adult Uptake and Child Tracking Moves.

Features of Slot 1 - Initiatory Phase

The first slot of the communicative loop is the initiatory phase which is composed only of the Child Entry Move. The following analyses examined the child's use and coordination of adaptive features and ability to produce integrated and nonredundant behaviors during this move. These analyses investigated Within-Person Hypotheses 1, 2, and 3. Hypothesis 1 was related to group differences. It asserted that the Child Entry Moves for the autistic group, when compared to the normal group, will demonstrate: more difficulty coordinating communicative gaze with gesture, facial, and vocal behaviors; greater lack of integration of gestural and vocal behaviors toward the same goal; and greater redundancy between gestural and vocal behaviors so that they will be merely repetitive, not supplementary behaviors. Hypothesis 2 predicted developmental differences for the normal group, such that across comparisons from earlier to later

times will show increases both in communicative gaze coordinated with behaviors and in integration and nonredundancy of behaviors used during Child Entry Moves. Finally, for the autistic and normal groups, Hypothesis 3 predicted that communicative gaze alone or coordinated with other behaviors will increase from first to successive loops and integrated and nonredundant behaviors will increase from first to successive loops.

Adaptive Behaviors of the Child Entry Move

Vocal channel. During the Child Entry Moves, the autistic and normal groups used vocal behaviors more frequently than gesture or facial behaviors and the most common type of entry move for both groups was a combination of vocal behaviors with gesture and/or facial behaviors. The transformed proportions for the mean use of vocal behaviors and the combination of these behaviors with other behaviors were subjected to individual ANOVAs. No significant results were found (see Table D- 3 and 4). However, overall the autistic group used vocal behaviors consistently more than did the normal group. The degree to which communicative gaze was combined with these behaviors was examined next.

Communicative gaze. The transformed proportions for the mean values of communicative gaze were also subjected to an ANOVA. These results are shown in Table 6 (see p. 104). There were significant differences for the main effects of group ($p < .01$), session ($p < .05$), and loop type ($p < .01$). Figure 6 (see p. 105) illustrates the interfactor relation between group and session.

Figure 6 shows that during the Child Entry Moves, the autistic group used significantly less communicative gaze than the normal group and the normal group showed increased use of communicative gaze as a function of session. In addition, the autistic and normal groups used communicative gaze more in SLs than FLs. A follow-up test using the Newman Keuls test for pairwise contrasts revealed no significant differences in the cell means of session for communicative gaze. However, when the

Table 6. Mean differences in and SD for communicative gaze used during Child Entry Moves for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	21	19	68	25	44
	First	03	07	38	21	21
2	Successive	16	11	97	27	56
	First	02	05	74	55	38
3	Successive	21	16	100.14	36	68
	First	28	14	92	27	60
	Marginal	15		80		48

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	10.97	1	10.97	93.04
Group	5.13	1	5.13	43.49**
Error	0.71	6	0.12	
Session	0.79	2	0.39	4.62*
Session x Group	0.36	2	0.18	2.10
Error	1.02	12	0.09	
Loop Type	0.32	1	0.32	21.38**
Loop x Group	0.08	1	0.08	5.43
Error	0.09	6	0.01	
Session x Loop	0.05	2	0.03	0.56
Session x Loop x Group	0.02	2	0.01	0.26
Error	0.56	12	0.05	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$. **$p < .01$.

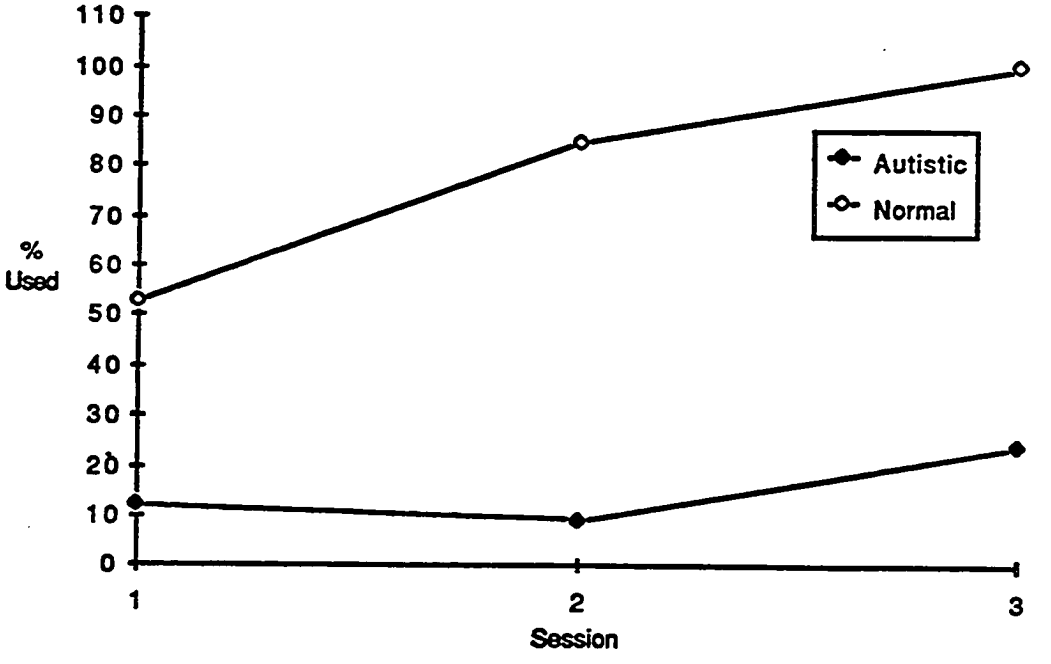


Figure 6. Mean differences in communicative gaze used during Child Entry Moves for the interaction of group and session.

more conservative Scheffe test of multiple comparisons was used, the percentage of communicative gaze at Session 3 was significantly greater than the percentage at Session 1. Therefore, not only were there differences between the autistic and normal groups, but differences occurred across the period studied.

Organization During the Child Entry Move

Communicative gaze coordinated with vocal behaviors and other behaviors. The child's ability to bring communicative gaze and vocal behaviors, with gesture and/or facial behaviors, into an organized, concerted action during Child Entry Moves was examined by performing an ANOVA on the transformed proportions. The results are presented in Table 7 (see p. 107). Significant main effects for group ($p < .05$) and session ($p < .05$) were found.

Figure 7 (see p. 108) illustrates that the autistic group used communicative gaze coordinated with vocal behaviors, plus other behaviors, less than the normal group but both groups demonstrated increases as a function of session. In addition, there was an interaction between loop type and group ($p < .05$). The use of coordinated gaze and vocal behaviors, combined with gesture and/or facial behaviors, was different for the two loop types. When a Newman Keuls procedure was performed on the means for session and for the interaction of loop type and group, no significant pairwise differences were found for communicative gaze coordinated with vocal behaviors. However, the Scheffe test of contrasts revealed significant differences between the means for session when the means of Sessions 1 and 2 were combined and the average compared with the mean of Session 3. Over the one year period, the autistic and normal groups demonstrated increased use of communicative gaze coordinated with multiple behaviors (vocal and gesture and/or facial).

These results continue to support aspects of Within-Person Hypotheses 1, 2, and 3. The ability to coordinate communicative gaze and multiple behaviors was different for

Table 7. Mean differences in and SD for communicative gaze co-occurring with vocal behaviors, and gesture and/or facial behaviors, during Child Entry Move for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	04	04	48	16	26] 18
	First	03	07	15	11	9
2	Successive	10	08	50	30	30] 20
	First	02	05	18	15	9
3	Successive	09	10	58	29	33] 37
	First	18	23	64	28	41
	Marginal	08	42	25		

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	2.99	1	2.99	61.04
Group	1.42	1	1.42	28.99**
Error	0.29	6	0.05	
Session	0.37	2	0.18	4.85*
Session x Group	0.11	2	0.53	1.40
Error	0.45	12	0.04	
Loop Type	0.11	1	0.11	5.63*
Loop x Group	0.12	1	0.12	6.02*
Error	0.12	6	0.02	
Session x Loop	0.18	2	0.09	3.58
Session x Loop x Group	0.04	2	0.02	0.82
Error	0.32	12	0.02	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*p< .05. **p< .01.

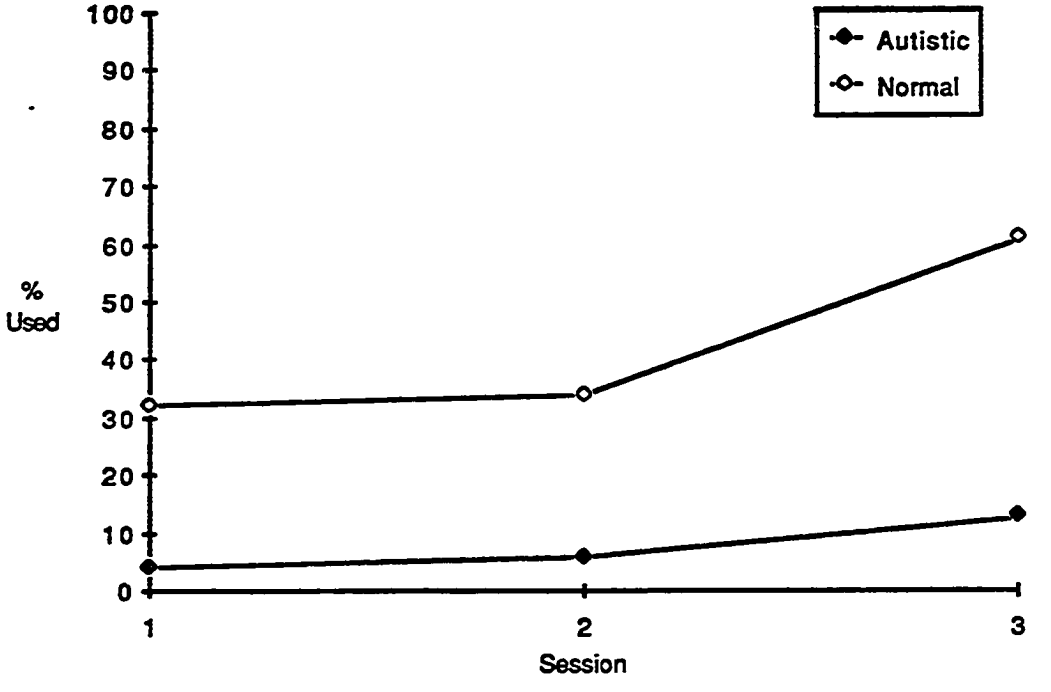


Figure 7. Mean differences in communicative gaze used with vocal behaviors, and gesture and/or facial behaviors, during Child Entry Moves for the interaction of group and session.

the autistic and normal groups and for the normal group at earlier and later sessions. In addition, communicative gaze increased as a function of loop type.

Capacity for integrated and nonredundant moves. The child's ability to combine vocal and gesture behaviors into an integrated (i.e., related to each other) and nonredundant (i.e., supplementary/ contributory in meaning) unit in Child Entry Moves was also examined. No significant differences were found for the production of integrated or nonredundant moves when separate ANOVAs were performed for the variables group, session, and loop type (see Tables D- 5 and 6). However, there was a significant effect of group ($p < .05$) when the ratings for integration or nonredundancy were combined and the transformed proportions subjected to an ANOVA. The results are presented in Table 8 (see p. 110). Figure 8 (see p. 111) shows that the autistic children produced less integrated, nonredundant moves than the normal group.

Evidence of group differences for the combined ratings of integrated and nonredundant moves support Within-Person Hypothesis 1 which predicted these group differences. However, significant developmental differences were not found for integrated and nonredundant moves in the normal group nor were there findings of significant loop type differences for either of the two groups. Therefore, the null theorems for Hypotheses 2 and 3 cannot be rejected.

Features of Slot II- Response-Acknowledge Phase

The second slot in the communicative loop is the response-acknowledge phase which is composed of Adult Uptake and Child Entry Moves. This slot was examined for both the adult's ability to monitor and respond to the Child Entry Move as well as the child's ability to track the adult's response.

Adaptive Behaviors of the Adult Uptake Move

The adults most frequently used speech, which was often accompanied by gesture and/or facial behaviors. Individual ANOVAs were performed for the adult's overall use of vocal behaviors and coordination of communicative gaze with vocal behaviors combined

Table 8. Mean differences in and SD for integrated and nonredundant Child Entry Moves for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	27	24	53	37	40
2	Successive] First	48	57	90	50	69
3	Successive] First	63	45	99	44	81
	Marginal	46		81		63

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	19.25	1	19.25	86.09
Group	1.44	1	1.43	6.42*
Error	1.34	6	0.22	
Session	1.39	2	0.69	2.41
Session x Group	0.05	2	0.03	0.09
Error	3.46	12	0.29	
Loop Type	0.00	1	0.11	0.04
Loop x Group	0.18	1	0.12	1.93
Error	0.55	6	0.02	
Session x Loop	0.09	2	0.05	0.27
Session x Loop x Group	0.12	2	0.06	0.34
Error	2.13	12	0.10	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$.

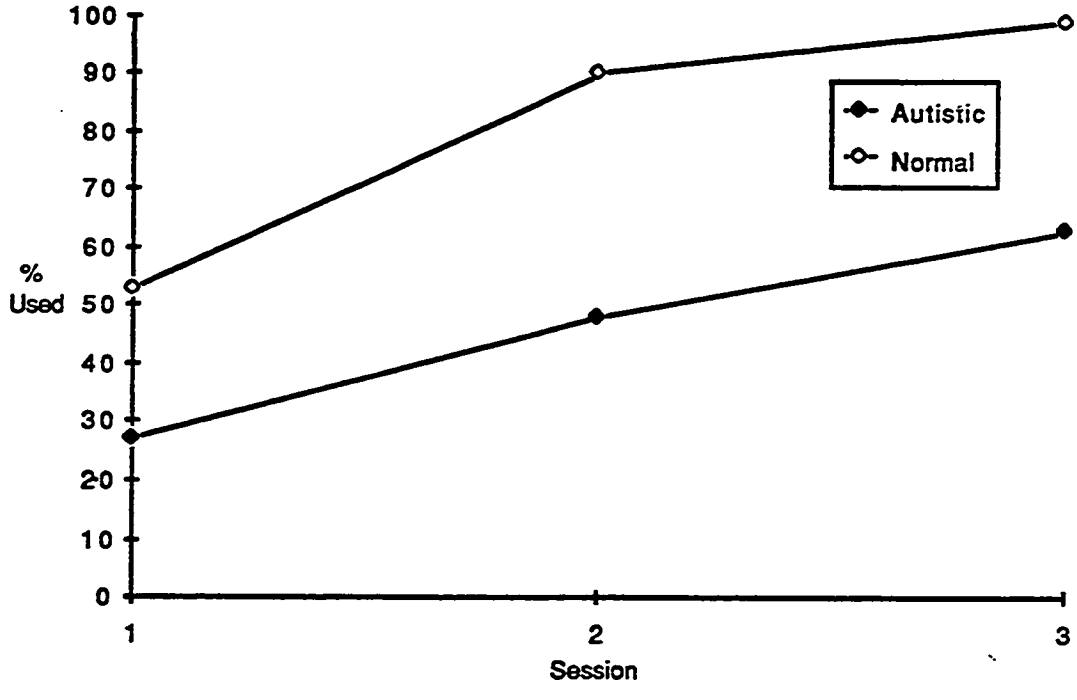


Figure 8. Mean differences in integrated, nonredundant Child Entry Moves for the interaction of group and session.

with gesture and/or facial behaviors. Across-Person Hypothesis 6 predicted that the adult's synchronization of communicative gaze coordinated with other behaviors will be interrupted by the autistic child's interactional breakdowns. These adults will not be able to compensate for the child's asynchronous behaviors and maintain temporal synchrony in the loop and the adult's use of communicative gaze will be less consistently coordinated with behaviors than will be evident for the normal group.

Vocal behaviors. The transformed proportions for the mean use of the vocal channel during the Adult Uptake Moves were subjected to an ANOVA. No significant results were revealed (see Table D- 7). The average use of the vocal channel was the same as a function of the variables group and session. Although the results of loop type and the interaction of loop type and group showed changes, no significant differences were found.

Organization of the Adult Uptake Move

Communicative gaze coordinated with other behaviors in the Adult Tracking Move. During the Adult Uptake Move, the adults used communicative gaze most often coordinated with a conventional word and a conventional gesture (for example, a point or a nod) and/or facial expression. When the transformed proportions for coordination of these behaviors were subjected to an ANOVA, no differences were observed (see Table D- 8). The adults behaved similarly despite child differences.

Interactional breakdowns in the child's adaptive behaviors were not replicated in the adult's behaviors. The adult's behaviors were not disrupted and instead, they behaved similarly across the autistic and normal groups. These findings fail to reject the null hypothesis.

Adaptive Behaviors of the Child Tracking Move

The Child Tracking Move in the communicative loop shows the child's ability to attend to the adult's behaviors and make adjustments during it or possibly in a subsequent loop.

It was assumed that the ability to fully monitor the adult paralleled developmental gains in coordinating word use and communicative gaze.

