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COMMUNICATIVE, COGNITIVE, AND SOCIAL DEVELOPMENT IN AUTISTIC CHILDREN

by

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ABSTRACT

COMMUNICATIVE, COGNITIVE, AND SOCIAL DEVELOPMENT IN AUTISTIC CHILDREN

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The purpose of this study was to examine communicative and cognitive-social development in autistic children functioning in the prelinguistic and early stages of language development compared to normal children. Four autistic children, ranging in age from six years, 11 months to 11 years, 10 months, and four normal children, ranging from 12 months to 26 months participated in this study. The subjects were videotaped while interacting with the investigator during free play and tempted communication settings in order to describe communicative behaviors. Additionally, measures were obtained from each subject in the cognitive-social areas of communicative intent, tool use, imitation, and play and in language comprehension.

The results indicated that, despite a wide variation in communicative means, the autistic subjects displayed a relatively homogeneous profile of communicative functions that was quantitatively and qualitatively different from the normal profile. The autistic

subjects demonstrated a proficiency in the use of communication to regulate another's behavior to achieve an environmental end and a deficiency in the use of communication to attract another's attention to oneself, to direct another's attention to an object, and to focus one's own attention to a referent. The results of the measures of cognitive-social abilities and language comprehension demonstrated scattered development for the autistic subjects. All of the autistic subjects displayed sensorimotor Stage VI functioning in tool use and combinatorial play, while none showed Stage VI behavior in symbolic play. The major differences between the verbal and preverbal autistic subjects was that the former demonstrated at least Stage V functioning in vocal communicative intent and vocal imitation, suggesting that these abilities may be precursory to referential speech in autistic children. The results of the cognitive-social assessment are discussed in relation to the "homology through shared origins" model proposed by Bates (1979). Explanations for the heterochrony in communicative and cognitive-social development of these autistic children are discussed. A model of the ontogeny of communication and the neural representation of language in autism are proposed. It is hypothesized that autistic children are selectively impaired in certain aspects of the social and linguistic domains.

Carol A. Prutting, Chair
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CHAPTER I

REVIEW OF THE LITERATURE

Behavioral Characteristics

The syndrome of autism was first identified as a clinical entity by Leo Kanner in 1943. Although nearly 40 years have elapsed, and myriad publications have appeared in the literature, Kanner's original reports provide the most insightful and abundant descriptions of the behavioral characteristics of autism. Based on the developmental histories of 11 children, Kanner noted that the essential feature, pathognomonic to the syndrome, was the inability, from birth, to relate to people and situations. Other core characteristics described by Kanner include the failure to assume an anticipatory posture in preparation for being picked up, the failure to use language to convey meaning to others, excellent rote memory, insistence on the maintenance of sameness, good relation to objects, and good cognitive potentialities. Kanner noted that the condition of autism differed from previously reported instances of childhood schizophrenia in respect to the age of onset and postulated that the 11 children had "come into the world with innate inability to form the usual biologically provided affective contact with people, just as other children come into the world with innate physical or intellectual handicaps" (p. 250). In a 30-year follow-up study of these 11 children, Kanner (1971) concluded that despite differences in outcome, the following two cardinal features were retained in adulthood: 1) the "extreme autistic aloneness" characterized by the inability to relate to people and situations, and 2) the insistence of sameness

manifested by repetitive movements, ritualistic behaviors, abnormal preoccupations, and resistance to change.

The diagnostic labels of "autism," "childhood schizophrenia," and "childhood psychosis" have been used interchangeably in the literature, resulting in confusions over the boundaries between these disorders (Rutter, 1978a). In the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1980), the term "infantile autism" was included and classified as a "pervasive developmental disorder," instead of the previous status as a subclass of childhood schizophrenia which was, in turn, a subordiante class of psychosis. The cardinal features of the syndrome of autism have been succinctly described in six broad categories:

1. Impairment of interpersonal relationships characterized by aloofness, decreased physical contact, and lack of eye contact.

2. Deficits in social behavior seen in severe limitations in cooperative play, toy play, and self-care skills.

3. Stereotyped activities including self-stimulatory behavior, various kinds of repetitions, and preoccupation with sameness.

4. Impairment of intellect manifested by concreteness of thought, school performance deficits, and difficulties with judgement and abstract thinking.

5. Disturbances of speech and language seen in various forms such as mutism, echolalic speech, delayed development, and a variety of other idiosyncrasies in word usage, speech modulation, and content.

6. Onset prior to the age of 30 months.
(Baltaxe & Simmons, 1975, p. 439)

These six broad categories are consistent with other current definitions of this syndrome (e.g., APA, 1980; Rutter, 1978a; Ritvo & Freeman,

1978). Despite differences in emphasis, these researchers appear to be describing a behaviorally similar population.

The term "autism" has been used synonomously with "childhood autism" and "early infantile autism." However, the latter terms are redundant in that early onset is implicit in the diagnosis of autism, and there are no reports of an adult-onset condition related to this syndrome. Therefore, the term "autism" is preferable and will be used throughout this paper to designate children displaying the six features outlined above.

The behavioral definition of the autistic syndrome, reported by Ritvo and Freeman (1978), represented the consensus of the National Society for Autistic Children. This report attributed the etiology of autism to physical dysfunction within the central nervous system, although the exact nature and type of dysfunction is as yet unknown. The incidence of autism was estimated at four or five per 10,000 births, occurring four or five times more frequently in males.

Ritvo and Freeman also reported that approximately 60% of autistic children have measured IQs below 50, and 20% have IQs between 50 and 70, indicating that autism and mental retardation coexist in the majority of cases. However, they noted that autistic children perform most poorly on tasks that involve abstract reasoning and symbolic or sequential information and best on tasks that involve visuospatial skills and rote memory. Thus, autistic children display a scattered profile of development which can be differentiated from mental retardation. Rutter (1978a) emphasized the need to consider the features characteristic of autism in relation to the child's mental age, rather than chronological age, in the differential diagnosis of autism and mental retardation.

Language Characteristics

Disturbances of speech, language, and communication are a primary diagnostic feature of the autistic syndrome (Baltaxe & Simmons, 1975; Ritvo & Freeman, 1978; Rutter, 1978a). The language disturbances of autistic children range from failure to develop any functional speech (i.e., nonverbal or mute) to functional but idiosyncratic use of spontaneous speech. Approximately 50% of autistic children never develop any functional speech (Rutter, 1978a). The degree of language impairment is prognostic (Eisenberg, 1956; Rutter & Bartak, 1971). The prognosis is poor for those who have not acquired any useful speech by the age of five (Eisenberg, 1956).

Certain common characteristics have been identified among autistic children who develop speech. Kanner (1943, 1946) characterized the language deficits associated with autism in terms of immediate and delayed echolalia and resultant pronominal reversals, extreme literalness, private and original frame of reference, affirmation by repetition, and rejection of simple verbal negation. Investigations of the linguistic deficits of autistic children indicate that phonological and syntactic development parallel normal development, but that semantic and pragmatic development are deficient (Baltaxe & Simmons, 1975; Rutter, 1978b; Tager-Flusberg, 1981). Idiosyncrasies in vocal delivery have been reported anecdotally throughout the literature, including such descriptions as "monotonous," "wooden," "mechanical," "flat," or "peculiar"; however, deficits in intonation and stress in autistic children are poorly understood (Baltaxe & Simmons, 1975; Fay & Schuler, 1980; Tager-Flusberg, 1981).

In an attempt to account for language deficits associated with autism, Baltaxe and Simmons (1975) hypothesized that the autistic child's capacity to understand functional linguistic relationships lags behind the capacity for labelling. Language development in the autistic child is characterized by a higher proporion of repetitions and a higher ratio of nouns to pronouns than that in normal children (Baltaxe & Simmons, 1975; Cunningham, 1966; Kanner, 1943). The autistic child appears to use echolalic utterances as a label for a situation or event, perhaps because of difficulties in decoding the utterance (Baltaxe & Simmons, 1975). There is some evidence to indicate that echolalia serves as a language-learning strategy for autistic children through the gradual decomposition of echolalic utterances and eventual reformation of the constituent segments into new utterances (Baltaxe & Simmons, 1977). Further support for the hypothesis of Baltaxe and Simmons (1975) comes from evidence of impaired comprehension and use of semantic relations, of the yes concept, and of personal pronouns in autistic children (Fay, 1980; Kanner, 1943; Simmons & Baltaxe, 1975), indicating difficulty learning relationships between words.

Application of a Pragmatic Framework

The language deficits associated with autism have recently been examined within a pragmatic framework. Bates (1976) introduced the term "pragmatics" to the study of child language and defined pragmatics as "rules governing the use of language in context." Baltaxe (1977) examined the conversational skills of autistic adolescents with advanced syntactic development and identified three areas of pragmatic deficits: impairments in speaker-hearer role relationship, difficulties in the

rules of conduct governing a dialogue, and deficits in verbal presupposition evidenced by the failure to distinguish between new and old information. Autistic individuals demonstrate particular difficulties with deictic features of language which necessitate the ability to shift reference between speaker and hearer roles. The pronominal reversals pathognomonic to the autistic syndrome (Kanner, 1943) may be viewed as one manifestation of a pragmatic deficit that disrupts the acquisition of deixis. Autistic individuals not only have difficulties with person deixis (e.g., pronominal reversals) but also have difficulties with place deixis (e.g., literal interpretation of prepositions) and time deixis (e.g., confusions with temporal relations). Fay (1980) suggested that the autistic child's deficits in linguistic deixis may be traced to impairments in the prelinguistic development of gestural deixis.

Many of the linguistic deficits associated with autism may stem from impairments in pragmatic competence. The autistic child has particular difficulty with shifting reference and interchangeability of the reciprocal roles of language. Baltaxe and Simmons (1977) analyzed the bedtime soliloquies of an autistic child and found a lack of dialogue structure, in contrast to the dialogue with an imaginary interlocutor evident in the bedtime soliloquies of normal children. The lack of a dialogue structure in the soliloquy epitomizes the pragmatic deficits of autistic children.

The failure to reciprocate in a social exchange was noted by Kanner (1946) in the autistic child's use of private, individualized references. Kanner demonstrated that the seemingly irrelevant utterances of the autistic child are metaphorical expressions which,

despite the failure to use socially acceptable and conventional meanings, can often be traced to a specific source or personal experience of the child. Kanner (1946) concluded that the metaphorical language of the autistic child is creative but not directly communicative and "is not primarily intended as a means of inviting other people to understand and share the child's symbols" (p. 244). Thus, the autistic child appears to lack the intentionality, awareness, or competence to use language as a tool for conveying a message to others.

Wing (1981) suggested that the autistic child may lack the innate capacity to modulate species-specific sounds and to recognize that people are potential partners in social integration. There is some evidence of abnormalities in the prelinguistic vocalizations of autistic children. In a series of experiments on the vocal behavior of nonverbal autistic children and prelinguistic normal children, Ricks (1979) found that the autistic children produced differentiated vocal signals in response to the four situations of request, frustration, greeting, and surprise. While the normal children all used the same, consistent intonated vocal signals, each autistic child used a distinctive, idiosyncratic vocal signal which was articulated rather than intoned and could be interpreted only by the child's own mother. Subsequently, Ricks demonstrated that the autistic children selectively imitated their own tape-recorded voices and did not respond to utterances of another child or adult, while the normal children imitated only meaningful vocalizations regardless of the speaker. Thus, the autistic children's propensity to imitate appears to be guided by the

identifications of their own voices rather than by the extraction of meaning.

Condon (1979) found that autistic children have difficulty in moving synchronously with environmental sounds and human speech. Using a frame-by-frame analysis of listener responses on sound films, Condon demonstrated that a normal neonate moves in precise synchrony with speech sounds and sustains the movement for the duration of the speech sound. Analysis of the body motion of autistic children in response to sound revealed that the children moved synchronously with the sound, but the movement occurred later and was more intense than the response of normal children, and the autistic children displayed multiple responses to each sound.