Analysis of the child tracking move for the autistic and normal groups examined the adaptive behaviors used and the child's ability to coordinate behaviors with communicative gaze during this move. This was related to Within-Person Hypotheses 1, 2, and 3. Hypothesis 1 predicted that, when compared to the normal group, the autistic group will have difficulty coordinating communicative gaze with gesture, facial, and vocal behaviors during child tracking moves. These differences were related to the child's ability to attend to the adult's behaviors. Interactional breakdowns in this attending were predicted to interfere with making use of the information from the adult's move. Additionally, Hypothesis 2 predicted that, for the normal group, communicative gaze coordination with other behaviors will increase from earlier to later times. Finally, Hypothesis 3 asserted that, for both groups, communicative gaze alone, or coordinated with other behaviors, will increase from first to successive loops.

Types of behaviors during the Child Tracking Move. During the Child Tracking Move, the children in the autistic and normal groups preferred to cease the movement behaviors (gestural, facial, vocal) they used in the Child Entry Move. Both groups demonstrated either of two types of tracking which co-occurred with some form of gaze. The first type included cessation of gesture, facial, and vocal behaviors, whereas the second type included gesture and/or facial behaviors. The gesture used during the second tracking type was primarily a posed gesture, presumably in anticipation of adult uptake behaviors.

The transformed proportions for the two types of tracking during the Child Tracking Move were subjected to an ANOVA. There were no significant differences found between the normal and autistic groups (see Tables D- 9 and 10). (Specific changes that occurred across the Child Entry and Tracking Moves will be described in the section which compares these moves.)

Gaze. Similarities were found between the autistic and normal groups in the behaviors used during the Child Tracking Moves. However, during this move, there were significant differences when the transformed proportions for overall use of communicative gaze were subjected to an ANOVA. An inspection of Table 9 (see p. 115) indicates significant differences for the main effects of group ($p < .01$) and session ($p < .05$).

Figure 9 (see p. 116) shows that the autistic group used less communicative gaze than the normal group during the Child Tracking Move. Moreover, communicative gaze increased as a function of session only for the normal group. A follow-up analysis for the main effect of session, using a Newman Keuls procedure, did not reveal significant pairwise differences in communicative gaze.

Additionally, an ANOVA was performed for the use of communicative gaze coordinated with cessation of the other behaviors during the Child Tracking Move. Table 10 (see p. 117) indicates a significant difference for the main effect of group ($p < .01$). Figure 10 (see p. 118) illustrates the autistic group's limited use of communicative gaze when compared to the normal group.

Organization During The Child Tracking Move

Communicative gaze coordinated With gestural and/or facial channels. The transformed proportions for communicative gaze coordinated with gesture and/or facial behaviors during the Child Tracking Move also were subjected to an ANOVA. There were no significant differences found between the autistic and normal groups (see Table D- 11). However, the autistic group was less able than the normal group to coordinate this combination of behaviors.

The autistic group's tracking of adult behaviors evidenced more interactional breakdowns than the normal group and overall, these moves for the autistic group were marked by less communicative gaze. However, differences between the groups were not noted for the use of communicative gaze co-occurring with gesture or facial behaviors.

Table 9. Mean differences in and SD for communicative gaze used during Child Tracking Move for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	13	15	47	26	30
2	Successive] First	23	24	64	30	44
3	Successive] First	18	23	100.09	43	64
	Marginal	18		73		46

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	10.10	1	10.10	58.51
Group	3.63	1	3.63	21.02**
Error	1.04	6	0.17	
Session	0.89	2	0.45	4.18*
Session x Group	0.79	2	0.39	3.68
Error	1.28	12	0.11	
Loop Type	0.09	1	0.09	3.04
Loop x Group	0.01	1	0.01	0.39
Error	0.18	6	0.03	
Session x Loop	0.43	2	0.02	0.37
Session x Loop x Group	0.14	2	0.07	1.19
Error	0.70	12	0.06	

Note. Arc sine transformation used to normalize distribution, transformed proportions proportions may be greater than 100.

*$p < .05$.

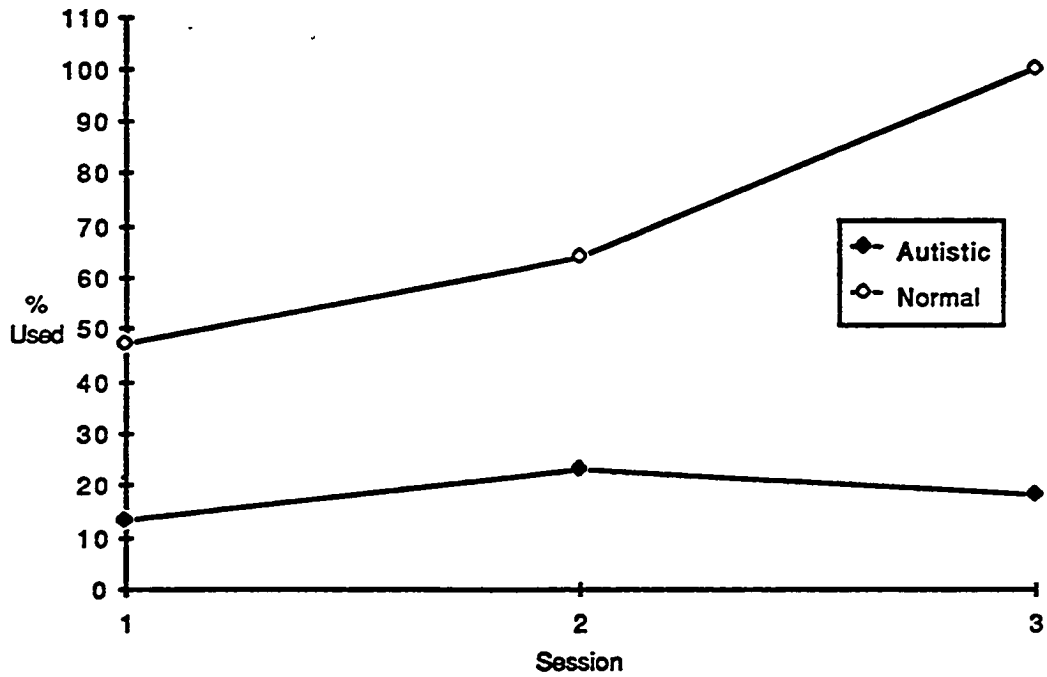


Figure 9. Mean differences in communicative gaze used during Child Tracking Moves for the interaction of group and session.

Table 10. Mean differences in and SD for communicative gaze used with cessation of other behaviors during Child Tracking Move for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	17	28	44	47	31
2	Successive] First	27	46	86	63	57
3	Successive] First	28	52	86	68	57
	Marginal	24		72		48

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	11.12	1	11.12	56.94
Group	2.76	1	2.76	14.16**
Error	1.17	6	0.20	
Session	0.75	2	0.37	1.03
Session x Group	0.25	2	0.13	0.35
Error	4.35	12	0.36	
Loop Type	1.09	1	1.09	4.69
Loop x Group	0.08	1	0.08	0.33
Error	1.39	6	0.23	
Session x Loop	0.19	2	0.10	0.25
Session x Loop x Group	0.09	2	0.05	0.12
Error	4.48	12	0.37	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*p<. 05. **p< .01.

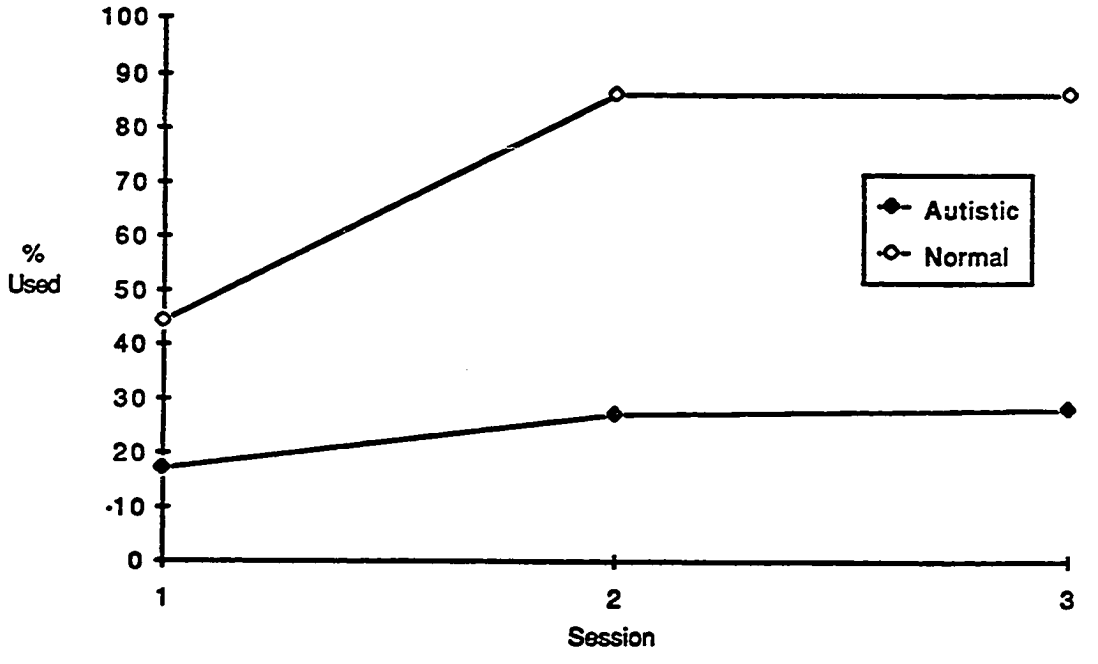


Figure 10. Mean differences in communicative gaze used with cessation of other behaviors during Child Tracking Moves for the interaction of group and session.

These findings support Hypothesis 1 only with respect to group differences in use of communicative gaze during the Tracking Move. In addition, Hypothesis 2 is partially supported by the evidence of some developmental trends found for the normal group. However, differences in the use of communicative gaze across loop type were not found and the null hypothesis for Hypothesis 3 cannot be rejected.

Consequences of Adult Uptake Moves-

Relation Between Child Entry and Adult Uptake Moves

Analysis of the relation between Child Entry and Adult Uptake Moves examined the synchrony across the two participants, that is, how the adult's response adapted to the child's behavior. Two categories identified changes in behaviors across child and adult moves: continued (C) and shift (S). When the status of a behavior remained the same across moves it was called a continued behavior, whereas when the relation between the behaviors in two moves was marked by a change in behavioral coding, it was called a shift (see Methods section). Across-Person Hypothesis 6 predicted that the adult's synchronization of communicative gaze coordinated with other behaviors will be interrupted by the autistic child's interactional breakdowns. Specifically, communicative gaze to autistic child will be less consistently coordinated with behaviors than will be evident for the normal group. This hypothesis was not supported by the analysis of Adult Uptake Moves.

Relation Between Behaviors Used

Gaze. Although the autistic and normal children demonstrated differences in their use of communicative gaze during the Child Entry Moves, the adults with these children showed no significant differences in the proportion of communicative gaze used with other behaviors. Adults used communicative gaze most often regardless of the child's gaze type. The relation between the child and adult's use of communicative gaze was not subjected to an ANOVA. However, the adults with the autistic group, and the normals at

the earlier sessions, most frequently shifted from the child's use of noncommunicative to communicative gaze in order to correct disruption.

Gesture. Analysis of the child and adult's use of gesture in the autistic and normal groups found that continued behaviors were more frequent than were shifts in behaviors. Most often, a gesture occurred and was continued across moves (designated $\underline{C}^{+}$). Adjusted proportions of gesture $\underline{C}^{+}$ were subjected to an ANOVA. Results revealed no significant differences (see Table D- 12).

As discussed in the Methods section, a gesture that continued to occur across moves could mean the behaviors were identical (for example, child clapped hands and adult clapped hands). However, when the adult used a gesture after the child did, the adult frequently changed the child's form of gesture (for example, the child pointed with outstretched arm and the adult nodded). This was called a gesture continued with a form change ($\underline{C}^{+F}$). The transformed proportions of these types of gestural relations were subjected to an ANOVA. Again, no differences were revealed (see Table D- 13).

Facial expression. Analysis of the relation between the child and adult's facial expression also revealed that continued behaviors occurred more often than did shifts in behaviors. An ANOVA revealed no differences in this relation as a function of the variables tested (see Table D- 14). The adults with the autistic and normal groups matched the child's facial expression exactly without changing the form. For example, the child smiled and the adult responded similarly.

Vocal. The primary adult response to a child's vocal move was a shift (S) within the category. The shift category was predominantly characterized either by S ON or S CHANGE. S ON primarily involved providing conventional words to a child's move that itself did not involve vocal means. This form of uptake gave verbal interpretation to the nonverbal behaviors. S CHANGE involved changing the child's vocal behavior, often by inserting a more conventional form. The transformed proportions for mean use of the forms S ON and S CHANGE were subjected to separate ANOVAs. There were no significant

differences found (see Tables D- 15 and 16). However, the adults with the autistic group used S CHANGE more frequently than those with the normal group. The transformed proportions were 74 and 45 percent, respectively.

In sum, although differences were found within the individual child moves of a CABS, these differences were not noted across child and adult moves. The adults compensated for the child differences and maintained synchrony in the interaction. Therefore, the null hypothesis for Hypothesis 6 cannot be rejected.

Consequences of Adult Uptake Moves-

Relation Between Child Entry and Child Tracking Moves

Analysis of the potential relation between the Child Entry and Child Tracking Moves also examined the continued and shift behavioral categories. Here, synchrony between the child and adult is involved because the adult behavior is still the intervening move. Results of this investigation should contribute to information concerning the child's benefit from the adult's move. Specifically, this involves the child's ability to attend to the forms of the adult's behaviors and integrate them with his/her own behaviors. Across-Person Hypothesis 4 predicted that, across Child Entry and Tracking Moves, the autistic group will demonstrate less adaptation than the normal group. This will be illustrated by less monitoring and attending via communicative gaze, less anticipatory posturing of behaviors used (for example, gesture), and less changes in facial expression. In addition, Across-Person Hypothesis 5 predicted that, for the normal group, across Child Entry and Tracking Moves, adaptation will increase from earlier to later times. This will be illustrated by increases in: communicative gaze, anticipatory posturing of the gesture used, and changes in facial expression.

Relation Between Behaviors Used

In the analyses Child Entry and Child Tracking Moves, results indicated four things: (1) the autistic group used communicative gaze less often than the normal group;

(2) for the normal group, communicative gaze increased significantly as a function of session; (3) the predominant form for the autistic and normal Child Entry Moves was vocal behavior coordinated with gestural and/or facial channels; and (4) during the Child Tracking Move, gesture and vocal behaviors frequently ceased. However, some gesture and facial behaviors continued to occur and/or change across the two child moves. These two behaviors were subjected to ANOVAs to determine if there were differences as a function of the variables group, session, and/or loop type.

Gesture. The adjusted proportions for gestures that continued to occur across the Child Entry and Tracking Moves were subjected to an ANOVA. Table 11 (see p. 123) shows that there were significant group differences ($p < .01$). The proportion of anticipatory gestures used for the autistic group was significantly less than the normal group. In addition, there was a significant interaction of group and session ($p < .05$).

The trends of the interaction between group and session are shown in Figure 11 (see p. 124). The autistic and normal groups used gestures across child moves differently in the three sessions. The normal group use of gestures that continued across Child Entry and Tracking Moves increased over time. A follow-up analysis of this interaction using the Newman Keuls procedure confirmed that the mean at Session 3 for the normal group was significantly greater than the means at Sessions 2 and 3 for the autistic group.

Facial expression. For the autistic and normal groups, the status of facial behaviors continued more frequently than they shifted across Child Entry and Child Tracking Moves. Most often, facial expression did not occur across child moves. However, there was a proportion of facial expression behaviors that did occur. It was of interest to determine if these facial expressions changed across child moves in response to the adult behaviors. When the transformed proportions of facial expression that continued with a changed form were subjected to an ANOVA, results were not significant (see Table D-17).

Table 11. Mean differences in and SD for gestures that continued to occur (C+) across Child Entry and Tracking Moves for each group by session and loop type with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive] First	51	72	48	13	49
2	Successive] First	19	19	72	28	46
3	Successive] First	16	16	100.08	45	62
	Marginal	29		76		52

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	13.08	1	13.08	87.80
Group	2.70	1	2.70	18.11**
Error	0.89	6	0.15	
Session	0.22	2	0.11	0.63
Session x Group	1.82	2	0.91	5.23
Error	2.09	12	0.17	
Loop Type	0.02	1	0.02	0.18
Loop x Group	0.02	1	0.02	0.25
Error	0.58	6	0.10	
Session x Loop	0.01	2	0.01	0.04
Session x Loop x Group	0.10	2	0.05	0.35
Error	1.75	12	0.15	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$. **$p < .01$.