Kubicek (1980) analyzed filmed mother-infant interactions between a mother and her four-month-old son, who was later diagnosed as autistic, and his normal fraternal twin brother. A frame-by-frame analysis of brief interactions of each mother-infant dyad revealed that the autistic twin displayed a more restricted repertoire of behaviors and did not vary the intensity of the few behaviors displayed. Interactions between the mother and the autistic twin lacked the give-and-take format of mutual exchange which was evident in interactions between the mother and the normal twin and involved subtle changes in facial expression and body movement. These findings support the hypothesis that autistic children are impaired in some aspects of the innate capacity to participate jointly in social interaction.

In reflecting upon her clinical experience with autistic children, Creak (1972) commented that:

> . . .they appeared not only to have nothing to communicate, and nothing to communicate with, but also

> seemed to have no urge or direction toward acquiring these elemental human attributes. (p. 6)

Anecdotal reports of the autistic child's failure to use speech and gestures for communicative purposes pervade the literature (e.g., Baltaxe & Simmons, 1975; Cohen, Caparulo, & Shaywitz, 1976; Creak, 1972; Kanner, 1943; Ricks & Wing, 1975; Rutter, 1978a). Some autistic children apparently engage in vocal or verbal behavior solely for the sensory stimulation inherent in the behavior rather than for communicative purposes (Fay & Schuler, 1980). In comparison with the language characteristics of developmental aphasic children, autistic children were found to show more "abnormal" language features (e.g., delayed echolalia, metaphorical language, pronoun reversal, stereotypic utterances), a paucity of spontaneous speech, and less use of speech or gestures for communicative purposes (Cantwell, Baker, & Rutter, 1978; Caparulo & Cohen, 1977; Rutter, 1978b).

In an attempt to identify specific language features displayed exclusively by autistic children, Needleman, Ritvo, and Freeman (1980) recently reported that a significant number of autistic children did use language communicatively. This finding appears to be inconsistent with previous reports in the literature. Unfortunately, the implications of this finding are limited because the authors did not describe the procedures used in collecting samples of language interaction and the measure of communicative use was unidimensional (present/absent).

There are several possible explanations to account for this seemingly disparate finding. First, the nature of the language deficits of autistic children changes over the course of development (Cantwell et al., 1978), and, therefore, the age of the subjects under study is a factor. The young autistic child's failure to use speech for

communicative purposes may transform into deficits in conversational rules in adolescence (Fay, 1980).

Secondly, many researchers set out to identify peculiarities, idiosyncrasies, or abnormalities in structural aspects of language of autistic children in their efforts to differentiate this population from other language-disordered populations. Therefore, they may overlook functional aspects of the autistic child's communicative efforts. Taxonomies used to classify verbal utterances are usually devised *a priori*, and certain types of utterances are deemed "abnormal" or "noncommunicative" by exclusion, based on the structural features rather than functional usage (e.g., Cantwell et al., 1978; Rutter, 1978b). However, the autistic child's use of metaphorical expressions, for example, may represent a failure to acknowledge the listener's needs. But it may also represent an intentional effort to communicate, albeit ineffective, because the listener could not decipher the message. Other examples of speech behaviors considered to be noncommunicative include echolalia, thinking aloud, and stereotypic utterances.

And thirdly, the context of social interaction influences the nature of communicative efforts. The use of controlled experimental situations unfamiliar to the child may distort the profile of communicative behaviors displayed by the autistic child. Cantwell and associates (1978) analyzed half-hour language samples recorded on audiotape in the homes of 12 autistic children. To account for the lack of "abnormal" language features in the sample of three of the 12 children, Cantwell and associates suggested that "abnormal language is most evident in an unfamiliar environment when there are high cognitive or linguistic demands" (p. 358). They also indicated that a longer sample

may have evoked abnormal features in these three children and noted that "although longer than those employed in most previous studies, half an hour is still a relatively short period of time" (p. 358). Thus, if the researcher's purpose is to identify abnormal language features, then language behaviors should be studied in an unfamiliar, highly demanding environment. However, if the researcher's purpose is to portray a representation of how language is used functionally, then communicative behavior should be studied as it occurs naturally in a familiar context.

There have been few investigations of autistic children's communicative behaviors displayed in natural interactions. Shapiro (1977) and his colleagues (Shapiro, Roberts, & Fish, 1970) were among the first to study the language of autistic children in a social context using a speech acts framework. The speech act theory, described by Austin (1962) and Searle (1969), implies that the speech act is the minimal unit of communication and that the intention of the speaker can be distinguished from the meaning of the utterance and the effects on the listener. Using a speech acts frame of reference, Shapiro (1977) considered the intentions of autistic children in the production of echolalic utterances and suggested that echolalia serves as a device for social closure. Echolalia may represent the autistic child's intention to maintain social interaction in the face of a failure to comprehend the message (Fay, 1969). Therefore, to regard echolalia and "appropriate" or "socialized" speech as mutually exclusive response classes (e.g., Cantwell, et al., 1978; Carr, Schreibman, & Lovaas, 1975) appears to be unwarranted when the linguistic and social context are considered.

The growing body of literature on developmental pragmatics provides a broad interactional framework from which communicative behavior can be studied within a social context (Prutting, 1982). A few recent investigations have used a developmental pragmatics framework to study verbal behaviors of autistic children in reference to contextual information.

In a multilevel pragmatic analysis, Prizant (1978) examined immediate echolalia displayed by autistic children in natural interactions in reference to the linguistic, nonlinguistic, and social contexts. Prizant identified the following seven functions of immediate echolalia: request, yes-answer, rehearsal, self-regulatory, declarative, turn-taking, and nonfocused. Using a similar methodology, Prizant and Rydell (1981) identified fourteen functions of delayed echolalia including providing information, verbal completion, label, calling, and situation association. They concluded that echolalic utterances should not simply be dismissed as pathological or nonfunctional, but rather should be viewed as a continuum of behavior ranging from automatic to intentional. One shortcoming of both of these studies is that echolalia was studied singly rather than in relation to other communicative behaviors.

Hurtig, Ensrud, & Tomblin (1982) analyzed the stereotypic question production of verbal autistic children in dyadic interaction. The found that, rather than serving as a request for information, the communicative function of question production was to initiate or maintain social contact. They suggested that the autistic children's questioning strategy reflects their limited repertoire of topic initiation devices.

McHale, Simeonsson, Marcus, and Olley (1980) compared the quality of autistic children's communicative behavior during interactions with their classmates and with their teachers. They found that a higher frequency of social communication was displayed during interactions with the teacher. Another interesting finding was that social communication consisted predominantly of gestural and motoric behavior and minimally of symbolic behavior (i.e., speech or signs). This latter finding is inconsistent with recurrent anecdotal reports of autistic children failing to use gestures for communicative purposes (e.g., Caparulo & Cohen, 1977; Kanner, 1943; Rutter, 1978a).

There has been only one reported study of the communicative functions of gestural behaviors in autistic children. Curcio (1978) examined how nonverbal autistic children communicate their wants and needs through gestures. His data were derived from teacher questionnaires and classroom observations. Curcio reported that these autistic children displayed some request, refusal, and greeting gestures; however, they did not exhibit any pointing or showing gestures. This is consistent with clinical observations reported by Ricks and Wing (1975). The absent development of showing and pointing gestures in autistic children represents a striking deviation from normal prelinguistic development (Curcio, 1978) and may be a contributing factor in their failure to use spontaneous language for communicative purposes in later development.

These findings demonstrate the significance of studying the communicative behavior of autistic children in natural interactions using a developmental pragmatics framework. These findings also indicate the need to redefine the language characteristics associated

with autism in consideration of the child's intention to communicate. It is counterintuitive to judge an utterance as noncommunicative based on structural features of the utterance without inferring the intentions of the child and the effects on the listener from the context. In Webster's New World Dictionary (Friend & Guralnik, 1960) context was defined as:

> . . .the parts of a sentence, paragraph, discourse, etc. that occur just before and after a specified word or passage and determine its exact meaning. (p. 319)

By definition, meaning cannot be divorced from context. Mishler (1979) discussed the limitations of using traditional "context-stripping" methods of experimental design to study "context-dependent" behavior. In discussing Mishler's article, Prutting (1982) emphasized the need to account for context rather than control for it in the study of communicative behavior.

Autistic children's use of gestural, vocal, and verbal behavior needs to be studied in naturally occurring interactions in order to arrive at a richer understanding of how these behaviors function for the autistic child. Some recent research has been directed toward understanding the functions of behaviors previously considered pathological (e.g., echolalia, repetitive questioning). However, little attention has been given to the autistic child's functional use of gestures and creative utterances (i.e., nonecholalic). The current literature provides only a fragmented representation of the communicative behaviors of autistic children.

The autistic child's development of intentional communication from gestures to words needs to be studied in context. Prutting (1982) identified the following dimensions of context that are central to the

study of communication: cognitive and social context (knowledge of the world and the communicative partner), physical context (perceptual properties), linguistic context (preceding, co-occurring, and subsequent verbal behavior), and nonlinguistic context (nonverbal and paralinguistic behavior). These multidimensional aspects of context should be used as a heuristic resource for discerning and understanding communicative behavior.

Cognitive/Social Characteristics

The cognitive and social context includes the child's knowledge, beliefs, and assumptions about general principles governing the world, conventional rules of a particular community, and the identity and shared knowledge of a particular communicative partner. The child's cognitive and social competence influence and are influenced by communicative interactions (Prutting, 1982). Bates (1976) stated that pragmatics occupies the interface among linguistic, cognitive, and social competence. Consideration of the autistic child's cognitive and social competence may provide clues about the nature of the pragmatic, linguistic, and, hence, communicative deficits associated with autism.

In reviewing the literature on cognitive and social development in autism, there are confusions and inconsistencies in the use of the terms "cognitive" and "social." In the developmental literature it is not clear what constitutes cognitive knowledge and how this differs from social knowledge. One operational division is that the cognitive domain includes knowledge of things and the social domain includes knowledge of people. However, this inanimate/animate division is an oversimplification and does not portray the developmental

interdependencies between these domains. Therefore, it is perhaps more useful to consider "cognitive-social" knowledge as an integrated system of knowledge of things and people in the world. This review of "cognitive-social" development in autism will use the terminology adopted by each particular investigator.

The cognitive- versus language-based nature of the communication problems of autistic children is an unresolved issued in the literature. The language and communication deficits have been viewed as a primary or causal symptom underlying other essential features of the syndrome (Churchill, 1972; Rutter, 1974), as one manifestation of an impairment in the ability to code and manipulate symbols (Hermelin & O'Connor, 1970; Ricks & Wing, 1975), or as one aspect of a pervasive cognitive deficit (Boucher, 1976). Rutter (1978a) stated that:

> . . .it is not yet known whether the disorder is of language as such or whether the language disability stems from a more widespread cognitive deficit affecting skills needed for language. (p. 153)

Because of the developmental interplay between language and cognition, it may be futile to interpret autism as either a language or a cognitive disorder. Schuler (1980) emphasized the need to study the interaction of linguistic, cognitive, and social development in autistic children.

A wide range of cognitive processing deficits has been identified in autistic children. The experimental investigations of Hermelin and O'Connor (1970) indicated that autistic children were able to recall random or nonsensical sequences as well as meaningful sequences for both auditory and visual information, while normal and nonautistic mentally retarded children were always better able to recall meaningful sequences. They also found that the autistic subjects performed similar to normal and mentally retarded children in the ability to code spatial

configurations. Hermelin and O'Connor concluded that the autistic children's failure to code temporally sequenced information may be related to their difficulties acquiring the rules of language and social interaction.

Lovaas, Schreibman, Koegel, and Rehm (1971) identified the attentional problem of "stimulus overselectivity" in autistic children. They found that autistic children responded to only one component of a multiple-stimuli complex, while normal children responded uniformly to all three components. Overselective responding of autistic children has been demonstrated both across sensory modalities (Lovaas et al., 1971) and within the same modality (Koegel & Wilhelm, 1973). Overselective attention has been reported to interfere with learning speech and related behaviors because the autistic child's response may be controlled by incidental or irrelevant cues (Lovaas et al., 1971; Rincover & Koegel, 1975).

Schuler (1980) reported the results of a nonverbal test procedure designed to assess perceptual and conceptual judgements of similarity using a match-to-sample paradigm. Practice trials were included to ensure that the children understood the required response. It was found that autistic children had the least difficulty making purely perceptual judgements (i.e., matching identical objects or broken and whole objects) and the most difficulty making judgements about conceptual relationships (i.e., matching objects and their functional equivalents such as a pair of scissors and a knife).

These studies demonstrate the pervasive learning difficulties faced by autistic children which could be detrimental to the acquisition of language. However, these findings provide only a piecemeal formulation

of the nature of cognitive functioning in autism. It is difficult to differentiate between causative and resultant factors of impaired language development. For example, stimulus overselectivity may interfere with the development of conceptual judgements or the generalization of newly learned behaviors; alternatively, stimulus overselectivity may be a function of developmental level (Schuler, 1980).

The literature currently indicates that certain aspects of cognitive development may set the pace for normal language acquisition (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Prutting, 1979; Sinclair, 1975; Slobin, 1973). The monumental works of Piaget (1952, 1954, 1962) have contributed to the understanding that cognitive abilities developing during the first two years (i.e., labelled the sensorimotor stage by Piaget) provide the basis for the emergence of language and have served as an impetus to the study of cognitive development in normal and disordered populations. One major implication of this research is that some language disorders may stem from a failure to develop specific cognitive abilities (Leonard, 1978).

In the autism literature, there have been several investigations of the development of specific cognitive abilities in relation to language acquisition using a Piagetian framework. In a longitudinal study of an autistic child from 3.5 to seven years of age, Shapiro, Huebner, and Campbell (1974) reported that "competence in language and play seemed to emerge together as though related to a third underlying factor--a factor to be inferred as cognitive organization" (p. 89). This study demonstrates the mutual interdependence between the emergence of language and symbolic play in this autistic child, similar to that found

in normal development (Bates et al., 1979; Piaget, 1962). Further evidence of the interdependence of language and play was reported by Wing, Gould, Yeates, and Brierley (1977). They studied play behaviors in mentally retarded and autistic children and found that symbolic play was associated with language comprehension age. Furthermore, the play behavior of the autistic children was restricted to stereotyped symbolic play or repetitive manipulations while the nonautistic mentally retarded children displayed symbolic play that was flexible and varied in theme. McHale and associates (1980) found that autistic children's use of symbolic communication was significantly correlated with the presence of symbolic play, further supporting the developmental relationship between language and play in autistic children.

Other evidence of impaired sensorimotor functioning in autistic children has been found in the study of imitation and object manipulation. Some autistic children are selectively impaired in body imitation with preserved abilities in motor-object imitation and spontaneous object use (DeMyer, Alpern, Barton, DeMyer, Churchill, Hingtgen, Bryson, Pontius, & Kimberlin, 1972). Autistic children who were able to imitate the use of objects failed to imitate pantomimic actions (Hammes & Langdell, 1981). Rutter (1978a) noted that autistic children often fail to develop "social imitation" which refers to copying the actions of the care-giver as a learning strategy. Impaired development in social imitation may be related to the autistic child's deficient use of symbolic play and social communication; however, this relationship remains elusive.

The developmental relationship between cognition and language in autism has been obscured by the piecemeal nature of the study of

isolated sensorimotor abilities. There have been few investigations of autistic children's profiles of sensorimotor functioning in relation to communicative and linguistic development. Curcio and Piserchia (1978) examined pantomimic representation in relation to gestural imitation, drawing, pretend play, and receptive and expressive speech in verbal autistic children. The found that, after controlling for receptive vocabulary, the echolalic children displayed more restricted forms of pantomime than the nonecholalic children. Furthermore, their findings showed flexibility in symbolic representation to be interrelated both across gestural and graphic modalities and across verbal and nonverbal modalities. Their results support Piaget's theory that language is but one manifestation of the child's cognitive structure.

Curcio (1978) examined communicative development as a product of prerequisite sensorimotor abilities in nonverbal autistic children. He found that these autistic children performed at the highest level on the object permanence scale and the lowest on the gestural imitation scale. Intentional communication of wants and needs was exhibited by only those children who had achieved at least Stage III in the development of imitation and Stage V in the development of causality and means-end. Based on these findings, Curcio suggested that specific sensorimotor developments may be prerequisite to intentional communication in autistic children and that the autistic child's understanding of causality and means-end is at least as critical as imitation for intentional communication.

Wetherby and Gaines (1982) employed a Piagetian framework as a means to study the relationship between cognition and language with autistic children in the early stages of language development. Using

nonverbal procedures to assess cognitive development, they found that all children evidenced competence beyond sensorimotor Stage VI in object permanence, causality, means-end, and space and demonstrated cognitive functioning between the early preoperational period and the concrete operations period. Furthermore, the stage of cognitive development did not correspond with and, in fact, exceeded that of language development. The authors suggested that the interdependence between cognition and language may vary during the developmental process. While the results of Curcio (1978) indicate that a certain level of sensorimotor development may be necessary for intentional communication, Wetherby and Gaines (1982) found that further cognitive development may not be sufficient for more advanced language development in autistic children.

In formulating a unified theory of cognitive development in autism, Schuler (1980) suggested that autistic children are relatively better developed in static dimensions of cognition and impaired in dynamic aspects of cognition. The former involves knowledge of objects as demonstrated by performance in object permanence, object manipulation, the construction of objects in space, and visuospatial skills. The latter involves the coordination of people and objects and includes knowledge of imitation, means-end, causality, and manipulation of symbols. Since the dynamic aspects of cognition and communication normally emerge in the context of social interaction (Bates, 1976; Bates et al., 1979), the autistic child's failure to learn from social interactions may contribute to impaired development in dynamic aspects of cognition. Research should be directed toward examining the interrelationship vis-a-vis linguistic, cognitive, and social development in autism.

The Emergence of Symbols

According to Piaget (1952, 1962), the child's cognitive structure forms the basis for the emergence of symbols, and language is but one manifestation of the symbolic function shared by other symbolic processes (e.g., imitation, play, drawing, visual imagery). Piagetian theory has influenced current views of language acquisition as a derivative of cognitive knowledge and has stimulated the search for cognitive prerequisites to language development (Bloom, 1973; Sinclair, 1975; Slobin, 1973). The treatises of Vygotsky (1962) and Werner and Kaplan (1963) emphasized the centrality of social origins of language acquisition. These theorists have had a major influence on current views of language acquisition as derived from the child's social motivation and learned through social interactions with the care-giver (Bruner, 1978; Lewis & Cherry, 1977; Lock, 1978; Schaffer, Collis, & Parsons, 1977).

In discussing the difficulty of uncovering cause-effect relationships in development, Kagan (1971) emphasized that developmental continuities of behaviors may be obscured by variations in relationships that change with age. He identified three classes of continuity in the child: 1) homotypic continuity which refers to stabilities in response classes that are manifested similarly; 2) heterotypic continuity which refers to stabilities between two response classes that are manifested differently but related to a mutual substrate; and 3) complete continuity which refers to stabilities in both the underlying psychological process and the manifested behavior. He suggested that heterotypic continuity predominates over homotypic continuity during the first decade when response systems are changing rapidly and that

complete continuity is most likely to occur after puberty when psychological organization has solidified. In describing the search for unobservable psychological processes that underly observable behaviors, Kagan states:

> The behavior of a typical psychologist during the last century resembles that of a child who has had a blanket thrown over him as he stood in a large room containing a variety of interesting objects. His task is to determine, without removing the opaque cover, what is in the room. (pp. 1-2)

The search for the underlying substrate of language acquisition, whether in cognitive, social, or linguistic domains, is based on the premise of heterotypic continuity in early childhood.

Bates and her colleagues (Bates, Camaioni, & Volterra, 1975; Bates et al., 1979) have attempted to integrate the contrasting theories of the cognitive basis of language and the social basis of language. Based on the results of a longitudinal study of three infants, Bates and associates (1975) identified three stages in the development of communication, borrowing terminology from the speech act theory of Austin (1962):

> 1) a "perlocutionary" stage, in which the child has a systematic effect on his listener without having an intentional, aware control over that effect; 2) an "illocutionary" stage, in which the child intentionally uses nonverbal signals to convey request and to direct adult attention to objects and events; and 3) a "locutionary" stage, in which the child constructs propositions and utters speech sounds within the same performative sequences that he previously expressed nonverbally. (p. 207)

Bates and associates (1975) suggested that the illocutionary stage corresponds with Piaget's sensorimotor Stage V and the locutionary stage corresponds with Piaget's sensorimotor Stage VI. By tracing the developmental history of communication, they showed that communicative

intent is displayed initially through preverbal gestures and vocalizations and ultimately through referential speech. This finding indicates that preverbal communicative intent is one ontogenetic predecessor of referential speech. Thus, the child uses communicative functions as a guide to the acquisition of linguistic forms (Bates, 1979a).

Bates and associates (1979) examined the interrelationship among linguistic, cognitive, and social development in an extensive cross-sectional study of 25 normal children between the ages of nine and 13 months. They found that the emergence of referential speech was correlated with communicative intent, tool use, symbolic play, and imitation. Bates (1979a) explained the developmental dependence among the linguistic, cognitive, and social domains with the "homology through shared origins" model. The model states that two related structures emerge from a third source, referred to as an underlying "software" or cognitive substrate. This homology model, supported by the findings of Bates and associates (1979), predicts that two homologous structures related through a shared underlying software, should emerge in no particular sequence since no causal relationship exists between the two structures. For example, the homologous structures of communicative intent and tool use are related through a shared cognitive substrate. Communicative intent may emerge earlier or later than tool use, perhaps due to environmental influences, but when either capacity is present, then it can be inferred that the cognitive substrate is present. Further, the homology model predicts that transfer from one domain to another should be bidirectional. For example, training or experience in

communicative intent may enhance the underlying "software" and spill over into tool use ability and vice versa.

Bates (1979a) formulated an explanatory theory of the phylogenetic and ontogenetic origins of the symbolic capacity based on the interdependence of linguistic and nonlinguistic domains. Bates hypothesized that the symbolic capacity evolved in phylogeny as a "new product" built from the interaction of available "old parts." The human symbolic capacity was generated through the process of "heterochrony," which refers to the natural selection for new capacities through changes in the developmental timing and growth formations of pre-existing capacities. Through the operation of heterochrony, specific, dissociable cognitive and social components evolved in the service of nonlinguistic functions. The relative proportions of available cognitive-social components reached a certain threshold level that results in new interactions among the components creating the new capacity for symbols. Thus, quantitative variations in timing lead to a qualitatively new capacity. Bates suggested that the heterochronous process that occurred in phylogeny is replicated in ontogeny.

In summary, the theoretical construct formulated by Bates (1979a) states that variations in the relative timing of cognitive and social components produced the symbol-using capacity in phylogeny through interactions of the component skills. Bates (1979c) isolated three cognitive-social components that contribute to the symbolic capacity: imitation, tool use, and communicative intent. The symbol-using capacity is manifested both inside and outside of communication (e.g., commenting to others; labelling to self) and in both the vocal and gestural modalities (e.g., referential speech, symbolic play). Thus the

"new product," the symbolic capacity, was constructed in phylogeny and is reconstructed in ontogeny from the interactions of at least three "old parts"--imitation, tool use, and communicative intent. And finally, Bates (1979a) proposed that the linguistic, cognitive, and social domains are interdependent systems that share the same underlying software and are thus based on the same structural principles.