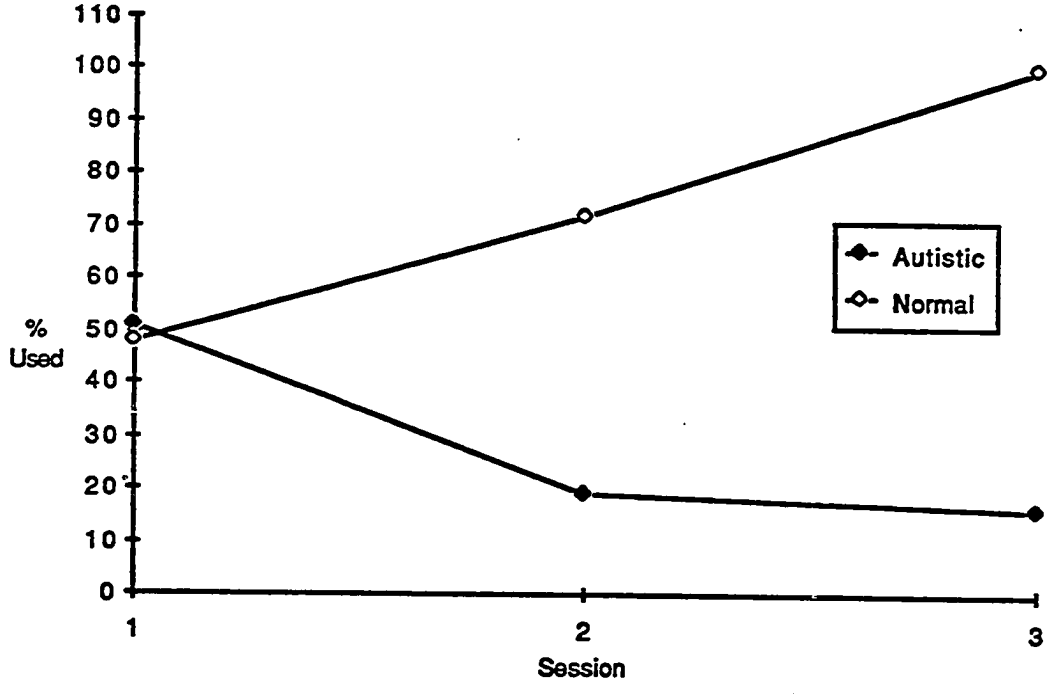


Figure 11. Mean differences in gesture behaviors that continued to occur (C+) across Child Entry and Child Tracking Moves for the interaction of group and session.

In sum, the children in the autistic and normal groups used similar means to move from Child Entry to Tracking Moves in the communicative loops. For the autistic group, anticipatory posturing of gestures occurred significantly less than for the normal group at Session 3. However, differences were found for the degree of adjustment made only in the gestural channel. Therefore, Hypothesis 4 was partially supported. In addition, developmental trends found for the normal group at earlier and later sessions also occurred for gesture behaviors and Hypothesis 5 was partially supported.

Consequences of Interaction-
Relation Between Prior and Successive Child Entry Moves

Through the mutual participation and adaptation of the child and the adult, some communicative loops continued for several rounds. This section describes the degree to which continued participation in communicative loops impacted on adjustments in behaviors in subsequent loops. Analyses involved examining adaptive behaviors and stability of the linguistic forms used. The variable loop type was omitted for these analyses. Across-Person Hypothesis 4 predicted that, across prior and successive Child Entry Moves, the autistic group will show less adaptation between the child's own behavior and the adult's response when compared to the normal group. This will be evidenced by: noncommunicative gaze, repetition of a signal unchanged from prior use (not fully integrating the adult's uptake behaviors with one's own), absence of change in facial expression to display recognition, and lack of stability in the use of conventional words. In addition, Across-Person Hypothesis 5 predicted that, for the normal group, there will be developmental differences in adaptation between earlier and later sessions. For this group, across prior and successive Child Entry Moves, adaptation will improve evidenced by increases in: communicative gaze, changes in gesture, facial, and vocal behaviors, and stability and use of conventional words.

Relation Between Behaviors Used

Gaze. For the autistic and normal groups, gaze behaviors continued from a prior to successive loop more frequently than did gaze shifts. The transformed proportions of communicative gaze continued across loops were subjected to an ANOVA. Table 12 (see p. 127) shows these results. There was a significant main effect of group ($p < .01$). Across prior and successive Child Entry Moves, communicative gaze occurred less for the autistic group than the normal group. In addition, there was a significant interaction of session and group ($p < .05$).

Figure 12 (see p. 128) shows the interaction of session and group for the continued occurrence of communicative gaze across Child Entry Moves. A follow-up analysis of this interaction using the Newman Keuls procedure confirmed that the normal group at Sessions 2 and 3 used communicative gaze more often than the autistic group at any session. In addition, for the normal group, the cell means at Session 3 were significantly greater than those at Session 1. Therefore, the continued use of communicative gaze across Child Entry Moves increased developmentally for the normal group. These differences were consistent with the findings for the rest of the study.

Gesture. For the autistic and normal groups, the status of the gesture was most often continued across Child Entry Moves and these continued behaviors were more frequently marked by the occurrence of a gesture (C^{+}). When an ANOVA was performed on the transformed proportions for gestures that continued to occur across Child Entry Moves, no significant differences were found (see Table D- 18). However, gestures that continued usually were changed (designated C^{+F}). Table 13 (see p. 129) shows that there were significant differences for gesture C^{+F} as a function of group ($p < .05$). Figure 13 (see p. 130) indicates that gestures that occurred and were changed across Child Entry Moves were less for the autistic than for the normal group.

Facial expression. For the autistic and normal groups, a facial expression was usually continued across prior and successive loops. Facial behaviors typically either

Table 12. Mean differences in and SD for communicative gaze that continued to occur (C^+) across Child Entry and Tracking Moves for each group by session with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	11	13	37	21	24
2	02	05	89	38	46
3	07	15	100.02	43	55
Marginal	07		76		41

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	4.12	1	4.12	42.23
Group	2.87	1	2.87	29.44**
Error	0.58	6	0.10	
Session	0.39	2	0.20	3.58
Session x Group	0.56	2	0.28	5.13*
Error	0.65	12	0.05	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$.**$p < .01$.

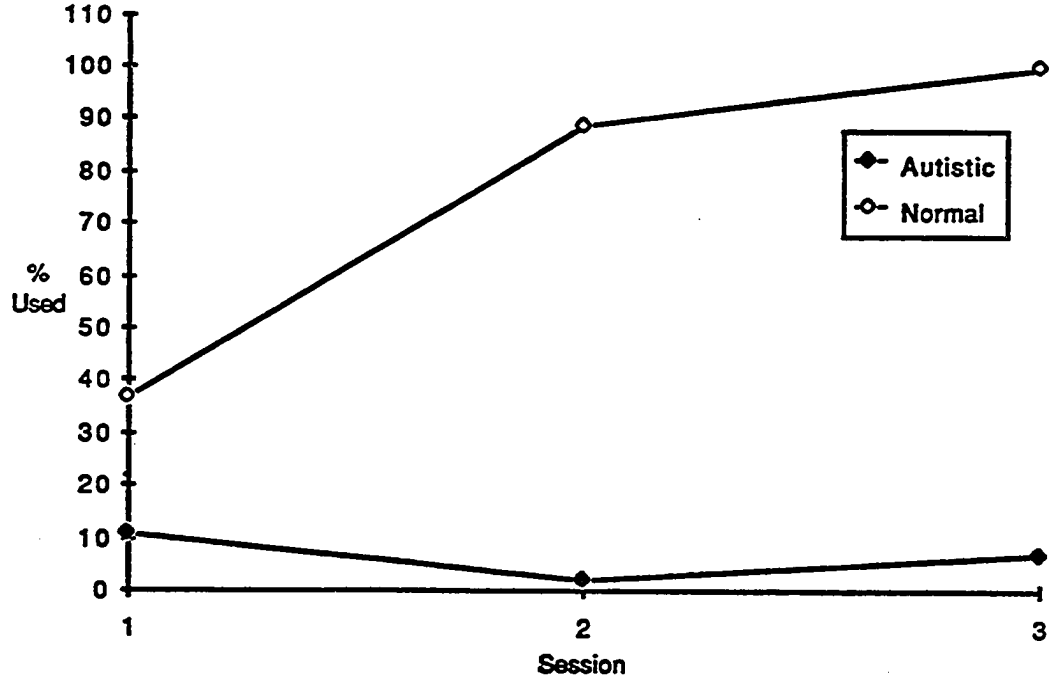


Figure 12. Mean differences in communicative gaze that continued to occur (C+) across prior and successive Child Entry Moves for the interaction of group and session.

Table 13. Mean differences in and SD for communicative gaze that continued to occur ($\underline{C}^{+F}$) across prior and successive Child Entry Moves for each group by session with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	44	29	68	34	56
2	47	20	50	09	48
3	24	22	78	26	51
Marginal	39		65		52

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	6.46	1	6.46	109.14
Group	0.43	1	0.43	7.26*
Error	0.36	6	0.06	
Session	0.03	2	0.01	0.22
Session x Group	0.27	2	0.14	2.27
Error	0.71	12	0.06	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$\underline{p}$< .05.

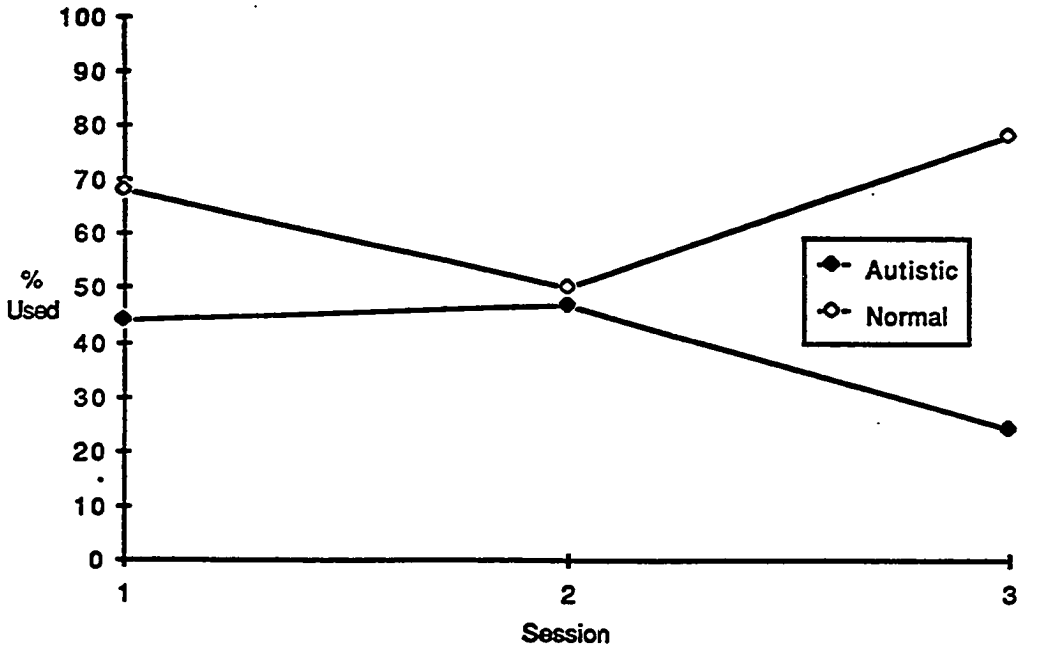


Figure 13. Mean differences in gesture behaviors that continued to occur and changed (C+F) across prior and successive Child Entry Moves for the interaction of group and session.

continued to occur or occurred with a change. When the transformed proportions of these were subjected to individual ANOVAs, no significant differences were found (see Table D- 19 and 20).

Vocal. For the autistic and normal groups, vocal behaviors that continued across prior and successive Child Entry Moves exceeded behaviors that shifted. Within the continued category, vocal behaviors most frequently either occurred or occurred with change. When ANOVAs were individually performed for both of these types, no significant differences were found (see Table D- 21 and 22).

Stability of Linguistic Forms

The last analysis examined stability in the use of linguistic forms. This involved the proportion to which conventional, linguistic forms (words) used continued to occur from prior to subsequent communicative loops. Results of this ANOVA are presented in Table 14 (see p. 132). As shown in this table, significant differences were found for the interaction of session and group ($p < .05$).

Figure 14 (see p. 133) shows the interaction between session and group for the continued use of conventional words across prior to successive loops. For the autistic group across the three sessions, the continued use of conventional words was variable and less than the normal group at Session 3. For the normal group, use of conventional words that continued to occur across Child Entry Moves increased across time. However, a follow-up analysis using the Newman Keuls procedure revealed no significant pairwise contrasts. Nonetheless, trends of significant differences between the autistic and normal groups for the continued use of linguistic forms raises the question of the validity of the strength of the word as a true linguistic form for the autistic group. The normal group's use of linguistic forms increased and continued across Child Entry Moves. The autistic group's use of linguistic forms not only was infrequent, but even less often, these forms continued to occur across Child Entry Moves. On the other hand, the autistic group used wordforms more often than the normal group. For the autistic group across

Table 14. Mean differences in and SD for conventional words that continued to occur (C^+) across Child Entry and Tracking Moves for each group by session with summary table of ANOVA.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	06	07	00	00	03
2	18	22	05	10	11
3	06	13	32	14	19
Marginal	10		12		11

SUMMARY TABLE

Source	Sum of Squares	Df	Mean Squares	F
Mean	0.30	1	0.30	15.10
Group	0.00	1	0.00	0.17
Error	0.12	6	0.01	
Session	0.10	2	0.05	3.37
Session x Group	0.17	2	0.08	5.37*
Error	0.19	12	0.02	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

*$p < .05$.**$p < .01$.

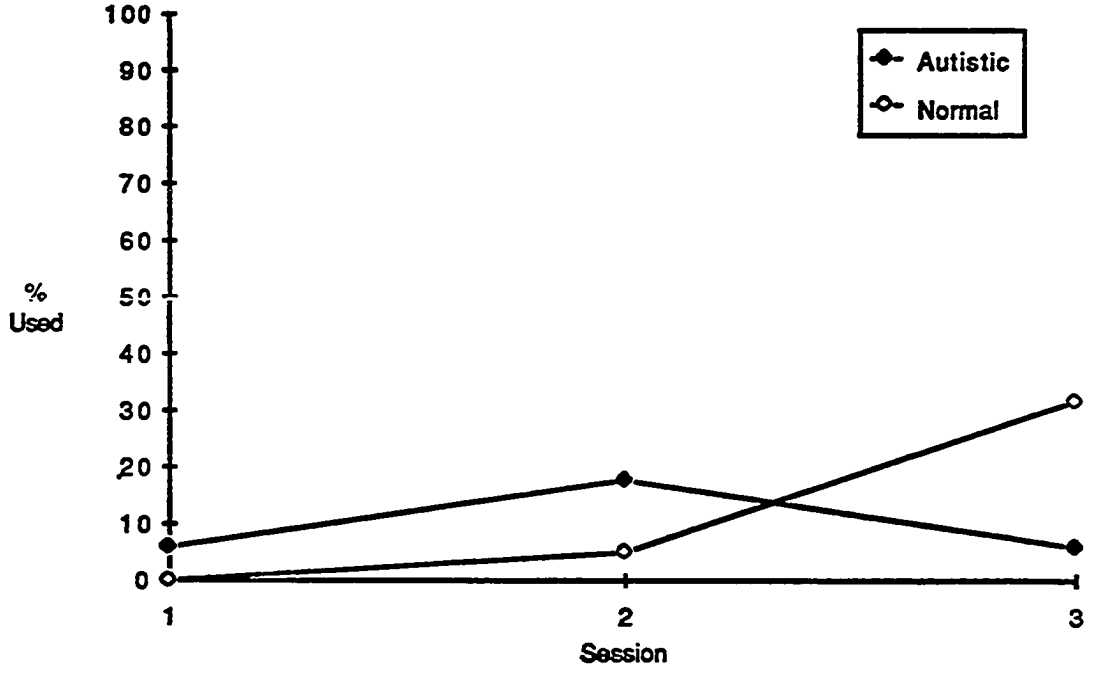


Figure 14. Mean differences in conventional, linguistic forms (words) that continued to occur (C+) across prior and successive Child Entry Moves for the interaction of group and session.

Child Entry Moves, wordforms remained wordforms more often then conventional words. Only a few of the wordforms used by the autistic group moved toward more conventional words.

In sum, as a consequence of interactions, similarities and differences were found for the autistic as compared to the normal group. The adaptive behaviors used across Child Entry Moves showed group similarities in the use of gestures that continued to occur and in the use of facial and vocal behaviors that continued to occur or continued to occur with a change. However, differences between the two groups were also found. The autistic group, compared to the normal group, showed: less incidence of communicative gaze that continued to occur, less capacity to use gestures differently once used, and less stability in the use of conventional words. Evidence from these analyses supports Hypothesis 4 which predicted the autistic group will show less benefit from continued participation in interactions. Group differences for changes in facial expression were not found. In addition, Hypothesis 5 predicted developmental differences for the normal group in the areas of communicative gaze, changes in the use of gesture and vocal signals and facial behaviors, and stability of conventional words used. This hypothesis was supported only by developmental findings for communicative gaze.

Discussion

This longitudinal study proposed two things: (1) a methodological system to describe the actual interactions of autistic and normal groups of children with adults during the transitional period to first words and (2) a model to understand the differences in these two groups in the developmental progress of communication. The communication process was described in the following way in terms of child and adult adaptive behaviors. The child initiated behaviors during interactions. The forms of these behaviors reflected primitive code use. These forms signalled a response from the adult who assigned communicative value to the child's behaviors by fixing the form, interpreting the communicative intent, and assigning meaning to the behaviors. The adult's response provided the connection between the forms used and the meaning conveyed and thereby gave opportunity for a child's primitive code to be elaborated. When the child could attend to the forms of the adult's response, there was opportunity to make use of the adult's response and make adjustments in behaviors in a later loop.

During the communication process, the critical moment for realization that one's behaviors are communicative occurs during the child's attending to the adult's response to the child's behaviors. In this moment, the child has the opportunity to learn that his/her own behaviors affect the adult in a particular way and to what form and what purpose the adult responded. Communicative behaviors, in synchrony with the other, are necessary for the development and progress of a conventional, linguistic code. Therefore, only when the child can coordinate behaviors to monitor the adult can s/he begin to learn specifically how his/her behavior is reflected in the adult's response. And, it is this observation which permits the child to adjust his/her original behaviors which serves to complete the communication process. The consequences of this attending can be seen in adjustments in subsequent behaviors. For example, the child directs a primitive grasp toward an object and the adult interprets the child's primitive

behaviors as a desire to obtain the object, gives the child the object, and says That? You want that. In this example, the adjustments in a subsequent loop could involve the child pointing, accompanied by the word that, and coordinated with gaze directed to an adult. Therefore, the methodological system provided a means to observe how children attended and made use of adult responses.

Findings of this longitudinal study identified interactional breakdowns, particularly during the critical moment in the autistic child's interactions. Interactional breakdowns primarily involved gaze shifts away too soon or onsets too late during the communicative process. Specifically, these shifts interfered with the child's ability to attend to the aspects of the adult's response that convey which form and which purpose the adult understood. Consequences of these breakdowns were seen both in the critical moment of the child tracking the adult response and in the child's adjustments in later loops. These breakdowns resulted in differences between the autistic and normal groups. During the critical moment of child tracking, the autistic group were slower to coordinate monitoring systems to attend to the adult's behaviors, used less synchronized visual regard to 'see' the adult's response, and demonstrated less anticipatory posturing of previously initiated behaviors. In later loops, the autistic group still did not demonstrate visual regard, and, when compared to the normal group, the autistic group more often repeated gestures unchanged from prior use, and less often continued to use conventional words from one loop to the next. Despite the autistic child's efforts to participate in these interactions and the adult's efforts to respond, the communicative work accomplished by these dyads was seriously mitigated.

The effects of these interactional breakdowns were measured along the dimensions of organization and adaptation of behaviors. Organization of behaviors was evaluated in terms of the child's ability for coordination, integration, nonredundancy, and temporal synchrony. Adaptation of behaviors was examined both as a consequence of adult uptake behaviors and participation in interactions. The discussion of this study is organized in

six sections: (1) Overall Group Findings, (2) Disruptions in Adaptive Behaviors of a Communicative Loop, (3) Consequences of Adult Uptake Moves, (4) Consequences of Participation in Interactions, (5) Individual Differences, and (6) Conclusions and Implications for Clinical Intervention and Future Research.

Overall Group Findings

Specific features in the moves of the Co-Adaptive Behavioral Sequences revealed similarities and differences between the autistic and normal groups. The two groups behaved similarly in seven ways. During the transition to first words, the children in the autistic and normal groups participated similarly in initiating behaviors. No child was fully capable of individually performing communicative acts with words of the linguistic code. Instead, it was the mutual behaviors of the child and the adult that enabled the behaviors to have linguistic form, communicative intent, and meaning. The combination of the adult's assignment of communicative value to the child's primitive behaviors and the child's ability to synchronize monitoring systems to observe the adult's response gave the child opportunities to see the adult's behaviors as related to one's own.

Another similarity between the autistic and normal groups was that they displayed consistent adherence to filling the slots of the structural sequence Child Entry-Adult Uptake-Child Tracking Moves. In addition, within the sequences, the autistic and normal children attempted to participate in extended rounds of successive communicative loops. However, the normal group was more successful in this endeavor, whereas the autistic group demonstrated variability and a decrease across sessions in the proportion of successive loops (see Figure 2, p. 92). This decrease in successive loops may be partially attributed to the types of interactions used by the adults and children. The experimenter did not attempt to control for the flexibility that was or was not present in the routines used in these interactions. Therefore, it is possible that the decrease in the

autistic group's participation in successive loops can be accounted for by the fact that, in later sessions, the adults with the autistic children used routines with more flexibility than was evident in earlier sessions. In Session 1, the autistic children filled in the lines of songs (Type 1); however, these routines were not as frequent in the last session where the interactions frequently had less structure (Type 2). This increased flexibility may account for the autistic child's difficulty in participating in successive rounds of interactions.

A fourth similarity between the autistic and normal groups involved temporal factors. Specifically, the lengths of time for the intervals of Child Entry and Adult Uptake Moves and Child Entry and Tracking Moves were similar. This is important when evaluating how the more primitive behaviors of infants or those of autistic children can be assigned communicative value by an adult. In this study, the adults were able to respond to the children's primitive behaviors within a similar amount of time. In addition, the interval of time between the Child Entry Move and Child Tracking Move was similar across groups. These similarities in timing are in spite of the finding that, during the transitional period to first words, the interval of time between the onset of the adult's response and the child's cessation of behaviors to monitor the adult's behaviors was significantly longer in the autistic group than in the normal group (This difference will be discussed in a subsequent section on Consequences of Adult Uptake Moves.)

Another similarity between the autistic and normal groups involved the behaviors used during the Child Entry Move and the Adult Uptake Move. Both groups of children, and the adults with whom they interacted, more frequently used vocal behaviors, combined with gesture and/or facial behaviors, despite differences in the quality of the vocal behaviors used. In addition, the adult's similarly responded to the children and the adult's ability to interpret the child's behaviors was not disrupted. This was true for the normal group, as well as for the autistic group. The adults managed to maintain

synchrony in the communicative loop despite the asynchrony found in the child's behaviors.

Finally, during the Child Tracking Move, both the autistic and normal groups demonstrated cessation of previous vocal activity, and sometimes gestural activity, even though the autistic group was then unable to monitor the adult via communicative gaze. This finding of cessation of behaviors during adult responses implies that even the autistic group demonstrated listener awareness and some adaptation.

A reasonable conclusion for the autistic group's similarities to the normal group of infants is that some of the rudimentary mechanisms involved in participating in communicative loops may be intact in the autistic group and resemble those of normal infants. These mechanisms allowed for initiating behaviors to which the adult assigned communicative value. However, it is important to note that the autistic group's ability to participate in communicative loops in the present study may be attributed in part to the familiarity of the adult to the child. Therefore, communicative loops may have been accomplished more easily because of the familiarity of the participants and their cooperative efforts.

In order to understand why the interactions of autistic and normal children were so different, and consequently, why the autistic group of children had such difficulty in learning to use conventional words and coordinate them with communicative action, we need to examine what the children in this study did with the adult's response. It is in this area that the autistic group demonstrated important differences from the normal group. Trends toward differences between the two groups suggest that, although the autistic group may learn to use conventional words and phrases, they demonstrate a limited variety of means to communicate and many of these means remain primitive. These differences between the two groups will be discussed in the following section.

Interactional Breakdowns in Adaptive Behaviors of a Communicative Loop

Co-Adaptive Behavioral Sequences were examined for changes in the children's adaptive behaviors during the Child Entry and Tracking Moves. These changes involved examining the child's ability to organize behaviors and produce coordinated, integrated, and nonredundant behaviors.

Coordination of the Adaptive Behaviors in Child Moves

The methodological system used in this study adequately described the effects of interactional breakdowns, as defined by gaze shifts away from the interaction, on the organization of behaviors during Child Entry and Tracking Moves. During the transition to first words, the normal group learned to coordinate visual regard with behaviors during these moves, thus affording them opportunities to fully attend to the interaction. On the other hand, the autistic child's behaviors evidenced disorganization during Child Entry and Tracking Moves. This disorganization was manifested in the following two areas: coordinating visual regard with behaviors used to direct signals and coordinating visual regard while ceasing behaviors in order to track the adult's response.

The implications of these findings are related to the child's ability to use conventional words coordinated with communicative action. The autistic group's level of disorganization during the Child Entry Move was not found in the normal group's behaviors even at nine months. This raises the question of the degree to which autistic child's use of vocal behaviors, produced without coordination of communicative action, can potentially advance to a developed conventional, linguistic code used communicatively. There is a clear difference between the adult's attribution of linguistic meaning and functional intent to a set of child behaviors and a child's use of behaviors in conventional form with communicative action. In order for the child's behaviors to achieve the level of sophistication ascribed to it in the adult's response, there needs to be greater coordination than this autistic group demonstrated.

Proficiency in this coordination was found for the normal group by the time they had developed first words.

In addition, during the critical moment of attending, the autistic child's behaviors lacked organization and s/he did not use communicative gaze while ceasing vocal and gesture behaviors. This disorganization interfered in the autistic child's ability to fully monitor the adult's response and make use of it in later loops. Therefore, interactional breakdowns in the autistic child's communicative loops during the transition to first words impacted on his/her communication. The "words" used by the autistic group of children served a more primitive, less adequate function than those used by normal children, that is, these "words" reflected that the autistic children only had rudiments of a code and they were not integrated with communicative functions.

It is too simple and tempting an explanation to describe the difficulties of the autistic group in terms of avoidance of eye contact. This serves only to identify the cardinal feature of the autistic syndrome and we need to understand the consequences of this behavior. The autistic child's gaze behavior during interactions is more adequately described as an inability to coordinate signalling and monitoring systems to effectively make use of the interactional context, namely, to monitor the response one's behavior calls out in another and make use of these responses. In the present study, this inability created interactional breakdowns which interrupted how the autistic child learned to understand his/her behaviors as communicative.

On the other hand, during successive Child Entry Moves, the autistic and normal groups showed some similar increases in coordinating communicative gaze with other behaviors as a function of participating in successive rounds of communicative loops. Therefore, at times the interactional context had some organizing effect on both the autistic and normal children's behaviors. For the normal group, coordination of communicative gaze increased across time so that by the time they developed first words, they could coordinate communicative gaze regardless of whether the entry move was in a

first or successive loop. Therefore, for the normal group, coordination of communicative gaze during child moves was developmental. These findings are consistent with Sugarman's theory (1978, 1984) which stated that both normal and autistic children learn to coordinate person and object schemas with communicative intent prior to the emergence of first words. Here, the autistic group had difficulty coordinating behaviors in the Child Entry Moves even when they used words. Therefore, for the autistic group, the coordination of person and object schemas with communicative intent was not evident as a precursor to first words. These disparate findings may in part be attributed to methodological differences between the present study and Sugarman's work. Sugarman did not look as carefully at or describe interactions as was done in this study. It is possible that she focused only on the child's initiatory behaviors, comparable to the Child Entry Move in the present study, and that she did not describe Child Tracking Moves or first and successive loops. Another possibility is that the autistic child described in Sugarman's study was higher functioning than the autistic subjects in the present study. The present study found evidence for coordination of communicative gaze with conventional words prior to the emergence first words for the normal group; but, the autistic group did not use communicative gaze consistently despite the emergence of some words.

Ability to Produce Integrated and Nonredundant Moves

The child's ability to organize vocal and gestural behaviors so that they are integrated and nonredundant signals an understanding of behaviors as communicative, that is, understanding that one's behaviors call out a response in others. Evidence from this longitudinal study revealed that the autistic group experienced greater difficulty in organizing integrated and nonredundant moves than did the normal group. This difficulty organizing behaviors that were not even fully linguistic or conventional signalled difficulty in the resources to produce even a primitive code communicatively.

Specific examples of redundancy used by the autistic group may clarify this claim. The three Child Entry Moves in Example 9 (see Appendix A) all illustrate redundancy in the behaviors of the moves. In each case the gestures used were idiosyncratic forms of the code for the individual dyad and simultaneous use of the gesture and the vocal behaviors represented a duplication of information. Example 9a was drawn from the interaction of an autistic boy with his teacher. In this dyad's code, the child's hand raised means to play tickle. The adult's response to the child's behaviors was to name the game as tickle and ask the child to raise his hand. In the example, the child's vocal and gestural behaviors did not supplement each other but each conveyed the same information in the code as either behavior did alone. The child's gesture behavior, raising his hand and immediately lowering it prior to the adult's response, was evidence that it was used as a signal for the game to begin but not to wait for the anticipated tickle. If he continued to leave his hand raised, we could argue that the vocal behavior named the game and the gesture behavior anticipated the adult's response. However, because the child lowered his hand immediately, there was evidence that the gesture and vocal behaviors signalled redundant meaning in the code represented in two different forms.

Example 9b provides a similar situation. This example was drawn from the interaction of an autistic girl with her teacher. In this dyad's code, either the gesture of circular movements in one's hand or vocalizing the name of the song means play this song. The autistic child used both gesture and vocal behaviors to convey the same meaning without adding additional information. Therefore, the gesture and vocal behaviors presented duplicate, not supplementary, information.

Finally, Example 9c was drawn from the interaction of the same autistic girl with her teacher. In this dyad's code, the vocal behavior this little piggy went to market means to sing this song, whereas the gesture of smacking the adult's hand means to do or play something. When the child directed both the nonconventional vocal and gesture behaviors together, the vocal behavior represented the information the adult needed to

respond and the gesture merely served to be a more general request. The vocal behavior, although somewhat ambiguous due to primitive phonological processes, served to trigger the beginning of a game and acted to specify the game and the general gesture behavior meant play. Therefore, the vocal behavior could have stood alone. Again, the autistic child's vocal and gestural use was superfluous and idiosyncratic and its presence questions the degree to which this child understood the vocal behavior as communicative. During the period studied, the normal group did not use these idiosyncratic gestures.

The autistic child's use of redundant vocal and gesture behaviors may be related to the gestalt mode of cognitive processing to which Prizant (1983, 1987) referred. This gestalt mode of processing reflects information learned as a whole rather than analyzed into its component parts. If autistic children do process information in a wholistic manner, then individual behaviors present are not analyzed and represented individually. In this study, the autistic group's use of redundant behaviors may reflect the consequences of this gestalt processing style. Failure to analyze component parts may impact upon understanding behaviors as communicative.

Although child entry behaviors were examined for organization, the adult behaviors were not examined in this way. There were two factors responsible for this decision. The first factor was that the adults were considered competent speakers who had adequate understanding and use of language. The second factor involved the assumption that adult's talk to young children is purposely simplistic and redundant. Therefore, redundancy in an adult's move, as in nodding and saying yes at the same time, may be indicative of a teaching style. On the other hand, during the transition to first words, the redundancy and lack of integration in the autistic child's entry moves were not found in frequency and kind in the normal group. This finding, coupled with the finding of lack of coordination in the autistic child's moves, supports a claim for difficulty in the child and not one of competence as was attributed to the adult's behaviors. Even if redundancy were considered typical in some contexts, the combination of lack of coordination with

redundant or unintegrated behaviors is indicative of two things. These are that the autistic group had not learned (1) how multiple behaviors can act together and (2) that gesture and vocal behaviors can either supplement each other or stand alone. For the autistic group, the only instances of vocal behaviors in isolation were imitative. Therefore, the autistic child's use of conventional words may represent a rather different ability than that found in normal children and this difference seems to be a consequence of a failure in attending to the adult's response and consequent interference in the understanding of behaviors as communicative.

In sum, results of the investigation of the individual child behaviors in Entry and Tracking Moves revealed that the autistic and normal groups of children demonstrated the ability to initiate behaviors to which the adult responded. This is evidence for at least primitive code use. However, differences between the two groups existed in the ability to organize behaviors and this may be related to the child's attending to the adult's behaviors and learning to understand behaviors as communicative.

Coordination of the Adaptive Behaviors in Adult Moves

The adults maintained synchrony in the loop and their behaviors were not vulnerable to the asynchrony created by the children's gaze shifts away from the interaction, nor their nonconventional and poorly organized behaviors. In addition, categories of adult behaviors were similar across the autistic and normal groups; although previous investigations of adult's talk to children have revealed differences in how mother's talk to their young (Cross, 1978; Sachs, 1979; Snow, 1977; Wells, 1980). Across the two groups, there was opportunity to determine how the children responded to adult behaviors that were similar, consistent, and predictable.

Consequences of Adult Uptake Moves

Trends in the autistic group in this study indicated that the autistic children did not coordinate monitoring systems during the adult's response and prepare to receive the

adult's response. Instead, the autistic child shifted away too soon from the interaction which created interactional breakdowns. These interactional breakdowns interfered in the child's integration of the adult's response. These breakdowns were seen during the adult's uptake behaviors, whereas the consequences of these breakdowns were observed in a later loop. The methodological system provided opportunities to observe these breakdowns, examine the consequences of adult uptake behaviors, and evaluate whether there were differences between the autistic and normal groups. The consequences of the adult uptake behaviors was evaluated in four ways. The first of these determined whether the timing during the interval from the onset of Child Entry Move to the onset of Child Tracking Moves was different. The second way evaluated individual behaviors during the Child Tracking Moves, especially with respect to use of communicative gaze and anticipatory posturing of behaviors. The third way examined changes in the child's behaviors from Child Entry to Child Tracking moves as a consequence of the intervening adult behavior. Finally, in order to assess if differences found in the autistic and normal group's behaviors were a result of differences in the child or the adult, the relationship between the Child Entry and Adult Uptake Moves was examined. That is, were the adults responding similarly to the child and were the children's responses consequent to what they could make use of in the interaction or were the adult responses different and did this difference affect the child's response?