The theoretical constructs formulated by Bates (1976, 1979a, 1979c) based on the study of normal children provide a broad framework encompassing the linguistic, cognitive, and social domains. This framework offers an expansive, interdisciplinary perspective from which to study the interaction of linguistic, cognitive, and social development and therefore has important implications for the study of autistic children. The theoretical constructs proposed by Bates make several contributions to the study of autism.

The early work of Bates (1976) and her colleagues (Bates et al., 1975) traced the ontogeny of communicative intentionality. This work provides a developmental model that is directly applicable to the study of preverbal and verbal behavior in autistic children. The speech act theory (Austin, 1962; Searle, 1969) made the distinction between the propositional content of an utterance and the intention of the speaker. Bates and associates (1975) extended the use of these speech act concepts to preverbal behavior. This framework provides a usable scheme for studying the communicative intentions of autistic children in the use of preverbal vocalizations and gestures in relation to verbal behavior.

The more recent work of Bates (1979a, 1979b, 1979c) and her colleagues (Bates et al., 1979) traced the emergence of symbols in

relation to prerequisite nonlinguistic capacities. This framework has direct implications for the study of symbolic development in autistic children. It suggests that the specific cognitive and social abilities that are requisite to the symbolic capacity may fail to develop and, consequently, preclude or disrupt the emergence of symbols.

One major contribution of the broad theoretical framework derived from the work of Bates and associates (1979) is the concept of heterochrony. While this concept was used to explain the construction of the symbol-using capacity in phylogeny and ontogeny, the use of this concept can be extended to explain deviations from normal development. Variations in timing at early stages in ontogeny would have developmental consequences that are cumulative and potentially deleterious. The principle of heterochrony suggests the mechanism that operates to produce the wide discrepancies between linguistic and nonlinguistic abilities and between social and nonsocial abilities in autistic children. Furthermore, the concept of heterochrony may help to account for the heterogeneity of the autistic population. Slight variations in the developmental timing of cognitive and social components in early stages may result in pervasive differences in later stages, based on the interaction of the components available at particular times in development. Thus, this model suggests that the particular combination of available components may lead to a distinct interaction and contribute to the homogeneity and heterogeneity of the autistic population.

A second major contribution of this framework is that it offers a broad theoretical construct from which to understand the core of the autistic syndrome. It provides a resource for exploring the

developmental interaction of linguistic, cognitive, and social knowledge in autistic children. Furthermore, this framework offers the potentiality to study autism in apposition to normal development as well as other language disorders.

Research Objectives

The first major objective of this investigation was to characterize how autistic children in the prelinguistic stage (i.e., nonverbal) and early stages of linguistic development (i.e., mean length of utterance of 3.0 or less) use communication in comparison to normal children functioning at similar stages of language development. In addressing this objective, the following two questions were asked: First, do these autistic children evidence communicative intent (i.e., producing a signal, either gestural, vocal, or verbal, to serve a communicative purpose) during self-initiated acts? Second, do the profiles of communicative functions displayed by these autistic children reflect a normal variation in developmental style as evidenced by only quantitative differences from normal children, or are the profiles displayed by these autistic children quantitatively and qualitatively different from those displayed by normal children?

The second major objective of this study was to examine the relationship between referential speech and the following four areas of cognitive-social development in these autistic children: communicative intent, tool use, play, and imitation. The rationale for selecting these areas was based on the findings of Bates and associates (1979) that in normal children these four areas were correlated with the emergence of referential speech. In the "homology through shared

origins" model, Bates (1979c) proposed that a critical threshold level in the areas of communicative intent, tool use, and imitation is necessary for the emergence of the symbolic capacity which is manifested in both referential speech and symbolic play. In regard to the homology model, two specific questions were addressed: First, what component skills are prerequisite to the symbolic capacity in autistic children? Second, do the symbolic capacities demonstrated by these autistic children support the "homology through shared origins" model proposed by Bates?

In order to address these research objectives, a descriptive approach was employed. The nature and scope of the communicative, cognitive, and social behaviors of interest necessitate a descriptive approach. In noting the complementary roles of descriptive and experimental studies, Curtiss (1981a) states:

> . . .though each case is intriguing in part because of its apparent uniqueness, it holds the promise of uncovering important and general principles of the system. Population studies by their very nature are ideal for studying issues of incidence, frequency, group trends, and the like, but they are of questionable value for probing a single phenomenon deeply. The kinds of observations that illuminate the qualitative character of a phenomenon, its inner nature--that is the stuff of case studies. (p. i)

Thus, a detailed analysis of communicative behavior occurring in natural interactions in a small number of autistic children may serve to elucidate the nature of the communicative breakdown associated with autism. Examination of individual profiles of communicative and cognitive-social capacities may provide clues about the interdependent relationship between these domains.

CHAPTER II

METHODS

A cross-sectional sample of autistic and normal children functioning in the prelinguistic and early stages of language development was examined in order to characterize the communicative abilities of autistic children. Measures were obtained from each subject in the areas of communicative intent, tool use, imitation, and play in order to examine the relationship between referential speech and these four areas of cognitive-social development.

Subjects

Four autistic and four normal children participated in this study. The diagnosis of autism was made by two independent diagnosticians employing the U. S. National Society for Autistic Children criteria (Ritvo & Freeman, 1978). According to these criteria, autism is a behaviorally defined syndrome with symptoms manifested prior to 30 months of age and includes disturbances of 1) developmental rates and/or sequences, 2) responses to sensory stimuli, 3) speech, language, and cognitive capacities, and 4) capacities to relate to people, events, and objects.

The autistic subjects were selected to meet the following additional criteria: 1) demonstrating language abilities in the prelinguistic and early stages of language development (i.e., Mean Length of Utterance [MLU] of 3 morphemes or less, spoken or signed); 2) ranging in age from 6 to 12 years; and 3) residing with their natural

parent(s) since birth. No attempt was made to control for previous educational experience, and therefore this variable may influence the communicative profiles of these subjects. Furthermore, the configuration of their pretreatment profiles cannot be determined.

The rationale for limiting this investigation to autistic children meeting the above criteria is as follows: First, there is a paucity of research investigating the communicative abilities of autistic children in the prelinguistic and early stages of language development. This subgroup constitutes well over half of the autistic population, and therefore merits further investigation. Second, because of the heterogeneity of the autistic population, investigations of autistic children should be restricted to a relatively homogeneous subgroup of this population in order to reveal meaningful findings. This investigation was restricted to prepubescent autistic subjects because the nature of the language deficits associated with autism changes in adolescence (Fay, 1980; Rutter, 1978a). Third, this investigation was restricted to noninstitutionalized autistic children because the quality of the language environment provided by the care-giver influences language development (Bates, Bretherton, Beeghly-Smith, & McNew, in Press).

Selection of a single measure of language development with which to match a control group of normal children poses a particular dilemma in the study of autistic children. (For a discussion of difficulties in selecting "correct controls" for autistic subjects, see Yule, 1978.) The MLU is a useful measure of constructional complexity in the grammatical development of normal children up to 4 morphemes (Brown, 1973) and has been the most widely used index for matching normal and

disordered children. However, autistic children often concatenate and ritualize certain groups of words in learning to talk, perhaps because of precocious rote memory skills; MLU may be misleadingly large and may not be a valid index of grammatical development in autistic children. Phrases such as "I want the X" or "Yes please want some X" may function as single morphemes for some autistic children just as the catenatives "wanna," "gonna," and "hafta" function for normal children. Therefore, normal subjects for the present study were selected to represent roughly equivalent stages of language development (i.e., prelinguistic, one-word, two-word, or three-word stage) as the autistic subjects, based on grammatical reconstruction abilities, rather than MLU.

The autistic subjects were selected from 1) school districts, 2) regional centers, and 3) the University of California, Santa Barbara Autism Project. The normal children were selected from 1) day care centers, 2) children of students, faculty, and staff, and 3) children receiving well child-care at the University of California Pediatric Clinic.

The four autistic children ranged in age from six years, 11 months to 11 years, 10 months, with a mean age of nine years, six months. The four normal children, selected to represent equivalent stages of language development, ranged from 12 months to 26 months, with a mean age of 19 months. The normal subjects had medical histories which indicated no major health problems and normal functioning in all areas of development. All children were drawn from homes where English was the native language, with the exception of one of the autistic subjects (see individual subject description for Subject A2 below). The

socioeconomic class of the families of all children was judged to be middle class based on the parents' education, occupation, and geographic area of residence (Kagan, 1971).

Individual Subject Descriptions

Descriptions of the four autistic subjects are presented below, followed by descriptions of the four normal subjects.

Subject A1 was a ten-year, six-month-old female autistic child. She has one younger sibling aged nine. Her mother has three older children by a previous marriage, but they were not living with the family. She lived with her sister, mother, stepfather, and two stepbrothers. Her birth history was normal; however, at three weeks of age she developed a low-grade fever and convulsions. She was hospitalized for 21 days for viral meningitis. Her mother reported that following the illness, she wanted to be left alone, resisted any handling by screaming, and had feeding problems. Her physical appearance and fine and gross motor coordination were normal.

Subject A1 showed a high frequency of self-stimulatory behavior, including turning her head back and forth, rocking, whistling and honking noises, and vocalizations, when she was not engaged in a structured task. When she became angry, or in an attempt to reject an activity, she displayed self-injurious behavior, including banging her body against the furniture and scratching herself. She was able to dress herself with assistance and feed herself with a fork; she had been toilet trained since age 8; however, she occasionally has toileting accidents. Test results on the Leiter International Performance Scale were unscorable (i.e., she accepted the materials and placed the blocks

in slots; however, she was unable to place any blocks in the correct slots). She appeared to be functioning in the severely retarded range, with the exception of some isolated motor skills such as rollerskating.

Subject A1's communication training included speech and sign language training. She had shown no success with speech and had poor verbal comprehension. Her use of sign language was prereferential (i.e., she used signs indiscriminately to request), indicating functioning at the prelinguistic stage. Her mother reported that she requests objects by signing and gesturing, she requests assistance by manipulating others' hands, and she indicates pain by crying and holding the part of her body that hurts.

Subject A2 was an 11-year, 10-month-old male autistic child. He is the second born with a 16-year-old and a 2.5-year-old sibling. His parents are both natives of the Phillipines; however, both parents speak to their children in English. His birth history and motor development were normal. Because of his lack of speech development, his hearing was tested at three years of age; it was reported that he had a moderate-to-severe hearing loss bilaterally. He was fitted with bilateral hearing aids. His parents suspected that he had more hearing than had been estimated because he responded to certain familiar television commercials and he rejected the hearing aids. Repeated hearing evaluations indicated normal hearing bilaterally, and, subsequently, he was enrolled in a classroom for autistic children at the age of five.

Subject A2's physical stature and appearance were normal for his age. He displayed inconsistent responses to auditory stimuli and a particular fascination for some visual stimuli such as steam rising from

a teapot. He exhibited a high frequency of self-stimulatory behavior when left alone, including hand flapping, jumping, loud vocalizations, and twirling a rubberband and a low frequency of self-injurious behavior, including hitting his face and chest and banging his leg. He had recently become aggressive when frustrated and would have a tantrum when he did not get what he wanted. He was able to dress himself and had been toilet trained since the age of nine. At the age of eight, results of the Leiter International Performance Scale indicated functioning at the five-year-old level (actual IQ score not reported). More recent formal intelligence test results were not available.

Since the age of five, communication training in Subject A2's classroom had included speech, sign language, total communication, written words, and pictures with minimal success using any of these communication systems. At the time of testing, he produced no words and displayed vocalizations that were predominantly self-stimulatory. His repertoire of conventional signs consisted of nut, apple, orange, cracker, drink, shoe, car, book, and ball; however, he used only the signs for book and ball discriminately (i.e., to request these and only these specific objects). In requesting other objects, he typically cycled through several of the signs in his repertoire in an apparent effort to guess the name of the desired object. Thus, he displayed the rudiments of referential sign language, indicating functioning between the prelinguistic and one-word stages. His parents reported that he requests objects or assistance by leading them by the hand to the desired source and that he shakes his head or pushes an object away to indicate rejection. They also reported that he conveys that he is in pain or is sick by crying. He showed poor verbal comprehension but was

able to follow some simple auditory commands (e.g., come here, sit down, wash your hands, throw that away).