Aspects of Timing

In comparison to the normal group when first words emerged, the autistic group demonstrated trends toward longer intervals of time between the Adult Uptake and Child Tracking Moves. For the normal group, this interval of time decreased from the emergence of communicative loops to first words. Therefore, the time it takes to coordinate one's monitoring systems in response to the adult's behaviors is developmental. This synchronization was particularly difficult for the autistic group who took more time than the normal group. In order to fully understand the impact of

this finding, it needs to be discussed with findings for the relation between the adaptive behaviors of Child Entry and Tracking Moves.

Relation between Child Entry and Child Tracking Moves

Evidence from the Child Tracking Moves revealed that the autistic group ceased gesture and vocal behaviors during these moves but did not coordinate visual regard. Additionally, the consequences of adult uptake behaviors were measured by examining both the relationship between Child Entry and Tracking Moves and the relationship between Child Entry and Adult Uptake Moves. The relationship between Child Entry and Tracking Moves will be discussed first. Results revealed that during the adult's response, the autistic group, as compared to the normal group, took more time to respond to the adult's behaviors and used less anticipatory posturing of the gesture. An example of this anticipatory posturing is as follows: During a normal child's entry move, the child extended his/her hand with the index finger raised above the others. During the Child Tracking Move, the child's index finger relaxed to a position in line with the other fingers but the hand remained loosely extended. This is different than the autistic boy who, during the Child Entry Move, extended his hand to the adult's lips and returned it to his lap and in the Child Tracking Move the hand movement was completely absent. Even when some monitoring was accomplished, evidenced by cessation of behaviors, the autistic group showed differences from the normal group. Differences related to visual regard and timing are characteristics of autistic interactions that further limit intake of the adult's behaviors. In addition, the findings, that the autistic group used less anticipatory behaviors than the normal group, continue to suggest that the autistic group had a different understanding of the behaviors as communicative.

Differences in gesture behavior for the autistic and normal group corroborate previous findings that autistic children use gesture less than their normal counterparts when matched for language age or mental age (Curcio, 1978; Loveland & Landry, 1986). But, here, the additional finding was that even when the autistic child used gesture, it

was not sustained in attending to the adult's response. This finding warrants additional interpretation. Lack of sustaining a gesture in anticipation of the adult's response does not limit information from the adult as do other characteristics; but this finding seems to reflect the actual consequence of the breakdown. That is, it is not only that the autistic child has more difficulty coordinating monitoring systems, but s/he may not actually anticipate the adult's response to the form used. Therefore, the autistic child does not overtly demonstrate a connection between the form s/he used and the form which the adult understood. Failing to make this connection results in a severe interruption in understanding behaviors as communicative. In this study, the autistic group continually struggled to learn to coordinate behaviors to monitor the adult's response, whereas the normal group quickly became more adept at this and focused on anticipating the adult's response. Prizant and Schuler (1987) claimed that behaviors become communicative when their effects can be anticipated. This notion is supported in this study. The autistic child is not only less able to monitor the adult's response, but s/he cannot overtly attend to or overtly anticipate what particular form or function the adult understood. Once again, interactional breakdowns interfere in the degree to which a behavior becomes communicative. The normal group demonstrated trends toward increased posturing of the gesture which signified anticipation of a response. These behaviors increased as the child moved closer to the emergence of first words. Therefore this anticipation is developmental and appears with frequency only after the child has organized his monitoring system first simply by cessation of behaviors.

This finding of anticipatory posturing at the critical point in an interaction brings to mind Saussure's distinction (cited in Pettit, 1977) of the speaker's message and the listener's interpretation. In this study, the model examined the combination of the child's behavior and adult's response because there was no child who alone was fully capable of producing a communicative act with words of the linguistic code. In interactions like these, when the child directs behaviors to the adult, the child is the

speaker and the adult is the listener who acts as the interpreter of the child's behavior. When the adult responds to the child, the roles become reversed and the child is the listener and the adult is the speaker. It is during the interval that the child, as listener and interpreter, has to determine the connection between his/her initiating behavior and the adult's response. In order for this to happen the child must fully monitor the adult's response and only in a later loop can we see the consequences of this attending. Saussure further described the articulation of the speaker, or the sentence construction, as the attention of the hearer. "'Attention' by its roots means 'waiting' or, more literally, 'stretching out'...'hanging on'" (Pettit, 1977, p. 25). It is this 'attention' and 'hanging on' that is at risk in the autistic child's difficulty and what creates the interactional breakdowns. These speculations need to be pursued further and they will be discussed with findings in the section on Consequence of Participation in Interactions. At this point, it is sufficient to say that description of actual interactions between the autistic and normal groups of children identified differences between the two group's in these children's ability to demonstrate anticipatory posturing.

Relation between Child Entry and Adult Uptake Moves

Analysis of Adult Uptake Moves revealed that the adults in the autistic and normal groups responded similarly regardless of the children's abilities and the adults maintained synchrony in the interactions by adapting to the children's signalling behaviors. This afforded all of the children similar opportunities to participate in interactions with predictable and consistent responses and to "see" what their behaviors signalled. Differences found are consequent to the child's abilities to make use of the adult response, or to a larger degree, the interactional process.

Adults in the autistic and normal groups used similar strategies to adapt to the child's behaviors. The typical relation between the Child Entry and Adult Uptake Moves was interesting and will be discussed briefly by looking at Example 8 (see Appendix A). This example was drawn from an interaction between an autistic boy and his female teacher

and it provides some typical adult responses to the child behaviors. The adult's response is discussed in terms of gaze, gesture, facial expression, and vocal behaviors. In this communicative loop, the child looked to the adult's mouth, lips remained tightly together, and he directed a swat at the adult's mouth. No vocal behavior was used. The adult monitored the child, nodded her head up and down, and her lips retracted up and back fully. Then, she assigned the child's gesture meaning by saying You want some more? and vocalized a raspberry sound. In this example, the adult visually monitored the child during the Child Entry Move and made consistent use of communicative gaze. Across autistic and normal groups, visual monitoring of the child occurred almost regardless of whether the child's gaze was directed to the adult or not.

On the other hand, the adult's typical response to the child's gesture was to use a gesture behavior in turn but change its form (either modify the child's form or change the form by creating one of her own). In Example 8, the child directed a gesture to the adult's mouth. The adult interpreted the child's gesture as to play raspberries and complied and, in addition, the adult provided feedback via the gesture of a nod. Therefore, the connection between the child's gesture- the swat to the adult's mouth- and the adult's response- a nod and interpretation of the meaning of the child's gesture with a verbalization and production of the raspberry sound- is not direct. The adult assumed the child could make the indirect connection between his own gesture and the adult's behavior.

This finding of an indirect connection between the child's gesture and the adult's response to it supports Werner and Kaplan's notion of the distancing principle (Werner and Kaplan, 1963) as well as Vygotsky's theory of "zone of proximal development" (Vygotsky, 1978). Both of these theorists argued for a space between the child's actual developmental level or internal schema and the level of potential development determined and guided by the adult's external presentation. Here, it is questioned whether the child with more primitive behaviors can make this connection. This ability

would have impact on use of the behavior as a sign in the code. It may be that the normal child learns to identify the relation between one's own and the adult's response by consistently being able to monitor the behaviors and to fully attend to them. In this study, specific behaviors during the autistic child's monitoring suggest that this s/he had difficulty in this area. When the behaviors represent similar channels but different forms, or different channels, and the connection between the two is indirect (for example, the child gestures and the adult interprets the behavior vocally), the quality of attending may be further mitigated. Again, the issue is whether the autistic child can make use of these aspects of the adult's response.

Although the adult's tended to use communicative gaze, even if it was not present in the child's behaviors, and to change the form of the child's gesture in their own response, this was not the case for facial expression. During the period examined, adults in the autistic and normal groups frequently matched the child's facial expression. However, this matching of facial expression was not found in the example given above. Instead, in this example, the adult changed the child's facial expression so that child pursed his lips tightly together, whereas the adult response was a smile. However, this particular relation was infrequent.

Overall, the adult's consistently used a more complex and conventional form of vocal behavior than did the child. There were three different relationships found between the child and adult's use of vocal behaviors. The first is illustrated in Example 8 (see Appendix A). In this example, in the absence of a vocal behavior by the child, the adult interpreted the child's gesture and responded vocally by production of a raspberry sound. This response was accompanied by a more conventional form, here the words You want some more. Sometimes, the adult's verbal response was also accompanied by an additional comment (You like that, huh) or extension (Raspberry. That's a raspberry sound you made). Again, as with gesture behaviors, the adult assumed that the child

could make the connection between the child's behavioral array and the adult's vocal response. For the autistic group, this assumption may be erroneous.

A second form of an adult vocal response occurred in the presence of a child vocal behavior. In this relation, the adults in the autistic and normal groups typically upgraded the child's behavior toward a more conventional one. For example, the child vocalizes /dɔ/ and the adult says that. This upgrading toward more conventional found occurred more frequently for the adults with the autistic group. When compared to the normal group, this more frequent upgrading of vocal forms for the autistic group may be a consequence of more nonconventional words, or wordforms, used by the autistic child.

Finally, a third relation between the child and adult's vocal behaviors occurred when a child used a conventional word and the adult responded with a conventional word and/or extended the child's form. For example, the child says that and the adult responds that's your sock.

The present research gave evidence that interactional breakdowns interrupt necessary monitoring. The autistic child's attending to the forms of the adult response was typically interrupted by gaze shifts away too soon or onset too late from the interaction. Mirenda, Donnellan, and Yoder (1983) suggested that autistic children may not be able to use visual regard for monitoring and may do just as well without making use of it. Here, this speculation is questioned. The autistic child's monitoring skill is at risk to make use of the adult's response even without visual attending.

Consequences of Participation in Interactions

Participation in a communicative loop requires precise movement and synchronization by the individual participants. During the transition to first words, interactions that involve this synchrony provide an arena for the child to learn to use conventional words and coordinate them with communicative action. This learning is accomplished by the mutually adaptive behaviors of a child and adult. However,

interactional breakdowns in the autistic child's communicative loops interfered with the ability to attend to the adult's response and make use of it. The consequences of these breakdowns were particularly evident in later loops. These consequences were determined by evaluating changes in behaviors across prior and successive Child Entry Moves.

Results indicated that the communicative loops of the autistic group in general were longer than the communicative loops of the normal group at the emergence of first words. In addition, for the normal group, the length of communicative loops diminished over time. This timing potentially impacted upon the consequences of the interaction. In addition, when specific behaviors of the autistic and normal group's prior and successive entry moves were compared, results indicated that the autistic group used less communicative gaze, repeated a gesture behavior unchanged from its immediately prior use, and were unable to continue use of a conventional word across Child Entry Moves. The consequences interactional breakdowns were manifested in gaze, gesture, and vocal behaviors, but were not evident in the behaviors of facial expression.

Relation Between Gaze, Gesture, and Vocal Behaviors in Prior and Successive Communicative Loops

Across prior and successive loops, the pattern for gaze behaviors was in line with the results of the rest of the study. The autistic group used communicative gaze less than the normal group in all child moves and, even when communicative gaze was used during a Child Entry Move, it was not maintained across communicative loops. These findings were significantly different than the normal group. Overall, the normal group's ability to synchronize visual regard during Child Entry Moves increased as did their ability to continue this synchronization across child moves. This ability is developmental and occurred more frequently around the use of first words (at 18-19 months). The normal group learned to synchronize word use and gaze for interactions, or, put differently, to use a linguistic code with communicative action. However, the autistic group did not

accomplish this ability despite some primitive code use in the form of gestures and wordforms.

The findings for gesture use across successive loops also are consistent with the rest of the study. When gestures were examined as a consequence of Adult Uptake Moves, the autistic group tended toward cessation of behaviors, whereas the normal group did this and later used anticipatory posturing. Speculation was that the autistic group was not making the connection between the forms the adult was using and his/her own primitive forms that elicited the response. This speculation is supported by findings for the consequences of interactions. Across prior and successive Child Entry Moves, both groups of children similarly continued to use a gesture when they had used it in a prior loop. However, the autistic used the same gesture more often in successive moves than did the normal group. The findings of the absence of anticipatory gesture and the repeated use of a gesture in interactions support the notion that the autistic group was not fully attending to the forms of the adult's response and therefore these autistic children were less able to integrate information from the response with their own behaviors and later make use of this response. Repetition of the gesture unchanged may reflect a more internally formed behavior that does not have the full benefit of the adult's response or of the interaction in general.

This finding of repetition of a gesture unchanged from its prior use relates to the issue of the autistic child's resistance to change, or insistence on sameness, (DSM-III- R, 1987; Kanner, 1946). It is possible that the autistic child's insistence on maintaining things as predictable may reflect his/her inability to integrate the adult's response with one's own. This notion is further supported by a significantly less amount of anticipatory posturing in the autistic as compared to the normal group. The autistic child may perseverate in the absence of full integration of the feedback available from the interaction. A related issue reflects whether the autistic child's perseveration of gesture use reflects the adequacy of the adult response to the child initiated behaviors.

In other words, does repetition of a gesture reflect that the interaction was successful and therefore the means used are repeated? This question can only be partially answered because the success of an interaction was not directly assessed in this study. However, the criterion for communicative loop selection was that the adult respond to the child's behavior and clearly, adults responded to the form and function they could understand in the child's behaviors. This is not a measure of success but it does indicate that the adult attended to the behaviors. In addition, for both the autistic and normal groups, there were successive rounds of communicative loops where the adult's response was similar. In these instances, the normal group made changes in their successive behaviors, whereas the autistic group did not make changes. An implication of this lack of change in forms used by the autistic group is that it reflects the absence of integration of the adult's response. However, the relative success of an interaction should be an area for future research.

The notion that the presence of interactional breakdowns found in the autistic group's communicative loops interfered with the potential benefits of participating in an interaction is also supported by evidence from the autistic child's vocal behaviors. During the transitional period to first words, the autistic and normal groups similarly used a vocal behavior and continued it across successive Child Entry Moves. In this respect, it appeared that the autistic group had developed some understanding of vocal forms as a means of a primitive code. On the other hand, although the autistic and normal groups made limited use of conventional words in Child Entry Moves, significant differences were found for the ability to continue use of these forms across successive loops. The normal group's use of conventional words increased as a function of time and this group continued to use conventional words across successive Child Entry moves. This was different for the autistic group's use of words. When compared to the normal group, the autistic group less often continued to use words across successive loops.

These results challenge the extent to which the autistic group's use of conventional words actually represented an understanding of words as communicative behaviors. The finding that words used by the autistic group did not not continue in successive loops implies that the words used by the autistic group failed to remain active signalling devices. These words did not appear to be a viable device to communicate and did not stabilize. It is speculated that one of the consequences of interactional breakdowns is that the autistic child fails to understand words as communicative behaviors. This failure did not occur in the normal infant during the transitional period to first words. For the autistic group, the consequences of interactional breakdowns were manifested in two ways: (1) the child not fully recognize the meaning a particular behavior called out in others and (2) the child did not recognize the adult's response as one that, in some form, his/her behaviors triggered. This lack of full recognition was evidenced by the lack of change in gesture found in later loops and in the difficulty in continuing linguistic forms across successive Child Entry Moves. In interactions during the transition to first words, the child's primitive behavior had the opportunity to become integrated within a larger behavioral ensemble that constitutes fully conventional ways of communicating. However, for the autistic group, interactional breakdowns ran interference in this process and the consequences were that the behaviors that the autistic children used were different than those of the normal group.

In addition, the conventional words and gestures used by the autistic group appeared to function differently than they did for the normal group. For the autistic group, forms of the gestures used were at least repeated across successive loops and this repetition may signify some understanding of gestures as communicative behaviors. On the other hand, conventional words were not repeated. These findings appear to distinguish the gesture from the vocal channel for the autistic group. However, this distinction is misleading. The gestures used by the autistic group were not fully conventional ways of communicating and were frequently idiosyncratic. Therefore, the gestures used were

actually similar to the conventional words in that they represented the autistic group's primitive code use and limited means of communicating.

In summary, by examining and describing actual interactions during the transition to first words, we have seen that interactional breakdowns contribute to significant differences in the developmental progress of communicative behaviors in autistic and normal groups of children. These differences support Lord's notion (1985) that the autistic child's ability to interpret social meanings may be different and that these differences may be found in the quality of this child's attention and responsiveness. This quality of attention is most important in the critical moment of an interaction. Consequences of interactional breakdowns result in the autistic child developing only the rudimentary aspects of a code with limited ways of communicating.

Individual Differences

For the most part, the children in the autistic group and the children in the normal group demonstrated similar behaviors when compared to the children in their respective groups. However, individual differences were noted. These differences will be discussed in the following section.

The Autistic Group

The four children in the autistic group all demonstrated interactional breakdowns in their communicative loops that interfered with their ability to make use of the adult response. These four children all represented the severe end of the classification of autism. Still, some individual differences across the group were revealed and these differences were specifically reflected in the use of gesture and vocal behaviors as means of signalling.

Of the four autistic children, Jake, Amy, Richard, and Bob (designated as Autistic Children 1, 2, 3, and 4, respectively), Jake used gestures most frequently and Bob used them least often. The gesture of pointing was used only once across the three sessions

and it was used by Richard who used it appropriately coordinated with communicative gaze. For the normal group, pointing emerged between 9 and 19 months and was used frequently by all four children.

Three of the autistic children, Jake, Amy, and Bob, used idiosyncratic gestures with or without vocal accompaniments. These were manifested differently in the children's behavior. For example, Jake pushed at the adult's mouth which the adult interpreted as to play raspberries or sing a song. During these behaviors, his communicative gaze was most frequently directed to the adult's mouth. On the other hand, Amy swatted at or smacked the adult's hand which the adult interpreted as to sing a song or play a game. Amy also directed her gaze to the adult's moving body part which, in this instance, was the adult's hand. Finally, Bob's gesture behavior was to raise his hand. This behavior sometimes was accompanied by the wordform /reɪz ɚ æn/ and was interpreted by the adult as to play a tickle game. During these behaviors, Bob's gaze was noncommunicative and focused on an area away from the dyád. As stated, Richard rarely used gestures. However, when he did use gestures, they were often unintegrated with the rest of his behaviors. For example, in telling the adult to sing faster his hand extended upward in a fist. Therefore, Richard's limited use of gestural behaviors may reflect his difficulty integrating this channel into his behavioral array. The idiosyncratic use of gesture by this group of autistic children supported previous research that the autistic child makes limited use of gestures (Curcio, 1978; Loveland & Landry, 1986; did, they were often unintegrated with the rest of his behaviors. For example, in telling the adult to sing faster his hand extended upward in a fist. Therefore, Richard's limited use of gestural behaviors may reflect his difficulty integrating this channel into his behavioral array. The idiosyncratic use of gesture by this group of autistic children supported previous research that the autistic child makes limited use of gestures (Curcio, 1978; Loveland & Landry, 1986; Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Mundy, Sigman,

Ungerer, & Sherman, 1986; Ricks & Wing, 1975; Wetherby, Yonclas, & Bryan, 1989).

Other differences within the autistic were found group in their use of vocal behaviors. In general, Richard and Bob used wordforms and linguistic forms more frequently than Jake and Amy; but, they used communicative gaze less than the other two children in the group. These differences were particularly evident at Session 2 when the number of tokens of conventional words was greater at either Session 1 or Session 3. This increase in conventional word use was contributed to only by Richard. During Session 2, Richard showed an increase in conventional words, specifically these were used to reject parts of routines suggested by the adults. For example, Richard's form elicited from his teacher the song "The wheels on the bus". The teacher's uptake behavior consisted of her complying with the meaning she assigned to Richard's form and an elaboration provided by suggesting another verse, such as should we do the doors on the bus. In a successive communicative loop, Richard's vocal behavior rejected this by saying /no dɔ/ (no doors).

The individual differences found between Richard and Bob and Jake and Amy may lead to the argument that Richard and Bob used different strategies for developing a conventional, linguistic code. But, Richard and Bob also demonstrated less integrated moves than Jake and Amy and yet made similar changes, or lack of them, in behaviors both as a consequence of adult uptake behaviors and of the interaction. Therefore, it seems inadequate to propose a different strategy. Richard and Bob acquired very primitive code use with limited speech for communication, whereas Jake and Amy showed almost no acquisition of a conventional, linguistic code. The conclusion may be that various differences are manifested as a result of interactional breakdowns; however, all of these differences seriously affected the development of a linguistic code used for communicative purposes.

The Normal Group

The children in the normal group behaved similarly in interactions with their mothers. All of the normal children, William, Sandy, Leslie, and Angela (designated as Normal Children 1, 2, 3, and 4, respectively) developed conventional words and coordinated them with communicative action. In addition, the normal children developed communicative use of conventional pointing. Some individual differences were found in the onset of the regular use of communicative loops and the acquisition of at least five conventional words used with communicative action. William and Sandy, began to use communicative loops regularly at 9 months, whereas for Leslie and Angela, onset was slightly later. For Leslie, onset of the regular use of these loops was at 10 months and, for Angela, onset was at 11 months. Similarly, the period for onset of first words varied. For William and Sandy, the transition to first words occurred at 18 months, whereas for Leslie, onset of first words used with communicative action was at 19 months, and for Angela, this onset was at 20 months. The consequences of these differences was negligible relative to the outcome of their goal. That is, all four children in the normal group developed the regular use of conventional words coordinated with communicative action. This was not true for the autistic group of children.

Concluding Comments, Implications for Clinical Intervention, and Directions for Future Research

Concluding Comments

The social-interactional context provides an important arena for learning about the communication process. The extent to which children learn to use a conventional, linguistic code and coordinate it with communicative action is dependent upon the child's ability to make use of this context. This context specifically contains the adult's response to the child's directed behaviors. The child's subsequent response to the adult's behaviors reflects the degree to which s/he made use of the social context.

One qualification of the social-interactional model is necessary. This model did not suggest that the adult's response provided the actual forms for the child to use. Evidence for the child's replication of the adult's form was not a frequent finding. The communicative work involved is much more complex than an imitating of forms. It is the actual response organized in a full behavioral array which provides the child with the opportunity to understand what of his/her form or function was realized. And, the child motivated to make him/herself understood, monitors this response and begins to make connections. Subsequent behaviors reflect his/her understanding of these connections.

Within the communicative loops, critical moments of interaction were located. It was during these moments that the child had the opportunity to connect his/her efforts with the adult response. In this way, primitive behaviors have the opportunity to become integrated within a larger behavioral ensemble that constitutes fully conventional ways of communicating. Paul (1987) suggested that it is these contexts which provide the necessary "hook up" (p. 77) between the child's own forms in a code and the meanings assigned to them.

Evidence from the methodological system employed highlighted how autistic and normal children's developmental progress differs. The methodology allowed us to look more carefully at the actual interactions, to identify interactional breakdowns in the autistic group's communicative loops, and to describe the consequences of these breakdowns on the communication process. These breakdowns signalled the autistic child's difficulty in coordinating monitoring systems to enable the child to adequately attend to the adult. Here, the consequences of these breakdowns were observed in the adaptive behaviors of the autistic child. These behaviors reflected limited use of the adult response in the child's subsequent behaviors. Consequently, successive loops of the autistic group evidenced primitive forms as unchanged, as in gesture behaviors, or not repeated at all, as in conventional words, as well as limited coordination of gestures

and/or conventional words with communicative action. Therefore, these breakdowns interfered with the autistic child's ability to adapt and these patterns mitigated developmental progress.

In addition, although the autistic group's signalling behaviors were different than the normal group during the transition to first words, this autistic group did participate in the predictable routines established between themselves and the adult. Prizant and Schuler (1987) argued that the autistic child is unable to break into the language system through joint attentional actions. Trends in this study qualify this argument in the following way. Here, the autistic group with a familiar adult did enter into these routines with a primitive code use that allowed them to initiate behaviors to which the adults responded. However, unlike the normal group during the transition to first words, the autistic group's ability was limited.

Autistic children's difficulties in social interactions can be described in terms of their failure to attend to forms that would become the signs of the code, corresponding to meaning. Specifically, the adult's response cannot act to mediate between the child's form and meaning. In other words, there is limited opportunity for the child, as the signifier, to connect his/her own behaviors with the adult's response, as what was signified. In order for the child's primitive behaviors to become signs in the code, the child must make this connection. Continued efforts toward establishment of a conventional, linguistic code used communicatively reflect disruption in this most basic process. Whorf (cited in Holquist, 1986) wrote "to strive at higher mathematical formulas for linguistic meaning while knowing nothing correctly of the shirt-sleeve rudiments of language is to court disaster" (p. ix). This statement describes the autistic child's lack of developmental progress in interactions where s/he is continually confronted with striving toward a higher formula of linguistic form and meaning in the face of interactional breakdowns. Therefore, mastering aspects of a conventional,

linguistic code coordinated with communicative action is attempted with interference in crucial and rudimentary aspects of the communication process.

Clinical implications

The results of this study suggest several clinical implications. These implications reflect three things: usefulness of the model and the methodology, requirements for participation in interactions, and the adult's response to children's behaviors. The most important clinical implication of this study involves both the model and methodology used. The model suggests that the unit of analysis for examining the communication process should be the child's initiating behaviors and the adult's response to them. This unit is important both for clinical intervention as well as for application outside of the clinical setting. The premise of language therapy with severely impaired children should be based upon a performance model for social interaction and not just on the individual child. This model of therapy assumes that it is the mutual responsibility of both participants to maintain the other in the interaction. Therefore, the participants must adapt and adjust to the other's behaviors. Within the structured context of a therapeutic setting, the clinician possesses greater linguistic competence than the child and also, the clinician has the ability to interpret the child's behaviors. The goals of this context should be that the adult continually recognize the child's behaviors and attempt to respond to them in order to facilitate the child's adjustment to the more conventional, linguistic forms of communication. However, in view of the slow progress of severely autistic children, and the fact that more often their language difficulties remain unremitted, the clinician's responsibility should be to respond to these signals and help the child develop at least a primitive code. In addition, it is the clinician's responsibility to help the child's "society" to accept his/her behaviors as having communicative value, specifically that they have meaning and function in the code to which others should respond.

A second implication of this study is related to the requirements for participating in interactions. Here, two points are relevant. The first point is related to the prerequisites of most traditional clinical models of intervention. These prerequisites require the child to attend during his/her own talk. Therefore, during the child's talk, s/he is directed to look at me (the adult). Looking during one's own talk aids the listener in responding to a behavior as communicative. For autistic and normal groups of children during the transition to first words, the adults responded to children's behaviors regardless of their communicative action. This response enabled severely autistic children to participate in interactions. However, results of this study indicate that monitoring the adult's response to the child's behaviors is a critical moment for the child and for the autistic and normal groups, this critical moment was different. Although it is important for the child to attend to the person to whom his/her behavior is directed, the information provided by the adult's response is critical to the language learner. In therapy sessions, especially for children during the transition to first words, it may be important to focus on the critical moment. It may be that the specific timing of onset of the adult's response, for example, a longer latency from the child's behaviors, may be required in order for the autistic child to organize his/her monitoring systems to attend to the adult's response.

Another point related to participating in conversation involves the use of routines. The context of the social interactions described in this study featured routines familiar to the child. Within these contexts, the autistic group could initiate behaviors to which the adult assigned communicative value. Therefore, it appears that these predictable routines aided the child in at least entering the interaction. Again, for children during the transition to first words, these opportunities are highly important for learning about words coordinated with communicative action. These routine contexts may be ones that these children find more possible to enter. Prizant and Schuler (1987) also suggested the use of "interactive scripts" (p. 295) in intervention. In the present

study, the routines used did allow for some flexibility and yet, the autistic children were successfully, albeit inconsistently, maintained within these routines. Therefore, routines may be useful as entry points for children with very primitive interactive skills.

Another important implication of this study is related to how adults respond to children's primitive behaviors. Here, the autistic group was engaged in interactions with teachers. Although the two teachers did not receive specific training for this study, both had experience with autistic children and demonstrated similar means to respond. The method of response to the children's behaviors was effective for engaging these children in interactions. Only once children enter an interaction can we show them which forms and which function we understood. Therefore, for severely autistic children it may be useful for adults to consistently assign communicative value to children's primitive behaviors in order to engage them in interactions. Further, the autistic group in this study could not adequately attend to the adult's response and this had impact upon the child's use of the response in later loops. Examination of the adult's responses to the children in both the autistic and normal groups revealed that they were often indirectly related to the children's behaviors, for example, the child gestured to the adult and the adult vocalized. Although this response may be an direct interpretation of the child's behaviors, the child and adults behaviors reflected the use of different channels. The autistic child may have extreme difficulty attending to these rather imprecise connections and the adult may need to make more obvious the connection between the child and adult's behaviors. For example, if in a dyad, a hand touching the adult's lips means to sing, the adult may need to tell the child the form and function she understood as in, you want me to sing, prior to complying with the child's behavior. This more elaborate response is in contrast to simply complying with the interpreted meaning of the child's behaviors and this response type would at least highlight for the child how his/her behaviors were interpreted.

An issue related to how the adult responds to children's primitive requests is how clinicians elicit from children, with limited word use, a linguistic form. In therapeutic settings, behaviors are often not responded to fully unless the child adjusts his/her behaviors to include a vocal response. For example, the child gestures to an adult's mouth and rather than give the gesture interpretation in the code, the adult requires the child to Tell me what you want. Say more. Again, it is questionable whether the child can make the necessary connection between his/her own behaviors and the adult's form. Therefore, just as the mother responds to the infant's primitive grasps as if s/he pointed and said that, the clinician should respond similarly and consistently before requiring developmental progress in the child's primitive behaviors.

Directions for Future Research

Areas for future research include using this methodology with a larger sample size of normal and autistic children and broadening the autistic sample to include higher functioning and younger children diagnosed with autism. The results of this study are relevant only for the severe end of the autistic continuum. They apply particularly to children with unremitted autism. Once these results are replicated, they can be compared to other language impaired populations. In addition, this study began looking at normal infants at nine months. It may be that prior to nine months, autistic and normal children look more similar than they did in this study and comparisons should be made. Further, application of the methodology also may be useful in diagnosis. Early evidence of interactional breakdowns in communicative loops may aid in earlier identification.

In addition, this methodological procedure merely served to outline the communicative process. Relations between child and adult behaviors were not fully investigated. Future research may be helpful in more adequately evaluating some of these relations, for example, the quality of the changes in the vocal behaviors of later loops.

Finally, here, complete visibility during the critical moment was considered essential for development of a conventional, linguistic code coordinated with communicative action. If visual attending is necessary, an area for future research should involve how blind children compensate for never getting to 'see' the adults' response. Condon (1979) noted that blind children orient to the faces of speakers. It may be that compensation for the absence of 'seeing' in blind children is accomplished by organization of the monitoring systems to 'hear' the response to behaviors.

Appendix A

Examples of Communicative Loops Drawn From Autistic and Normal Interactions

Example 1 (drawn from an interaction between a normal boy at 9 months and his mother)

	SLOT I	SLOT II
MOVE		
1. Child Entry Move		
TIME___ Onset_____Offset		
Behaviors		
Gaze:	to the adult's mouth then shifts to the adult's face	
Gesture:	---- (Dashed line - - - - indicates absence of salient behavior.)	
Facial:	places tongue between lips, then makes raspberry sound	
Vocal:	----------audible raspberry sound (Dashed line ----- indicates other behavior prior to onset.)	
2.	Adult Uptake Move	
	TIME__Onset_____Offset	
	Behaviors	
	Gaze:	to the child's face
	Gesture:	----------hand moves to child's chin and wipes it as says
	Facial:	lips retracted lightly upward
	Vocal:	----------Little drool bucket. There you go.

Example 1 (continued)

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: - - - -

Facial: tongue remains between lips and face

Vocal: - - - -

Example 2 (drawn from an interaction between a normal boy at 14 months and his mother)

Communicative Loop 1

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: extends arm, index finger posed above others then lowers

Facial: Lips parted and retracted up

Vocal: - - - -

2. Adult Uptake Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the child's face then to the direction of point and back to his face

Gesture: - - - -

Example 2 (continued)

Facial: Lips parted and retracted up

Vocal: That's your juice cup

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: - - - -

Facial: - - - -

Vocal: - - - -

Communicative Loop 2

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: extends arm, index finger posed above others

Facial: - - - -

Vocal: /dæt/ (that)

Example 2 (continued)

2. Adult Uptake Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the child's face

Gesture: - - - -

Facial: - - - -

Vocal: Yeah. That's your cup but we're not drinking now.

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: - - - -

Facial: Lips parted and retracted up

Vocal: - - - -

Example 3 (drawn from an interaction between a normal boy at 18 months and his mother)

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: moves both hands rapidly across own stomach, then says

Example 3 (continued)

Facial: Lips part and retract upward fully

Vocal: ----------/t k t k/ (tickle, tickle)

2. Adult Uptake Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the child's face

Gesture: - - - -

Facial: lips part and retract upward more fully.

Vocal: Tickle, tickle, tickle, tickle.

3. Child Tracking Move

TIME____Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: fingers remain still on stomach as says

Facial: Lips part and retract upward more fully

Vocal: ----------/dæt/ (that)

Example 4 (drawn from an interaction between an autistic boy and his teacher)

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to the adult's mouth

Gesture: hand extends out to adult's lips, swats at it three times and returns arm and vocalizes

Facial: lips purse tightly together

Vocal: --(makes audible raspberry sound)

2. Adult Uptake Move

TIME___Onset_____Offset

Behaviors

Gaze: to the child's face

Gesture: moves head up and down and says, then makes raspberry sound

Facial: lips retracted back and upward, eyebrows raised

Vocal: You want me to do that? (then makes raspberry sound)

Example 4 (continued)

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the adult

Gesture: - - - -

Facial: - - - -

Vocal: - - - -

Example 5 (drawn from an interaction between an autistic girl and her teacher)

SLOT I

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to the adult's hand

Gesture: makes rotating movement in the palm of the adult's hand and says

Facial: lips retract and extend upward

Vocal: /dɪ ɔ pɪgɪ/ (this little piggy)

Example 6 (drawn from interaction of a normal boy at 14 months and his mother)

SLOT I

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: looks at adult's face

Gesture: hand extends down to belly button, index finger extended above other fingers

Facial: - - - -

Vocal: /ðæt/ (that)

Example 7 (drawn from an interaction between an autistic boy and his teacher)

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: -----to the adult's face

Gesture: hand extends to adult's mouth and pushes at it

Facial: lips tightly together (then move for vocal)

Vocal: -------- /mɔ̃ / (more)

Example 7 (continued)

2. Adult Uptake Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the child's face

Gesture: nods head up and down and says

Facial: lips retracted back and upward

Vocal: Yes. Yes. Okay, I'll do more.