Subject A3 was an eight-year, 11-month-old female autistic child. She has no siblings and lives with her mother. Her parents were divorced when she was about seven years of age. She had a history of neonatal hypoglycemia and postnatal anoxia. Her developmental disabilities and autism were reported to be secondary to congenital cytomegalic inclusion disease. She had eye surgery at age two and subsequently showed a mild hyperopia with visual acuity within normal limits. Her hearing is normal, although auditory discrimination errors were evident in her immediate echolalia. Her gross and fine motor coordination were delayed. Her gait was wide-based and ataxic; she had balance and depth perception problems which resulted in particular difficulty climbing steps.

Subject A3 displayed a high frequency of self-stimulatory behavior, including hand flapping, spinning objects, glottal fricative noises, and vocalizations and self-injurious behavior including slapping her face and chest and head banging. She was not able to dress herself, fed herself with a spoon only, and was not toilet-trained (i.e., she had several toileting accidents daily and used the phrase "wanna go potty" indiscriminately). She was untestable on formal intelligence tests (i.e., she would not follow or comply with the instructions); however, informal assessments indicated functioning in the severely retarded range.

Subject A3 demonstrated a referential use of speech; her expressive lexicon contained more than 50 different words or phrases used referentially. She displayed immediate and delayed echolalia. Most of

her phrases were produced with a rising intonation on the final word. Mean Length of Utterance (MLU) derived from a spontaneous language sample of 200 utterances excluding immediate echolalia in the manner described by Brown (1973) was an average of 2.74 morphemes per utterance. However, this may be an inflated measure of grammatical complexity because of her tendency to concatenate certain words (e.g., wanna go X, want some X). Her sentence constructions were limited to pivot-open combinations (e.g., want some coke, want some juice), indicating functioning in the early two-word stage. Her verbal comprehension was poor; she was able to follow only simple commands when cued by the communicative context (e.g., "wash your hands" when standing in front of the sink). Her mother reported that she began producing words at three years of age and that she was able to request objects or assistance verbally or by leading her mother by the hand to the desired source. She was able to reject an object or event by saying "nope" or "stop it," and she occasionally indicated that she was sick by saying "want some aspirin."

Subject A4 was a six-year, 11-month-old autistic male child. He has no siblings. He was living with his mother; his parents were divorced when he was about five years old. His birth history was normal. He lived aboard a small sail boat with his parents from the age of ten months to 24 months. His parents reported that his motor and social development were normal until nine months and that he did not progress in development during his extended cruise. His physical appearance was normal; however, he showed mild delays in gross and fine motor development.

Subject A4 had shown significant improvement since participating in a previous study by this investigator at the age of four years, eight months (see Subject 5 in Wetherby & Gaines, 1982). His self-injurious behavior, which consisted of head banging, had been eliminated and self-stimulatory behavior, including jumping, hand flapping, and screaming was displayed only when he became excited. He was able to dress himself, feed himself, and was toilet trained. At the age of six years, seven months, results of the Stanford-Binet were a mental age of four years and an IQ of 54. At the age of four years, eight months, results of the Leiter International Performance Scale were a mental age of three years, 10 months and an IQ equivalent of 78.

Subject A4 demonstrated a referential use of speech. He often spoke in a low volume resulting in poor speech intelligibility. He displayed immediate echolalia infrequently and produced some communicative delayed echolalia and stereotypic phrases. Based on a spontaneous language sample of 200 utterances excluding immediate echolalia, his MLU was an average of 3.04 morphemes per utterance. This may be an inflated measure of his grammatical development because, like Subject A3, he would concatenate certain words in his stereotypic phrases (e.g., yes please I want the X). His sentence constructions contained subject and predicate constituents and some grammatical morphemes (e.g., sitting on the chair; I want a drink of water please; I want the popcandy please), indicating functioning in the three-word stage. His expressive language abilities had significantly improved since the age of four years, eight months. At that time, his verbal production consisted of immediate echolalia, single-word labelling responses, and babbling, and his MLU was 1.31. At the time of the

current investigation he was able to request objects and assistance verbally but would occasionally lead his mother by the hand to the desired source. He was able to reject by saying "no" or "don't want X," and to convey that he was in pain by saying "hurt X."

Subject N1 was a 12-month-old male normal child. He is the first born with no younger siblings. His expressive language abilities included babbling and prereferential vocalizations associated with familiar actions (e.g., /ba/ while opening a book; /ba ba /while waving), indicating functioning in the prelinguistic stage. The child's mother reported that he was able to comprehend a few lexical items and simple commands in context. His mother reported that he babbled, gestured, and cried as communicative means to indicate his wants and needs.

Subject N2 was a 17-month-old female normal child. She is the first born with no younger siblings. Her expressive language abilities included babbling, vocal imitation, prereferential vocalizations, and five to ten word-like referential vocalizations (e.g., /ma / for mine; /ba/ for bottle; /ka/ for car; and uh oh), indicating functioning in the early one-word stage. The child's mother reported that she was able to comprehend single-word object names and one-step directions. According to her mother's report, she indicated her wants and needs by vocalizing, producing word-approximations, pointing, and crying.

Subject N3 was a 21-month-old female normal child. She is the first born with no younger siblings. MLU derived from a spontaneous language sample of 200 utterances was an average of 1.49 morphemes per utterance. Her sentence constructions consisted of pivotal and relational categories (e.g., top off; this book; daddy bottle; Amy

blow), indicating functioning in the early two-word stage. Her mother reported that she was able to comprehend simple conversational speech and that she generally communicated through verbal means.

Subject N4 was a 26-month-old male normal child. He is the first born with no younger siblings. MLU derived from a spontaneous language sample of 200 utterances was an average of 2.47 morphemes per utterance. His sentence constructions contained subject and predicate constituents and some grammatical morphemes (e.g., what happened; I want the bubbles; I wanna go see Mommy; can you gimme that book), indicating functioning in the three-word stage. His mother reported that he was able to comprehend most instructions directed toward him and that he was able to communicate his needs through verbal means.

Data Collection

Assessments of communicative and cognitive-social abilities were carried out during two sessions within a period of one week. Each session lasted between one and two hours. A parent or teacher/clinician was present for each session. During the first session, the following procedures were administered in the order listed:

1) 15 minutes of adjustment and familiarization,
2) 15 minutes of language comprehension testing scored live,
3) 10 minutes of free play videotaped,
4) 15 minutes of tempted communication videotaped,
5) 10 minutes of imitation testing scored live, and
6) 10 minutes of tool use testing scored live.

During the second session, the following procedures were administered in the order listed:

1) 15 minutes of adjustment and familiarization,

2) 15 minutes of tempted communication videotaped,

3) 10 minutes of free play videotaped, and

4) 10 minutes of elicited play videotaped.

Specific information about the procedures used for the assessment of each area follows.

Samples of communicative behavior displayed by the autistic and normal subjects were collected on videotape while each subject interacted with the investigator. Each subject was videotaped on two separate days during a one-week interval in the environment(s) most familiar to the child to ensure collection of a representative sample of communicative abilities in a natural context (Mishler, 1979). The autistic subjects were videotaped one time at home and one time in their clinic or classroom. The normal subjects were all videotaped twice at home because none attended day care programs.

Each subject was videotaped in two settings on each of the two videotaping sessions, a free play setting and a tempted communication setting. The free play setting consisted of placing one of five standard sets of toys and common objects (see Appendix A) in front of the child for at least two minutes, or longer when the child displayed continued interest. The tempted communication setting consisted of presenting each child with a standard series of eight communicative temptations (see Appendix B) designed to allure communicative behavior.

The investigator introduced all toys, objects, and communicative temptations in a manner intended to establish and maintain the child's attention and interest, without using verbal utterances to direct the child's behavior. That is, the communicative context was designed to be

nondirective in order to promote communicative behavior initiated by the child. A total of 60 minutes of each subject's interactions with the investigator was videotaped.

In addition to the collected samples of communicative behaviors, abilities evidenced to be prerequisite to referential speech in normal children was assessed. Measures of prerequisite abilities were derived from the normal developmental literature (Bates et al., 1979; McCune-Nicolich, 1981; Miller, Chapman, Branston, & Reichle, 1980; Piaget, 1954; Uzgiris & Hunt, 1975). Measures of communicative intent, tool use, imitation, and play were included because these cognitive-social abilities correlated with the emergence of referential speech in normal children (Bates et al., 1979). Additionally, a measure of language comprehension was included because comprehension correlated with sensorimotor development in normal children (Miller et al., 1980).

Communicative Intent

Measures of gestural and vocal communicative intent were derived separately from the videotaped series of eight communicative temptations (see Appendix B). Assessment scales for gestural and vocal communicative intent were designed by the investigator based on the findings of Bates and associates (1979). (The assessment scales for communicative intent are presented in Appendix C.) The total possible score for gestural and for vocal communicative intent was six. In other words, a separate score, ranging from one to six, was obtained for each modality of communicative intent. The score for each modality was the highest level of communicative intent displayed by each subject during the tempted communication setting on the two videotaping sessions.

Tool Use

An assessment of nonsocial tool use or means-end behavior was administered to each subject. The ability to use a support or tool as a means for obtaining a desired object was assessed with four types of tools, based on familiarity and contiguity with the goal. The nonsocial tool use opportunities were adapted from Uzgiris and Hunt (1975) and Bates et al. (1979) and are listed in Appendix C.

The procedures described by Uzgiris and Hunt (1975) and employed by Bates et al. (1979) for the assessment of means-end allow for several demonstrations of the tool used. However, since the child's use of a tool to obtain a goal following a demonstration may reflect imitation rather than an understanding of means-end, no demonstrations were allowed in this study.

The following procedures were used in the assessment of tool use. Prior to each tool use opportunity, the investigator allowed the child to play with a toy of interest. The toy was then removed and placed in a location out of the child's reach. The tool was positioned in the appropriate relation to the desired object and within the child's reach. The child was then encouraged to get the object but was not allowed to directly reach the object. The tool use opportunities were presented in the following order to prevent learning within the assessment: 1) unfamiliar, noncontiguous; 2) unfamiliar, contiguous; 3) familiar, noncontiguous; and 4) familiar, contiguous. Six trials (i.e., three trials using one of two comparable supports) were given for each of the four types of tools, providing a maximum of 24 tool use opportunities. A passing response consisted of a subject retrieving the desired object with the tool. Each subject received credit for passing a given type of

tool use if at least one correct response at that level was exhibited. The total possible score for tool use was four.

Imitation

Assessments of gestural and vocal imitation were administered to each subject using the procedures and scoring criteria described by Uzgiris and Hunt (1975). Four imitation schemes were assessed based on familiarity and complexity and are shown in Appendix C. A maximum of five trials was presented to obtain the best possible performance. Each subject received credit for passing a given imitation item if at least two differentiated instances of correct responding at that level were exhibited. The total possible score for gestural imitation and for vocal imitation was four.

Play

Measures of combinatorial and symbolic play were derived separately from videotaped samples of free play and elicited play (see Appendix A for materials). On the second videotaping session, an elicited play setting was videotaped following the free play setting described above. The elicited play setting consisted of probing spontaneous object manipulation, subsequent to modeled opportunities in the following manner. First, the investigator modeled appropriate play behaviors with one item from each of the five sets of toys or objects listed in Appendix A. Subsequently, the child was presented with this modeled item and encouraged to play with it. Finally, the child was presented with a generalization item from the same set of toys or objects and was encouraged to play with it. Imitation of the modeled action scheme with

the modeled item was not considered as play behavior. Application of the modeled action scheme with the generalization item was reflected in the scoring system if that level of play was not displayed spontaneously. The scoring system for combinatorial and symbolic play was designed by this investigator, based on the findings of Bates et al. (1979) and McCune-Nicolich (1981), and is presented in Appendix C. The score for combinatorial and symbolic play was the highest level displayed by each subject during the videotaped samples of free play and elicited play. The total possible score for combinatorial play and symbolic play was six. That is, a separate score, ranging from one to six, was obtained for each type of play.