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to the adult's face

Gesture: - - - -

Facial: - - - -

Vocal: - - - -

Example 8 (drawn from an interaction between an autistic boy and his teacher)

SLOT I SLOT II

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gaze: to unrelated context

Gesture: raises hand and swats at the adult's mouth, then lowers hand

Facial: - - - -

Vocal: - - - -

Example 8 (continued)

2. Adult Uptake Move

TIME___Onset_____Offset

Behaviors

Gaze: to the child's face

Gesture: moves head up and down, then says and produces raspberry sound

Facial: lips retracted up and back

Vocal: --------You want some more? (then makes raspberry sound)

3. Child Tracking Move

TIME_____Onset_____Offset

Behaviors

Gaze: to unrelated context

Gesture: - - - -

Facial: - - - -

Vocal: - - - -

Example 9

Example 9a (drawn from an interaction between an autistic boy and his teacher)

SLOT I

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gesture: raises hand in the air and rapidly lowers it as says

Vocal: /reɪz ɚ hæ/ (raise your hand)

Example 9b (drawn from an interaction between an autistic girl and her teacher)

SLOT I

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gesture: takes adult's hand and with index finger

Vocal: /raʊn rɚ/ (round, round)

Example 9c (drawn from an interaction between an autistic girl and her teacher)

SLOT I

MOVE

1. Child Entry Move

TIME___ Onset_____Offset

Behaviors

Gesture: smacks adult's hand and says

Vocal: /dɪ ɪtl pɪɡ mɑr/ (this little piggy went to market)

Appendix B

Value Assignments for Behaviors in a Co-Adaptive Behavioral Sequence

The four identified adaptive behaviors of each of the moves within sequence were assigned quantitative values. The values were as follows:

Gaze behavior was communicative (2), intermittent (1), or noncommunicative (0). Behaviors of gesture and facial expression individually were absent (0) or present (1).

Vocal behavior was either absent (0) or present(1) in one of six forms each of which was coded in terms of types. These were: vocalization =(1); imitation, wordform (indexical), or phrase of song= (2); combination of (1) and (2) = (3); conventional word =(4); and a combination of categories (1) and (4)= (5) or (2) and (4)= (6).

The coding for a Child Tracking Move was the same as a Child Entry Move. However, a Child Tracking Move may indicate cessation of active modalities and therefore behavioral coding may equal zero. Moves are artificial slots to be filled and it was possible that not all behaviors existed. A Child Tracking Move can merely reflect cessation of gesture, facial, and vocal behaviors with noncommunicative gaze. Therefore, unlike a Child Entry Move, a Child Tracking Move could be coded as zero.

Ratings of integration and nonredundancy were individually rated. Integration or nonredundancy individually received scores of (1) and nonintegration or redundancy received scores of (0).

Appendix C

Continued and Shift Categories Used in Comparisons of the Moves Within a CABS

A continued behavior across the moves being compared was coded as (0), whereas a shift in behaviors was coded as (1). A continued behavior was coded as C+ when a behavior occurred when the coding across the two moves was identical (and not absent in both cases being compared). A continued behavior was coded as C- when a specific behavior did not occur for either of the moves compared. This occurred only when the coding was zero for the behaviors.

A Shift occurred across the moves being compared when the behavioral coding marked different numbers . Shifts could be of three types. These were: S ON, S OFF, S CHANGE. The first type, S ON, occurred only when a behavior in the moves being compared went from absent (0) in the first move to present (1) in the next move. S OFF was directly opposite an S ON. That is, for the first move in the comparison, the behavior occurred, while in the second move the behavior was absent. Finally, the third type of shift was S CHANGE. An S CHANGE only occurred for gaze and vocal behaviors. A shift of this type occurred when there were changes across the category of behavior. For example, going from a vocalization to a wordform.

It should be noted that for comparisons involving a continued behavior or a shift in behavior, the combination codings of the vocal behaviors, that is those coded 3 or 6, were ignored. Instead, these were compared in terms of the lowest and closest even number. For example, when a combination of vocalization and wordform occurred, only the wordform was examined. Likewise, when a combination of wordform and conventional word, both occurred during a behavioral move, only the conventional word was examined.

Appendix D

Date Tables for Nonsignificant Findings

Table 1. Mean differences in and SD for length of interval between Child Entry and Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	28.76	14.52	27.40	3.64	28.08
	First	35.69	20.30	36.00	8.41	35.84
2	Successive	33.39	15.57	33.92	10.08	33.65
	First	30.42	9.07	34.68	7.34	32.55
3	Successive	35.60	15.32	33.48	6.44	34.54
	First	36.99	14.99	39.50	8.84	38.25
	Marginal	33.48		34.16		33.82

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100. Length of intervals presented in frames with 30 frames per second.

Table 2. Mean differences in and SD for length of interval between Child Entry and Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	41.41	14.55	59.43	6.84	50.42
	First	64.43	18.79	65.78	12.84	65.11
2	Successive	46.33	12.17	45.78	10.86	46.05
	First	44.38	15.19	52.56	13.13	48.47
3	Successive	51.57	19.84	44.19	4.00	47.88
	First	75.17	52.56	47.12	11.42	61.14
	Marginal	53.88		52.58		53.18

Table 3. Mean differences in and SD for vocal behaviors used during Child Entry Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	1.02	.67	.97	.09	1.00
	First	1.10	.65	.70	.09	.90
2	Successive	1.21	.28	.65	.23	.93
	First	1.06	.40	.60	.17	.83
3	Successive	1.19	.46	.87	.35	1.03
	First	1.25	.64	.89	.12	1.07
	Marginal	1.14		.78		.96

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100. Length of intervals presented in frames with 30 frames per second.

Table 4. Mean differences in and SD for vocal behaviors combined with gesture and/or facial behaviors during Child Entry Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.57	.29	.83	.24	.70
	First	.75	.40	.55	.11	.65
2	Successive	.85	.25	.63	.26	.74
	First	.69	.19	.42	.20	.55
3	Successive	.43	.31	.65	.19	.54
	First	.66	.33	.76	.25	.71
	Marginal	.65		.64		.65

Table 5. Mean differences in and SD for Integrated Child Entry Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.45	.13	.96	.16	.70
	First	.85	.50	1.15	.52	1.00
2	Successive	.97	.48	.94	.45	.95
	First	1.17	.50	1.26	.62	1.22
3	Successive	1.08	.57	1.33	.49	1.20
	First	1.01	.38	1.05	.35	1.03
	Marginal	.92		1.11		1.02

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 6. Mean differences in and SD for nonredundant Child Entry Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.79	.54	1.02	.44	.90
	First	.83	.64	.58	.31	.70
2	Successive	.68	.65	1.57	.00	1.22
	First	.86	.60	1.17	.50	1.01
3	Successive	1.01	.74	1.21	.46	1.11
	First	.99	.40	1.44	.27	1.21
	Marginal	.86		1.16		1.01

Table 7. Mean differences in and SD for vocal behaviors in Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	1.36	.42	1.57	.00	1.47
	First	1.28	.34	1.57	.00	1.42
2	Successive	1.48	.18	1.57	.00	1.53
	First	1.47	.21	1.57	.00	1.52
3	Successive	1.57	.00	1.57	.00	1.57
	First	1.46	.22	1.57	.00	1.52
	Marginal	1.44		1.57		1.50

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 8. Mean differences in and SD for communicative gaze used during Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.88	.21	1.14	.29	1.00
	First	.77	.09	1.22	.46	1.00
2	Successive	.80	.25	1.10	.42	.95
	First	1.14	.50	1.21	.45	1.18
3	Successive	1.06	.37	.95	.42	1.01
	First	.99	.35	1.03	.46	1.07
	Marginal	1.10		1.11		1.03

Table 9. Mean differences in and SD for cessation of gesture, facial, and vocal behaviors in Child Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.53	.49	.32	.15	.42
	First	.47	.25	.46	.17	.47
2	Successive	.46	.36	.25	.16	.36
	First	.37	.43	.27	.15	.32
3	Successive	.70	.68	.38	.21	.54
	First	.45	.25	.35	.28	.40
	Marginal	.50		.34		.42

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 10. Mean differences in and SD for gesture and/or facial behaviors used during Child Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	1.06	.41	1.22	.41	1.14
	First	1.27	.36	1.26	.37	1.26
2	Successive	1.42	.31	1.11	.15	1.26
	First	1.18	.45	1.20	.50	1.19
3	Successive	1.15	.50	1.09	.40	1.12
	First	1.00	.13	1.19	.26	1.09
	Marginal	1.18	1.18	1.18		

Table 11. Mean differences in and SD for communicative gaze with gesture and/or facial behaviors used during Child Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.02	.04	.35	.17	.18
	First	.04	.07	.28	.08	.15
2	Successive	.15	.22	.51	.30	.33
	First	.21	.35	.26	.20	.23
3	Successive	.27	.39	.49	.12	.38
	First	.07	.14	.64	.64	.36
	Marginal	.12		.42		.27

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 12. Mean differences in and SD for gesture behaviors that continued to occur (C^+) across Child Entry and Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	1.18	.45	1.02	.40	1.10
	First	.98	.41	.95	.44	.97
2	Successive	.90	.13	1.09	.40	1.00
	First	1.08	.35	1.18	.45	1.13
3	Successive	.56	.74	1.26	.37	.91
	First	1.08	.66	1.18	.45	1.13
	Marginal	.96		1.11		1.03

Table 13. Mean differences in and SD for gesture that continued to occur and changed (C+F) across Child Entry and Adult Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	1.02	.50	.57	.20	.79
	First	.89	.47	.63	.32	.76
2	Successive	1.36	.42	.79	.31	1.07
	First	.88	.67	.82	.53	.85
3	Successive	.79	.91	1.13	.31	.96
	First	.99	.43	1.42	.29	1.21
	Marginal	.99		.89		.94

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 14. Mean differences in and SD for facial behaviors that continued to occur (C+) across Child Entry and Adult Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.47	.74	.73	.26	.60
	First	.26	.32	.65	.50	.46
2	Successive	.50	.71	.84	.22	.67
	First	.54	.54	.74	.33	.64
3	Successive	.33	.47	.70	.61	.52
	First	.60	.34	.24	.30	.42
	Marginal	.45		.65		.55

Table 15. Mean differences in and SD for vocal behaviors that shifted on (S ON) across across Child Entry and Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.23	.27	.05	.16	.21
	First	.19	.30	.07	.52	.28
2	Successive	.09	.09	.19	.45	.26
	First	.16	.15	.15	.62	.31
3	Successive	.15	.19	.24	.49	.21
	First	.20	.39	.07	.35	.21
	Marginal	.17		.39		.25

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 16. Mean differences in and SD for vocal behaviors that shifted with a change (S CHANGE) across Child Entry and Adult Uptake Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.57	.33	.68	.17	.62
	First	.63	.46	.52	.19	.57
2	Successive	.68	.32	.40	.27	.54
	First	.66	.25	.45	.26	.55
3	Successive	1.08	.57	.33	.17	.70
	First	.83	.42	.36	.19	.60
	Marginal	.74		.45		.60

Table 17. Mean differences in and SD for facial behaviors that continued to occur and changed (C^{+F}) across Child Entry and Child Tracking Moves for each group by session and loop type.

MEANS AND STANDARD DEVIATIONS (SD)

		Group				
		Autistic		Normal		
Session	Loop Type	Mean	SD	Mean	SD	Marginal
1	Successive	.42	.77	.05	.10	.23
	First	.00	.00	.06	.13	.03
2	Successive	.00	.00	.30	.25	.15
	First	.04	.07	.06	.13	.05
3	Successive	.09	.17	.55	.74	.32
	First	.19	.24	.00	.00	.10
	Marginal	.12		.17		.15

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 18. Mean differences in and SD for gestures behaviors that continued to occur ($\underline{C}^+$) across prior and successive Child Entry Moves for each group by session.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	.69	.43	.75	.32	.72
2	.60	.26	.70	.27	.65
3	.35	.33	.96	.41	.66
Marginal	.55		.80		.68

Table 19. Mean differences in and SD for facial behaviors that continued to occur ($\underline{C}^+$) across prior and successive Child Entry Moves for each group by session.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	.35	.54	.44	.33	.39
2	.51	.74	.45	.18	.48
3	.14	.12	.26	.17	.20
Marginal	.33		.38	.36	

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 20. Mean differences in and SD for facial behaviors that continued to occur and changed ($\underline{C}^{+F}$) across Child Entry and Child Tracking Moves for each group by session.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	.08	.77	.24	.25	.16
2	.13	.00	.30	.13	.22
3	.06	.17	.15	.13	.10
Marginal	.09		.23		.16

Table 21. Mean differences in and SD for vocal behaviors that continued to occur ($\underline{C}^{+}$) across prior and successive Child Entry Moves for each group by session.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	.45	.33	.58	.15	.52
2	.32	.14	.28	.18	.30
3	.74	.69	.41	.08	.57
Marginal	.50	.42	.46		

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

Table 22. Mean differences in and SD for vocal behaviors that continued to occur and changed (C^{+F}) across prior and successive Child Entry Moves for each group by session.

MEANS AND STANDARD DEVIATIONS (SD)

	Group				
	Autistic		Normal		
Session	Mean	SD	Mean	SD	Marginal
1	.31	.25	.41	.34	.36
2	.21	.17	.26	.15	.23
3	.74	.69	.28	.14	.51
Marginal	.42		.32		.37

Note. Arc sine transformation used to normalize distribution, transformed proportions may be greater than 100.

References

American Psychiatric Association. (1987). Diagnostic and statistical manual of mental disorders-III- R (3rd revised ed.). Washington, DC: Author.

Argyle, M. & Cook, M. (1976). Gaze and mutual gaze. NY: Cambridge University Press.

Barthes, R. (1982) Structuralism and after. (A. Lavers, Trans.). Cambridge: Mass.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979a). The emergence of symbols: Cognition and communication in infancy. NY: Academic Press.

Bates, E., Camaioni, L., & Volterra, V. (1979b.) The acquisition of performatives prior to speech. In E. Ochs & B. Schieffelin (Eds.), Developmental pragmatics. NY: Academic Press.

Bateson, M. C. (1975). Mother-infant exchanges: The epigenesis of conversational interactions. In D. Aaronson & R.W. Rieber (Eds.), Developmental psycholinguistics and communication disorders. Annals of the New York Academy of Sciences.

Bloom, L. (1973). One word at a time: The use of single-word utterances before syntax. The Hague: Mouton.

Bloom, L. & Lahey, M. (1978). Language development and language disorder. NY: John Wiley and Sons.

Boucher, J. (1976). Articulation in early childhood autism. Journal of Autism and Childhood Schizophrenia, 6, 297 - 302.

Bretherton, I. & Bates, E. (1979). The emergence of intentional communication. In I. Uzgiris (Ed.), New directions for child development. San Francisco: Josey-Bass.

Bruner, J. (1973). Organization of early skilled action. Child Development, 44, 1-11.

Bruner, J. (1975). From communication to language: A psychological perspective. Cognition, 3, 255-287.

Bruner, J. (1981). Intention in the structure of action and interaction. In L. Lipsitt (Ed.), Advances in infancy research, Vol. 1. Norwood, NJ: Ablex Press.

Bruner, J. (1983). Child's talk. NY: Norton and Co.

Caron, A. J. Caron, R. F., Caldwell, R. C. & Weiss, S. J. (1973). Infant perception of the structural properties of the face. Developmental Psychology, 9, 385-399.

Chapman, R. (1977). Comprehension strategies in children. In J. Kavanaugh & P. Strange (Eds.), Language and speech in the laboratory, school, and clinic. Mass: The M.I.T. Press.

Condon, W. (1975). Multiple response to sound in dysfunctional children. Journal of Autism and Childhood Schizophrenia, 5, 37-56.

Condon, W. (1977). A primary phase in the organization of infant responding behavior? In H. R. Schaffer (Ed.), Studies in mother-infant interaction . NY: Academic Press.

Condon, W. (1979). Neonatal entrainment and enculturation. In M. Bullowa (Ed.), Before speech- The beginning of interpersonal communication. Cambridge: Cambridge University Press.

Condon, W. & Sander, L. W. (1974a). Neonatal movement is synchronized with adult speech: Interactional participation and language acquisition. Science, 183, 99-101.

Condon, W. & Sander, L. W. (1974b). Synchrony demonstrated between movements of the neonate and adult speech. Child Development, 45, 456-462.

Cross, T. (1978). Motherese: Its association with the rate of syntactic acquisition in young children. In N. Waterson & C. Snow (Eds.), The development of communication. London: Wiley.

Curcio, F. (1978). Sensorimotor functioning and communication in mute autistic children. Journal of Autism and Childhood Schizophrenia, 8, 281 - 292.

Dahl, E., Cohen, D., & Provence, S. (1986). Atypical development: DSM-III and the Pervasive Developmental Disorders of early onset. Journal of the American Academy of Child Psychiatry, 25, 170-180.

de Villiers, P. & de Villiers, J. (1987). Commentary on language and autism. In D. Cohen & A. Donnellan (Eds.), Autism and Pervasive Developmental Disorders. NY: John Wiley & Sons.

Dore, J. (1975). Holophrases, speech acts, and language universals. Journal of Child Language, 2, 21 - 40.

Dore, J. (1979). Conversational acts and the acquisition of language. In E. Ochs & B. Schieffelin (Eds.), Developmental pragmatics. NY: Academic Press.

Dore, J. (1983). Feeling, form, and intention in the baby's transition to language. In R. Golinkoff (Ed.), The transition from prelinguistic to linguistic communication. NJ: Erlbaum.

Dore, J. (1985). Holophrases revisited, dialogically. In M. Barrett (Ed.), Children's single-word speech. London: Wiley Press.

Dore, J. (1986). The development of conversational competence. In R. Schiefelbusch (Ed.), Language competence: Assessment and intervention. San Diego, CA: College-Hill Press.

Dore, J. (1989). Monologue as a reinvoicement of dialogue. In K. Nelson (Ed.), Narratives from the crib. Cambridge: Harvard University Press.

Dore, J., Franklin, M., Miller, R., & Ramer, A. (1976). Transitional phenomenon in early language acquisition. Journal of Child Language, 3, 13 - 29.

Duchan, J. (1987). Functionalism: a perspective on autistic communication. In D. Cohen & A. Donnellan (Eds.), Autism and pervasive developmental disorders. NY: John Wiley & Sons.

Exline, R.V. & Winters, L.C. (1965). Affective relations and mutual glances in dyads. In S. Tomkins & C. Izard (Eds.), Affect, cognition, and personality. NY: Springer.

Golinkoff, R. (1981). The influence of Piagetian theory on the study of the development of communication. In I. Sigel; D. Brodzinsky; & R. Golinkoff (Eds.), New Directions in Piagetian theory and practice. Hillsdale, NJ: Lawrence Erlbaum Assoc.

Greenfield, P. (1976). Toward an operational and logical analysis of intentionality: The use of discourse in early child language. In P. Greenfield & J. Smith (Eds.), The structure of communication in early language development. NY: Academic Press.

Grice, H. (1969). Utterer's meaning and intention. Philosophical Review, 7, 147-177.

Harding, C. (1981). A longitudinal study of the development of the intention to communicate. Dissertation Abstracts International, (University Microfilms No. 8123796).

Harding, C. (1982). Development of the intention to communicate. Human Development, 25, 140 - 151.

Harding, C. (1983). Setting the stage for language acquisition: Communication development in the first year. In R. Golinkoff (Ed.), The transition from prelinguistic to linguistic communication. NJ: Lawrence Erlbaum Press.

Harding, C. & Golinkoff, R. (1979). The origins of intentional vocalization in prelinguistic infants. Child Development, 50, 33 -40.

Hayes, (1984). Interaction, engagement, and the origins and growth of communication: Some constructive concerns. In L. Fagans, C. Garvey, & R. Golinkoff (Eds.), The origin and growth of communication. Norwood, NJ: Ablex.

Hermelin, B. & O'Connor, N. (1970). Psychological experiments with autistic children. London: Pergamon.

Holquist, M. (1986). Introduction. In C. Emerson & M. Holquist (Eds.), Speech Genres and Other Late Essays (V. McGee, Trans.). Austin: University of Texas Press, Slavic Series, Number 8.

Hutt, C. & Ounsted, C. (1966). The biological significance of gaze aversion with particular reference to the syndrome of infantile autism. Behavioral Science, 11, 346-356.

Jaffe, J., Stern, D., & Perry, J. (1973). "Conversational" coupling of gaze behavior in prelinguistic human development. Journal of Psycholinguistic Research, 2, 321-329.

Kanner, L. Irrelevant and metaphorical language in early infantile autism. (1946). American Journal of Psychiatry, 103, 242 - 246.

Kendon, A. (1967) Some functions of gaze-direction in social interaction. Acta Psychologica, 26, 22 -63.

Koegel, R. L. & Wilhelm, H. (1973). Selective responding to multiple visual cues by autistic children. Journal of Experimental Child Psychology, 15, 442-454.

Konstantareas, M. M., Mandel, L., Homatidis, S. The language patterns mothers and fathers employ with their autistic children. Applied Psycholinguistics, 9, 403-414.

Lamb, M. E. (1981). The development of social expectations in the first year of life. In M.E. Lamb & L.R. Sherrod (Eds.), Infant social cognition: Empirical and theoretical considerations. NJ: Lawrence Erlbaum.

Langer, J. (1969). Disequilibrium as a source of development. In P. Mussen, J. Langer, & M. Covington (Eds.), Trends and issues in developmental psychology. New York: Holt, Rinehart, and Winston.

Levinson, S. (1984). Pragmatics. Cambridge, MA.: Cambridge University Press.

Lord, C. (1985). Language comprehension and cognitive disorder in autism. In F. J. Morrison, C. Lord & D. Keating (Eds.), Applied developmental psychology, Vol 1. NY: Academic Press.

Lovaas, O., Schreibman, J., Koegel, R. & Rehm, R. (1971). Selective responding by autistic children to multiple sensory input. Journal of Abnormal Psychology, 71, 211-22.

Loveland, K., & Landry, S. (1986). Joint attention and language in autism and developmental language delay. Journal of Autism and Developmental Disorders, 16, 335-349.

Loveland, K., Landry, S., Hughes, S., Hall, S., & McEvoy, R. (1988). Speech acts and the pragmatic deficits of autism. Journal of Speech and Hearing Research, 31, 593 - 604.

McDowall, J. (1978). Interaction synchrony: A reappraisal. Journal of Personality and Social Psychology, 36, 963-975.

Maurer, D. & Salapatek, P. (1976). Developmental changes in the scanning of faces by infants. Child Development, 47, 523-527.

Mead, G.H. Mind, self, and society- From the standpoint of a social behaviorist. (1934). Chicago: Chicago University Press.

Miller, G., Galanter, E., & Pribram, K. (1960). Plans and structure of behavior. NY: Holt.

Mirenda, P., Donnellan, A, & Yoder, D. (1983). Journal of Autism and Developmental Disorders, 13, 397 - 411.

Mundy, P., Sigman, M., Ungerer, J., & Sherman, T. (1986). Defining the social deficits of autism: The contribution of nonverbal communication measures. Journal of Child Psychology and Psychiatry, 27, 657-669.

Murphy, C. & Messer, J. (1977) Mothers, infants and pointing: A study of a gesture. In H. R. Schaffer (Ed.), Studies in mother-infant interaction. New York: Academic Press.

Newson, J. (1974). Toward a theory of infant understanding. Bulletin of the British Psychological Society, 27, 251-257.

Newson, J. (1979). The growth of shared understandings between infant and caregiver. In M. Bullowa (Ed.), Before speech: The beginnings of interpersonal communication. Cambridge: Cambridge University Press.

Oxman, J., Webster, C., and Konstantareas, M. (1978). Condon's multiple-response phenomenon in severely dysfunctional children: An attempt at replication. Journal of Autism and Childhood Schizophrenia, 8, 395-402.

Paul, R. (1987). Communication. In D. Cohen & A. Donnellan (Eds.), Autism and pervasive developmental disorders. NY: John Wiley & Sons.

Peters, A. (1983). The units of language acquisition. London: Cambridge University Press.

Pettit, P. (1977). The concept of structuralism. Berkely: University of California Press.

Prizant, B. (1982). Gestalt language and gestalt processing in autism. Topics in Language Disorders, 3, (1), 16 - 23.

Prizant, B. (1983). Language acquisition and communicative behavior in autism: Toward an understanding of the "whole" of it. Journal of Speech and Hearing Disorders, 48, 296 - 307.

Prizant, B. & Wetherby, A. (1985). Intentional communicative behavior of children with autism: Theoretical and practical issues. Australian Journal of Human Communication Disorders, 13, 21-59.

Prizant, B. & Duchan, J. (1981). The functions of immediate echolalia in autistic children. Journal of Speech and Hearing Disorders, 46, 241 - 249.

Prizant, B. & Rydell, P. (1984). Analysis and functions of delayed echolalia in autistic children. Journal of Speech and Hearing Research, 27, 183 - 192.

Prizant, B. & Schuler, A. (1987). Facilitating communication: Theoretical foundations. In D. Cohen & A. Donnellan (Ed.), Autism and pervasive developmental disorders. NY: John Wiley & Sons.

Reynolds, B., Newsom, C., & Lovaas, O. (1974). Auditory overselectivity in autistic children. Journal of Abnormal Child Psychology, 2, 153-163.

Rheingold, H. (1961). The effect of environmental stimulation upon social and exploratory behavior in the human infant. In B. M. Foss (Ed.), Determinants of infant behavior (Vol. 1). NY: Wiley.

Richer, J. (1978). A partial noncommunication of culture to autistic children. In M. Rutter & E. Schopler (Eds.), Autism: A reappraisal of concepts and treatment. NY: Plenum Press.

Ricks, D. & Wing, L. (1975). Language, communication, and the use of symbols in normal and autistic children. Journal of Autism and Childhood Schizophrenia, 5, 191 -220.

Robson, K. (1967). The role of eye to eye contact in maternal-infant attachment. Journal of Child Psychology and Psychiatry, 8, 13-35.

Rosenfeld, H.M. (1978. Diagnosis and definition of infantile autism. Journal of Autism and Childhood Schizophrenia, 8, 139-161.

Rutter, M. (1981). Whither interactional synchrony? In K. Bloom (Ed.), Prospective issues in infancy research. Hillsdale, NJ: Erlbaum.

Ryan, J. (1974). Early language development: Toward a communicational analysis. In M. Richards (Ed.), The integration of a child into a social world. Cambridge: Cambridge University Press.

Sachs, J. (1979). Topic selection in parent-child discourse. Discourse Processes, 12, 145-153.

Schaffer H. R., Collis, G. M. & Parson, G. (1977). Vocal interchange and visual regard in verbal and preverbal children. In H. R. Schaffer (Ed.), Studies of mother- child interaction. London: Academic Press.

Schieffelin, B. (1983). Looking and talking: The functions of gaze direction in the conversations of a young child and her mother. In E. Ochs & B. Schieffelin (Eds.), Acquiring conversational competence. London: Routledge and Kegan Paul.

Schopler, E., Reichler, J. & Renner, B. (1985). The Childhood Autism Rating Scale (CARS). NY: Irvington Publishers.

Schreibman, L. & Lovaas, O. (1973). Over-selective responses to social stimuli in autistic children. Journal of Abnormal Psychology, 5, 425-436.

Schuler, A. (1980a). Aspects of communication. In W. Fay and A. Schuler (Eds.), Emerging language in autistic children. Baltimore: University Park Press.

Schuler. A. (1980b). Aspects of cognition. In W. Fay and A. Schuler (Eds.), Emerging language in autistic children. Baltimore: University Park Press.

Searle, J. R. Speech acts. NY: Cambridge University Press, 1969.

Shields, M. (1978). The child as psychologist. In A. Lock (Ed.), Action, gesture, and symbol: The emergence of language. NY: Academic Press.

Sigman, M. & Ungerer, J. (1984). Attachment behaviors in autistic children. Journal of Autism and Developmental Disabilities, 114, 231 -244.

Snow, C. (1977). Mother's speech research: From input to interaction. In C. Snow and C. A. Ferguson (Eds.), Talking to children: Language input and acquisition. Cambridge University Press.

Sroufe, L.A. & Wunsch, J.P. (1972). The development of laughter in the first year of life. Child Development, 43, 1326-1344.

Stern, D. (1971). A micro-analysis of mother-infant interaction behavior regulating contact between a mother and her three and a half month old twins. Journal of the American Academy of Child Psychiatry, 10, 501-517.

Stern, D. (1974). Mother and infant at play: The dyadic interaction involving facial, vocal and gaze behaviors. In M. Lewis & L. Rosenblum (Eds.), The effect of the infant on its caregiver. London: Wiley.

Stern, D. (1977). The first relationship: Infant and mother. Cambridge, MA: Harvard University Press.

Stern, D. (1981). The development of biologically determined signals of readiness to communicate, which are language "resistant". In Stark (Ed.), Language behavior in infancy and early childhood. Elsevier North Holland, inc.

Stern, D. (1985). The interpersonal world of the infant. NY: Basic Books, Inc.

Stern, D., Hofer, L., Haft, W., & Dore, J. (1985). Affect attunement: The sharing of feeling states between mother and infant by means of inter-modal fluency. In T. Field & N. Fox (Eds.), Social perception in infants. Norwood, NJ: Ablex.

Stern, D., Jaffe, J., Beebe, B., & Bennett, S. (1975) Vocalizing in unison and in alternation: Two modes of communication within the mother infant-dyad. Annals of

the New York Academy of Sciences: Developmental Psycholinguistics and Communication Disorders, 263, 89 - 100.

Sugarman, S. (1978). Some organizational aspects of preverbal communication. In I. Markova (Ed.), The social context of language. London: Wiley and Sons Ltd.

Sugarman, S. (1984). The development of preverbal communication: Its contribution and limits in promoting the development of language. In R. Schiefelbusch and J. Pickar (Eds.), The acquisition of communicative competence. Baltimore: University Park Press.

Tager-Flusberg, H. (1988). On the nature of a language-acquisition disorder: The example of autism. In F. Kessel (Ed.), The development of language and language research: Essays in honor of Roger Brown. NJ: Lawrence Erlbaum Associates, Inc.

Tiegerman, E. & Primavera, L. (1984). Imitating the autistic child: Facilitating communicative gaze behavior. Unpublished manuscript.

Tinbergen, E. & Tinbergen, N. (1972). Early childhood autism: An ethological approach, advances in ethology. Journal of Comparative Ethology, Supplement No. 10. Berlin: Paul Perry.

Trevarthen, C. (1977). Descriptive analyses of infant communicative behavior. In H. R. Schaffer (Eds.) Studies in mother-infant interaction. NY: Academic Press.

Trevarthen, C. (1980). The foundations of intersubjectivity: Development of interpersonal cooperative understanding in infants. In D. Olson (Ed.), The social foundations of language and thought: Essays in honor of Jerome Burner. NY: Norton.

Trevarthen, C. & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding, and acts of meaning in the first year. In A. Lock (Ed.), Action, gesture, and symbol. NY: Academic Press.

Vine, I. (1973). The role of facial-visual signaling in early social development. In M. Von Cranach & I. Vine (Eds.), Social Communication and movement. NY: Academic Press.

Volkmar, F. (1987). Social development. In D. Cohen & A. Donnellan. Autism and pervasive developmental disorders. NY: John Wiley & Sons.

Volkmar, F., Cohen, D., & Paul, R. (1986). An evaluation of DSM-III criteria for infantile autism. Journal of the American Academy of Child Psychiatry, 25, 190 -197.

Vygotsky, L. (1962). Thought and language. Cambridge, MA: M.I.T. Press.

Vygotsky, L. (1978). Mind in society. Cambridge, MA: Harvard University Press.

Wells, G. (1980). Adjustments in adult-child conversation: Some effects of interaction. In H. Giles (Ed.), Language: Social psychological perspectives. London: Pergamon.

Werner, H. & Kaplan, B. (1963). Symbol formation. NY: Wiley and Sons.

Wetherby, A. (1986). Ontogeny of communicative functions in autism. Journal of Autism and Developmental Disorders, 16, 292-316.

Wetherby, A., Cain, D., Yonclas, D., & Walker, V. (1988). Analysis of intentional communication of normal children from the prelinguistic to the multi-word stage. Journal of Speech and Hearing Research, 31, 240 - 252.

Wetherby, A. & Gaines, B. (1982). Cognition and language development in autism. Journal of Speech and Hearing Disorders, 47, 63 - 70.

Wetherby, A. & Prutting, C. (1984). Profiles of communicative and cognitive-social abilities in autistic children. Journal of Speech and Hearing Research, 2, 364 - 377.

Wetherby, A., Yonclas, D., & Bryan, A. (1989). Communicative profiles of preschool children with handicaps: Implication for early identification. Journal of Speech and Hearing Disorders, 54, 148 - 158.

Wing, L. (1978). Social, behavioral, and cognitive characteristics: An epidemiological approach. In M. Rutter & E. Schopler (Eds.), Autism: A reappraisal of concepts and treatment. NY: Plenum Press.

Wing, L. (1981). Language, social, and cognitive impairments in autism and severe mental retardation. Journal of Autism and Developmental Disorders, 11, 31 -44.

Wolf, P. (1963). Observations on the early development of smiling. In B.M. Foss (Ed.)., Determinants of infant behavior (Vol. 2), London: Methuen.

Yule, W. (1978). Research methodology: Which are the correct "controls"? In M. Rutter & E. Schopler (Eds.), Autism: A reappraisal of concepts and treatment. NY: Plenum Press.