Language Comprehension

Verbal language comprehension of the following eight semantic categories was assessed using the materials, procedures, and scoring criteria described by Miller and associates (1980): 1) person name, 2) object name, 3) action verb, 4) possessor-possession, 5) absent person or object, 6) action-object, 7) agent (other than child)-action, and 8) agent (other than child)-action-object. The investigator instructed the child verbally, using no gestural cues, to identify objects or carry out actions with objects. Each subject received credit for passing a given semantic category if at least two instances of correct responding at that level were displayed. Tasks five through eight were administered only if the relevant single-word comprehension was evidenced on tasks one through four. The total possible score for language comprehension was eight.

Data Analysis

In order to examine the subjects' communicative behaviors, the videotaped segments of free play and elicited communication were analyzed and coded according to the following steps: 1) transcription of videotapes, 2) segmentation of communicative acts, 3) analysis of communicative means, 4) derivation and ascription of functional categories, and 5) tabulation of individual subject's data. These steps are described in detail below.

Transcription of Videotapes

The initial phase of analysis was to transcribe the videotaped samples of free play and tempted communication from the two videotaping sessions. The transcription method used was a modified version of the notation system devised by Sugarman-Bell (1978) and adapted by Gaines (1981). Five participants, 25 objects, and 30 high frequency actions were coded using the notation system listed in Appendix D. All other participants, objects, and actions not contained in this list were written out using orthographic transcription. All vocalizations were transcribed and demarcated by slashes using broad phonetic transcription, and all verbalizations were written out and demarcated by quotation marks using orthographic transcription.

The child's stream of behaviors was recorded element-by-element to form a protocol of the on-going behaviors on the videotape. A behavioral element refers to an interaction between a participant and the other participant or an object, or any vocalization or verbalization. For example, each of the following comprises one behavioral element:

cPIk. . . . . .(child picks up kangaroo)

cOb . . . . . .(child looks at book)

cV/a/ . . . . . .(child utters the vocalization /a/)

Simultaneous behaviors were denoted with a · between the two co-occurring behavioral units, and sequential behaviors were denoted with a -- between behavioral elements. The transcript protocol took an average of ten hours to code for each subject. Two samples from the transcript protocol are presented in Appendix E.

Segmentation of Communicative Acts

The next phase of the analysis was to segment the transcript protocol into discrete communicative acts. A communicative act was defined as verbal behavior, vocal behavior, and/or kinesic behavior initiated by the child. For the purpose of this study, verbal behavior included all utterances that were identifiable as English morphemes and contained at least 75% of the phonemes in the adult code. For example, "tot off" used as an approximation of "top off" was considered to be verbal behavior, but "baba" used an an approximation of "bottle" was not considered to be verbal behavior. Vocal behavior consisted of all other utterances, including word-like approximations, babbling, and nonspeech sounds. All verbal and vocal behaviors were included as communicative acts whether used inside or outside of a communicative context. The rationale for including all verbal and vocal behavior in the analysis was that a behavior could not be determined to be noncommunicative without careful consideration of the preceding, co-occurring, and subsequent behaviors in the context. Therefore, the term "communicative act" may be a misnomer in reference to some of the segmented behaviors;

however, the quality was reflected in the analysis of communicative function. Inclusion of all verbal and vocal behavior in this phase of the analysis allowed for a comparison of the proportion of communicative and noncommunicative behavior displayed by the autistic and normal subjects to be derived later in the analysis. Kinesics, as defined by von Raffler-Engel (1981), are "message-related movements of the eye and other parts of the body as they function in an interactional exchange of a message" (p. 7). For the purpose of this study, kinesic behavior consisted of a nonrepetitive change in behavior addressed to a person or object, and included conventional gestures such as pointing, showing, and pushing away, and aberrant behaviors such as self-injury.

These communicative acts included only spontaneous gestures, vocalizations, and verbalizations initiated by the child and did not include any acts produced by the child in response to the investigator's verbal utterances in a dialogue context. Thus, the corpus of communicative acts did not consist of any immediate echolalia, but may have included delayed echolalia. A communicative act was commenced when the child initiated interaction with the adult or an object and was terminated when the child's attentional focus shifted or a turn was exchanged. One communicative act may consist of one behavioral element or several behavioral elements. And, one communicative act may consist of one word or several utterances. Examples of segmented communicative acts are shown in the transcript samples presented in Appendix E.

Analysis of Communicative Means

Following data transcription and segmentation, the communicative acts were described in terms of communicative means, i.e., kinesic,

vocal, or verbal behavior as defined above. Each communicative act was assigned to one of six categories of communicative means from the transcript protocol. These discrete categories were adapted from Bricker and Carlson (1980) and are presented in Table 1 below.

Table 1
Categories of Communicative Means

1) Simple Kinesic Behavior:	gesturing without looking or vocalizing
2) Simple Vocal Behavior:	vocalizing without gesturing or looking
3) Simple Verbal Behavior:	verbalizing without gesturing or looking
4) Compound Kinesic Behavior:	gesturing and looking
5) Compound Vocal Behavior:	vocalizing while looking and/or gesturing
6) Compound Verbal Behavior:	verbalizing while looking and/or gesturing

Analysis of Communicative Function

The category system used in the attribution of communicative function was not developed on an *a priori* basis. But rather, the categories were operationally defined based on a contrastive set of behaviors, such that all of the communicative acts displayed by the autistic and the normal children were ascribed to mutually exclusive categories. The work of Dore (1974, 1975), Halliday (1975), and Bates and associates (1979) with normal children and that of Prizant (1978), Prizant and Duchan (1981), and Prizant and Rydell (1981) with autistic children were utilized as a framework for defining the category system used in this study.

One criticism of descriptive studies of normal child language has been the lack of validation of the "rich interpretation" of primitive utterances, i.e., attributing too much meaning to the child's one- and two-word utterances without substantial empirical evidence to support an

intuitive judgement. In discussing the problem of criteria for valid attribution of function, Cazden (1977) stated that "the key ingredient here is contrast in co-occurring features of the child's linguistic and nonlinguistic behavior and of the speech situation" (p. 313). The work of Dore (1974) and that of Prizant (1978) served to exemplify the use of mutually exclusive combinations of critical features in attributing communicative functions to verbal utterances. The methodology used by these researchers was applied to kinesic and vocal communicative acts as well as verbal communicative acts.

Eight types of behavioral evidence were used to attribute functions to each communicative act displayed by the autistic and normal children:

1) the communicative means, i.e., verbal, vocal, or kinesic,
2) the linguistic context of the communicative act,
3) the nonlinguistic context of the communicative act, i.e., vocalizations, gestures, and facial expressions,
4) whether the child addressed the adult and/or an object or event,
5) whether the child did or did not await a response from the adult,
6) whether the child accepted or resisted subsequent adult response,
7) the nature of the adult's response, and
8) the situational context, i.e., the relevant aspects of events occurring immediately before, during, and after the communicative act.

After viewing and reviewing the videotapes, 15 functional categories were derived from mutually exclusive combinations of these eight

behaviors. The category system was determined by the number of communicative acts that shared a certain set of co-occurring features (e.g., child addresses adult, child awaits response, and adult responds by attending to child), and the saliency of the contrastive set of features. These 15 functional categories were not intended to be exhaustive for children other than the ones studied, and a finer-grained analysis may lead to a larger corpus of functional categories. However, it was felt that this category system was not too cumbersome for efficient use and yet was descriptive enough to characterize the communicative acts of the autistic and normal children.

Tabulation of Data

For each of the six types of communicative means, absolute frequency and percent of the total number of communicative acts displayed by each subject were calculated and tabulated. For each of the 15 categories of communicative function, absolute frequency and percent of the total number of communicative acts displayed by each subject were calculated and tabulated.

The assessment of the four areas of communicative intent, tool use, imitation, and play yielded two composite scores in each area except tool use and only one composite score in the area of tool use. Thus, seven composite scores were obtained for each subject from the cognitive-social assessment. Additionally, a composite score for language comprehension was obtained for each subject.

Reliability Procedures

Procedures to establish reliability were used at each phase of the study. One independent observer was trained to transcribe the videotapes using the notation system presented in Appendix D. The trained observer transcribed a randomly-selected 12-minute episode of each of the eight subject's 60-minute videotape. Transcripts were compared for interobserver agreement on the occurrence of each behavioral element. An agreement consisted of the co-occurrence of a behavioral element on each transcript protocol. A disagreement consisted of an omission, substitution, deletion, or addition of a behavioral element.

Subsequently, the observer was trained to segment the communicative acts. The trained observer segmented the 12-minute transcribed episodes for each of the eight subjects. Transcripts were compared for interobserver agreement on the occurrence of each communicative act. An agreement consisted of the equivalent inclusion of a series of behavioral elements constituting a kinesic, vocal, or verbal behavior within a segment on each transcript protocol. A disagreement consisted of a discrepancy in the inclusion of a kinesic, vocal, or verbal behavior.

The observer was trained in the category systems for coding communicative means and communicative functions. Twenty-five percent of the communicative acts displayed by each of the subjects was selected for rating by the independent observer. These communicative acts were selected from a continuous episode in the middle of the videotapes containing a sample of the free play and elicited communication settings. An agreement consisted of ascribing the communicative act to

the same category. Additionally, intra-observer reliability was calculated by having the investigator reanalyze the same 25% of the communicative acts and rate them for communicative function two months after the original analysis was conducted. The categorizations of the independent observer and the investigator were compared to the original analysis conducted by the investigator to calculate interobserver reliability for communicative means and communicative function and intra-observer reliability for communicative function.

Reliability of the measures of communicative intent, tool use, play, imitation, and language comprehension were obtained. An independent observer accompanied the investigator and rated each child's performance during the assessment of tool use, imitation, and language comprehension. An agreement consisted of the same score of correct or incorrect for each trial. An observer was trained in the use of the assessment scales for communicative intent and play. The trained observer rated an episode of elicited communication, free play, and elicited play for each of the subjects. An agreement consisted of ascribing the same level of performance for each opportunity of communication or play.

Reliability Results

The interobserver reliability for transcription of the 12-minute videotaped episodes was calculated for 1863 behavioral elements and was found to be 87.9% agreement. Interobserver reliability for segmentation of the 12-minute videotaped episodes was calculated for 361 communicative acts and was 95.8% agreement. Reliability for categorizing communicative means and communicative functions was

calculated for 435 communicative acts. Interobserver reliability for the six categories of communicative means was 100% agreement. Interobserver reliability for the 15 categories of communicative functions was 91.9% agreement, and intra-observer reliability for communicative functions was 92.9% agreement.

The interobserver reliability calculated for the assessment measures were as follows: 98.8% agreement for the communicative intent, 100% agreement for tool use, 96.2% agreement for play, 98.6% agreement for imitation, and 100% agreement for language comprehension.

CHAPTER III

RESULTS

The major results of this study may be summarized as follows:

1) There was wide individual variation in the profiles of communicative means, both within and across groups.

2) Despite the wide variation in communicative means, the autistic subjects displayed a relatively homogeneous profile of communicative function that was quantitatively and qualitatively different from the normal profile.

3) The measures of the cognitive-social abilities and language comprehension demonstrated scattered development for the autistic subjects.

The results are presented below for individual subjects, as well as for the autistic and normal groups. The Mann Whitney U test (Meredith, 1967) was performed to test for statistically significant differences between the groups.

Segmentation of the transcript protocol yielded 897 communicative acts for the autistic subjects and 832 communicative acts for the normal subjects. The autistic and normal subjects did not differ significantly in the number of communicative acts displayed during one hour of videotaping ($U = 8$; $p < .443$). Thus, the corpus of communicative acts displayed by each group did not differ in frequency; however, there was within-group variability for both the autistic and the normal children.

Communicative Means

The modality of communicative means was described according to the classifications of simple versus compound kinesic, vocal, and verbal behaviors. The number and percent of communicative acts for each of these six categories of communicative means are presented in Table 2. Variability in performance is evident both within groups and across groups, and this variability cannot be attributed to differences in developmental level.

A comparison of the modes of communicative means (i.e., kinesic, vocal, verbal) displayed by each subject is shown in Table 3 and Figure 1. Subjects A1, A2, N1, and N2 displayed kinesic and vocal behavior but no verbal behavior, indicating functioning at a preverbal level. It is important to point out that the rigorous definition of verbal behavior may underestimate referential abilities. Subjects A3, A4, N3, and N4 displayed kinesic, vocal, and verbal behavior. The most salient difference across groups was the proportion of kinesic behavior to vocal behavior displayed by the preverbal subjects. The preverbal autistic subjects (A1 and A2) displayed more kinesic behavior than vocal behavior, whereas the preverbal normal subjects (N1 and N2) displayed substantially more vocal behavior than kinesic behavior. The performance of the subjects displaying referential speech (A3, A4, N3, and N4) showed wide individual variability within groups. The normal subjects displayed substantially more verbal behavior than nonverbal behavior. This pattern was displayed by Subject A4; however, subject A3 displayed more vocal behavior than verbal behavior.

A comparison of the complexity of communicative means (i.e., simple versus compound) displayed by each subject is shown in Table 4 and Figure 2. With the exception of Subject A1, the autistic subjects

Table 2

Number and Percentage of Communicative Acts for Each Category of Communicative Means

	Simple Kinesic	Simple Vocal	Simple Verbal	Compound Kinesic	Compound Vocal	Compound Verbal
			Austic Subjects			
A1	124 (57.9%)	23 (10.7%)	*	15 (7.0%)	52 (24.3%)	*
A2	48 (23.0%)	41 (19.6%)	*	60 (28.7%)	60 (28.7%)	*
A3	21 (6.5%)	81 (25.2%	37 (11.5%)	15 (4.7%)	72 (22.4%)	96 (29.8%)
A4	9 (5.9%)	22 (14.5%)	40 (26.3%)	2 (1.3%)	7 (4.6%)	72 (47.4%)
Total	202 (22.5%)	167 (18.6%)	77 (8.6%)	92 (10.3%)	191 (21.3%)	168 (18.7%)
			Normal Subjects			
N1	18 (9.9%)	67 (36.8%)	*	17 (9.3%)	80 (44.0%)	*
N2	27 (17.8%)	53 (34.9%)	*	5 (3.3%)	67 (44.1%)	*
N3	2 (0.7%)	19 (6.9%)	123 (44.4%)	2 (0.7%)	11 (4.0%)	120 (43.3%)
N4	15 (6.8%)	20 (9.0%)	79 (35.8%)	10 (4.5%)	5 (2.3%)	92 (41.6%)
Total	62 (7.5%)	159 (19.1%)	202 (24.3%)	34 (4.1%)	163 (19.6%)	212 (25.5%)

Note: * indicates no occurence of this behavior.

Table 3

Number and Percentage of Communicative Acts for Each Mode of Communicative Means

	Kinesic	Vocal	Verbal
	Autistic Subjects		
A1	139 (65.0%)	75 (35.0%)	*
A2	108 (51.7%)	101 (48.3%)	*
A3	36 (11.2%)	153 (47.5%)	133 (41.3%)
A4	11 (7.2%)	29 (19.1%)	112 (73.7%)
Total	314 (35.0%)	358 (39.9%)	245 (27.3%)
	Normal Subjects		
N1	35 (19.2%)	147 (80.8%)	*
N2	32 (21.1%)	120 (78.9%)	*
N3	4 (1.4%)	30 (10.8%)	243 (87.7%)
N4	25 (11.3%)	25 (11.3%)	171 (77.4%)
Total	96 (11.5%)	322 (38.7%)	414 (49.8%)

Note: * indicates no occurrence of this behavior.

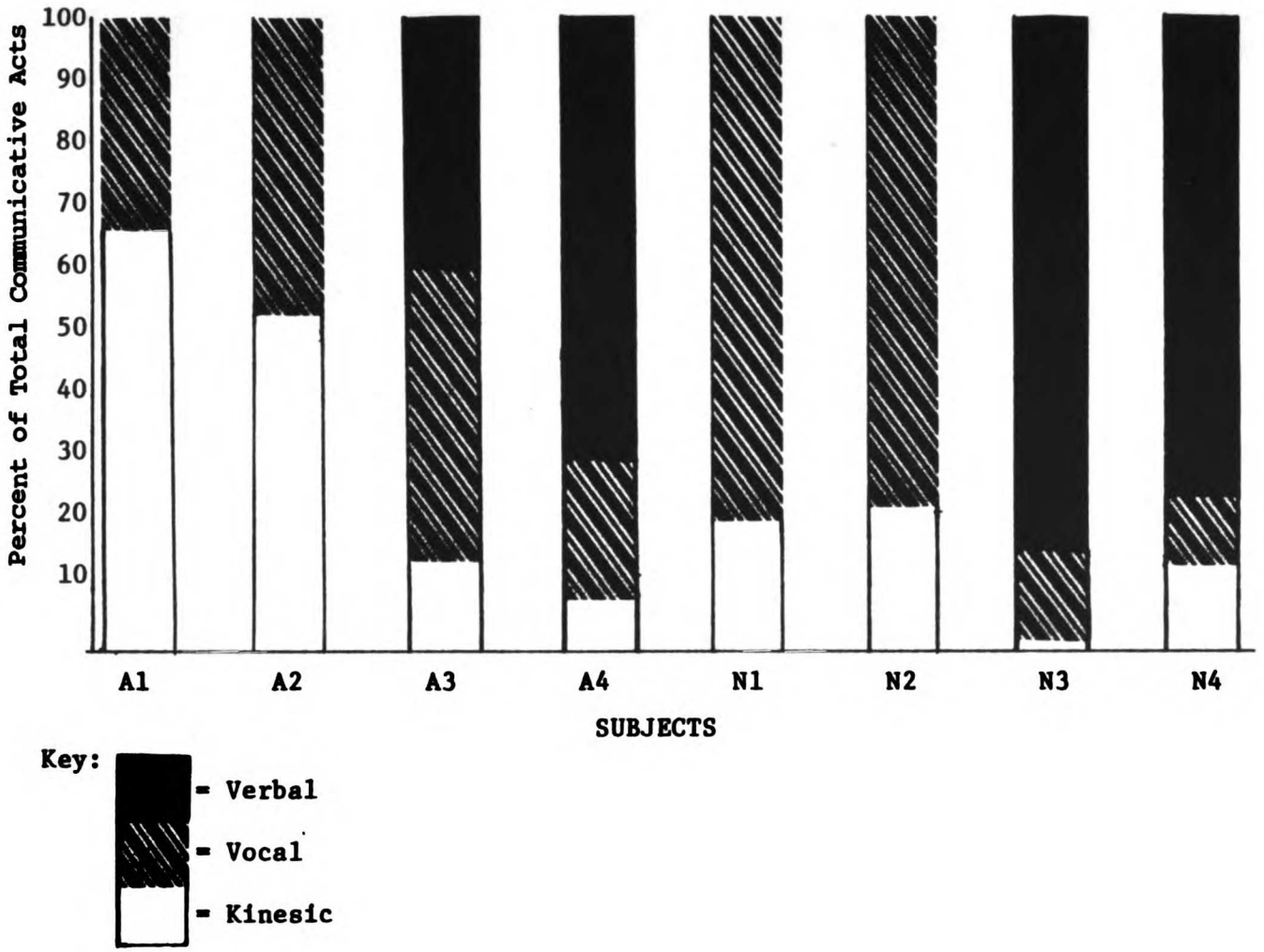

Figure 1. Individual Subject Profiles for Mode of Communicative Means

Table 4

Number and Percentage of Communicative Acts for Complexity of Communicative Means

	Simple	Compound
	Austic Subjects	
A1	147 (68.7%)	67 (31.3%)
A2	89 (42.6%)	120 (57.4%)
A3	139 (43.2%)	183 (56.8%)
A4	71 (46.7%)	81 (53.3%)
Total	446 (49.7%)	451 (50.3%)
	Normal Subjects	
N1	85 (46.7%)	93 (53.3%)
N2	80 (52.6%)	72 (47.4%)
N3	144 (52.0%)	133 (48.0%)
N4	114 (51.6%)	107 (48.4%)
Total	423 (50.8%)	409 (49.2%)

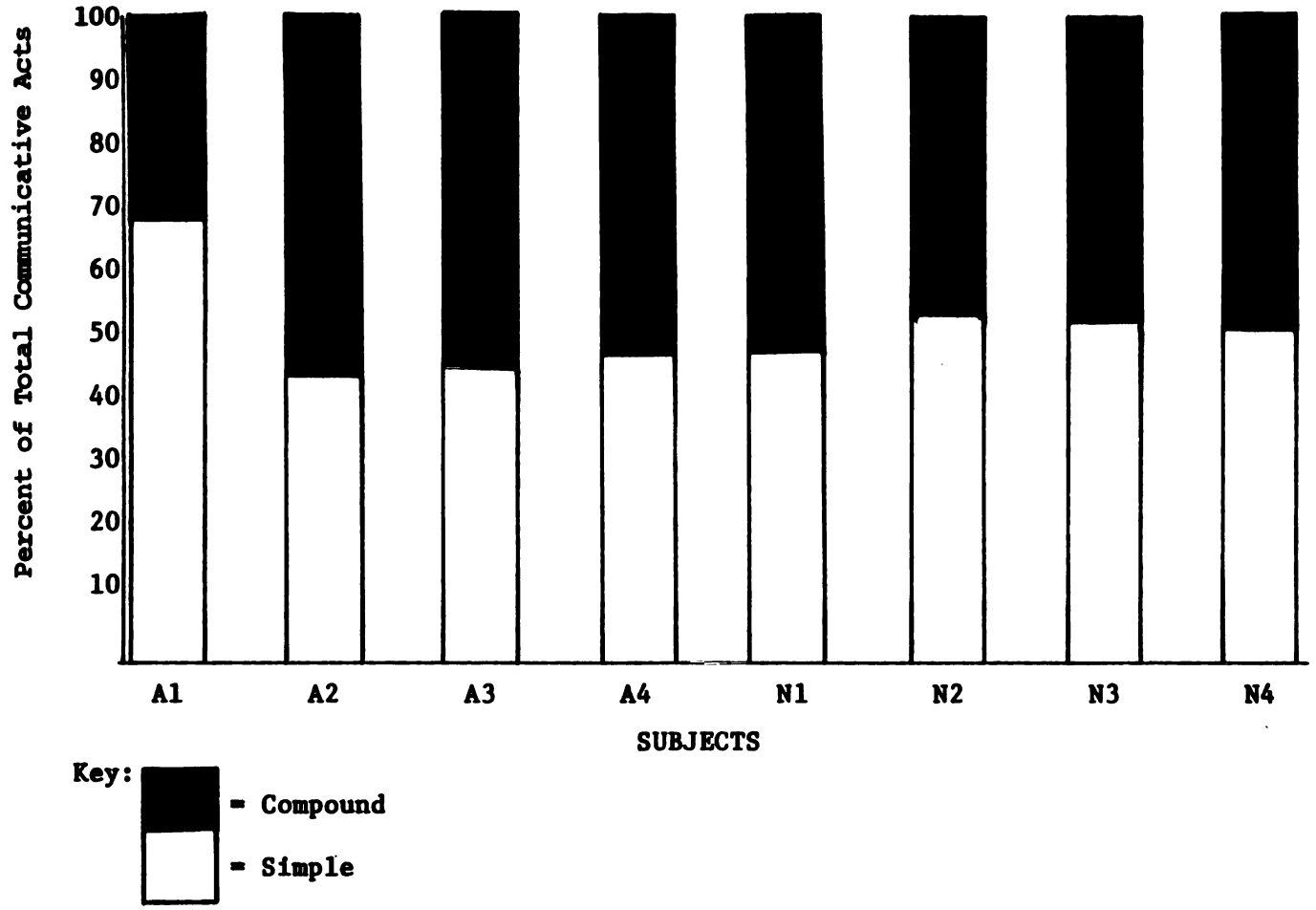

Figure 2. Individual Subject Profiles for Complexity of Communicative Means

displayed slightly more compound behavior than the normal subjects; however, the difference was not significant ($U = 5$; $p < .243$). Subject A1 displayed a disproportionately higher relative frequency of simple behaviors than compound behaviors. No developmental trends were evident for complexity of communicative means.

In summary, the analysis of communicative means indicated wide individual variation, both within and across groups, which could not be attributed to developmental trends. One major difference across groups was that the preverbal autistic subjects displayed a higher relative frequency of kinesic behavior than vocal behavior, whereas the preverbal normal subjects displayed a higher relative frequency of vocal behavior than kinesic behavior.

Communicative Functions

Fifteen categories of communicative functions were derived from the videotapes, based on the mutually exclusive combinations of critical features. The behavioral definitions of each category are presented below. The critical features necessary for inclusion in the category are delineated. Specific examples from the videotapes of each functional category are provided.

Request object.

1) Child addresses object or adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior (e.g., extending open hand), and/or displays resistance to subsequent adult response until object is obtained.

3) Communicative act may be a verbal, vocal, and/or kinesic behavior.

4) Adult responds by transferring a tangible object or indicates that the child cannot have the object requested.

5 Child accepts object when offered by adult, as evidenced by holding, interacting with, or consuming object.

The request object category is the "instrumental" (Halliday, 1975) function of language. The child's act serves the communicative function of signalling demand of a tangible object. As with all of the request functions, the act is communicative and there is evidence of intentionality. The act may or may not contain propositional information. Examples of the request object function include the verbal request "want some coke" and "more toy," vocalizing /baba/ while extending hand toward bottle, pointing to a toy, and pushing adult's empty hand toward food item.

Request action.

1) Child addresses object or adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.

2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior and/or displays resistance to subsequent adult response until action is carried out.

3) Communicative act may be a verbal, vocal, and/or kinesic behavior.

4) Adult responds by carrying out an action that involves a tangible object or the child's body or indicates with verbal or nonverbal behavior that the action will not be carried out.

5) Child accepts adult's action as evidenced by using the object that the action was carried out on.

The request action category is the "regulatory" (Halliday, 1975) or "directive" (Prizant & Rydell, 1981) function of language. The child's act serves to regulate the behavior of the adult. The act may or may not contain propositional information. Most of the communicative acts in this category were imperative acts to request assistance, e.g., child said "open" while giving container to adult or child put adult's hand on lid; however, there were some examples of directives in which the child was requesting an action but not seeking help, e.g., child said "sit down" while gesturing to the adult to sit on the couch.

Request social routine.

1) Child does not address object but does address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior or displays resistance to subsequent adult response until the social interaction is carried out.
3) Communicative act may be a verbal, vocal, or kinesic behavior.
4) Adult responds by carrying out a social interaction directed toward the child in a game-like situation; the interaction may involve the child's body-part, but does not involve the object.
5) Child accepts the adult's action, as evidenced by verbal or nonverbal indication of pleasure.

The request social routine category is a specific type of request action function in which the desired response is a social interaction

between the adult and the child, rather than between the adult and a tangible object. Examples from the videotapes follow. The adult initiated pat-a-cake and, subsequently, the adult put her hands in her lap. The child requested the social routine by the communicative act of pulling the adult's arms up and opening the adult's hands to a horizontal position. In another example, the child vocalized /zzz/ to request a social game initiated by the examiner in an earlier segment of the tape. This latter social game was novel to the child and involved the adult moving her hand around in the air as if it were an imaginary fly, and then making the imaginary fly land on the child's nose while producing a buzzing sound. There were no verbal examples of the request social routine function; however, a verbal act such as saying "play pat-a-cake" may have met the criteria necessary for this category.

Request permission.

1) Child may or may not address object, but child does address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior or displays resistance to subsequent adult response until permission is granted.
3) Communicative act may be a verbal, vocal, or kinesic behavior.
4) Adult responds by verbally and/or nonverbally granting or denying permission.
5) Child accepts the adult's permission by carrying out the action requested; child may resist denial of permission.

Request for permission is a later-emerging "regulatory" function according to Halliday's (1975) taxonomy. While the request action

function involves the adult carrying out the action, the request permission function involves the child carrying out the action. All the examples displayed on the videotapes were verbal, e.g., "wanna go potty okay" to request permission to go to the bathroom, or "doll walk" to request permission to take the doll for a walk. Although there were no prelinguistic examples, it is possible to request permission through vocal and/or kinesic means, e.g., pointing, grunting and alternating eye contact between the adult and the bathroom to request permission to go to the bathroom.

1) Child may or may not address object, but child does address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior or displays resistance to subsequent adult response until information is attained.
3) Communicative act must have referential value, i.e., verbal, signed, or alternative language system.
4) Adult responds verbally by conveying information or acknowledges that a question was asked.
5) Child acknowledges the adult's response by discontinuing the request for information.

The request information category is requesting an answer (Dore, 1974) and the "heuristic" function of language (Halliday, 1975) and is a later-emerging pragmatic function. The act serves the communicative function of finding out about an object or event and has the form of an interrogative. The act must be propositional. Examples from the videotapes include, "what happened" uttered immediately after some boxes

fell causing a loud noise, and "what is that" uttered while pointing to a picture in a book.

Protest.

1) Child addresses object/event or adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze or other nonverbal behavior and/or displays resistance to subsequent adult response until undesired action is ceased.
3) Communicative act may be a verbal, vocal, and/or kinesic behavior.
4) Adult responds by ceasing an undesired action that involves a tangible object or the child's body, removing an undesired object, or indicates through verbal or nonverbal means that the protest will not be met.
5) Child discontinues protest when the undesired action is ceased.

The protest category falls within the "instrumental" function described by Halliday (1975). The child resists an adult action or rejects an object that is offered. The protest function may be viewed as a specific type of request action or directive in which the child is commanding the adult to carry out an action. In the case of the protest, the adult response involves the cessation of an undesired action, whereas in the case of the request action, the adult response involves the commencement of a desired action. The child indicates discontent through linguistic or prelinguistic means and demonstrates evidence of intentionality. Examples from the videotapes include a child pushing away the adult's hand when an undesired food item was

offered to the child, a child saying" will you stop it" while the adult is blowing up a balloon, and a child slapping her (own) face after the adult pulled her back into her seat.

Acknowledgement of other.

1) Child does not address object, but child does address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze, subsequent gaze check, or other nonverbal behavior.
3) Communicative act may be a verbal, vocal, and/or kinesic behavior.
4) Adult responds by focusing attention to the child, as evidenced by nonverbal (e.g., approaching the child, looking at the child, displaying back-channel cues such as nodding head, vocalizing uh-huh or yeah) or verbal (i.e., answering) means.
5) Child repeats acknowledgement until the adult has attended to him/her.

The acknowledgement of other category includes greeting, calling (Dore, 1974), and other conversational devices such as politeness markers and boundary markers (Dore, 1977). These different functions were displayed infrequently, and therefore, it was decided to classify these acts into a single category based on the similar contextual features. The acknowledgement of other category is the "interactional" function of language (Halliday, 1975) in which the child indicates notice of the adult's presence for a communicative purpose. The communicative act may or may not be propositional. There is evidence of

intentionality. Examples include waving or saying "hi" or "bye" when a person arrives or leaves, shouting "mom" when the child's mother is across the room, saying "thank you" or giving the adult a kiss after a desired object was given to the child, and saying "sorry" after breaking a toy belonging to the adult.

Showing-off.

1) Child does not address object, but child does address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze, subsequent gaze check, or other nonverbal behavior.
3) Communicative act is a gestural performance which may or may not be accompanied by a vocal or verbal behavior.
4) Adult responds by focusing attention to the child, as evidenced by looking at the child and smiling, laughing, applauding, or praising verbally.
5) Child shows contentment from adult's praise, as evidenced by smiling, clapping, repeating gestural performance, or other nonverbal behavior.

The showing-off category serves the "look at me" function of attracting attention to one's self. The act is a gestural performance involving the child's body. An object may or may not be used as a prop. The gestural performance may be accompanied by a vocal or verbal behavior, such as "watch" or "look," for the purpose of guiding the adult's attention to the source of showing-off. There is evidence of intentionality. Examples from the videotapes include a child putting a lid on a jar, then clapping and looking at the adult, and a child

holding his hands over his eyes, slowly uncovering his eyes, and then looking at the adult and laughing. Frequently, the initial performance was accidental, and after realizing that the performance attracted the adult's attention, the child repeated the performance. Unless intentionality was evidenced on the first performance, only the repetitions were classified as showing-off.

Commenting.

1) Child addresses object or event and addresses adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.
2) Child awaits response from adult, as evidenced by eye gaze, subsequent gaze check, or other nonverbal behavior.
3) Communicative act may be a verbal, vocal, and/or kinesic behavior.
4) Adult responds by focusing attention to the object or event commented upon, and may subsequently focus attention to the child, as evidenced by eye gaze and accompanying nonverbal and verbal behavior, to acknowledge the comment.
5) Communicative act immediately follows the child's participation in or observation of an event, an action, or handling of an object; child resumes previous activity subsequent to gaze check.

The comment category serves the "look at this" function of attracting attention to an object or event. The act is communicative and intentional and may or may not have referential meaning. The comment function includes such acts as showing (Bates et al., 1979) (i.e., holding up an object to show an adult), describing, informing,

and interactive labelling (Prizant & Rydell, 1981) (i.e., labelling an object or event while addressing adult and awaiting a response). Examples from the videotapes include saying "that's wet" while looking at the adult and touching the spot where a drink spilled, holding a toy car out toward the adult and smiling while looking at the adult, and saying, "I got the ball" immediately after taking the ball from the adult.

Self-regulatory.

1) Child addresses object or event, as evidenced by eye gaze, body orientation, physical contact, and/or gesture, but does not address adult.
2) Child does not await response from adult.
3) Communicative act must have referential value, i.e, verbal, signed, or an alternative language system.
4) Adult does not respond.
5) Communicative act immediately precedes or co-occurs with a motoric response enacted by the child involving the child's body or an object.

The self-regulatory category appears to serve a cognitive rather than a communicative function (Prizant & Duchan, 1981) in which the child verbally directs or regulates his/her own behavior. The communicative act must be linguistic. There is evidence of intentionality. All examples from the videotapes were verbal and include a child saying "sit down" immediately before making the clown sit in the toy car, saying "put on" immediately prior to putting the ring on the pole, saying "brush" while child is brushing her own hair and looking in a mirror, and saying "put your hands down" immediately before

the child ceases the self-injurious act of slapping her face. The self-regulatory category and the request permission share the common situational feature of the child carrying out an action subsequent to the communicative act. However, the self-regulatory act is not produced in an interactive manner (i.e., not directed to the adult, and not awaiting adult response), whereas the request permission act is interactive.

Label.

1) Child addresses object, as evidenced by eye gaze, body orientation, physical contact, and/or gesture, and the child does not address adult.
2) Child does not await response.
3) Communicative act may be a verbal, vocal, and/or kinesic behavior.
4) Adult may or may not respond by focusing attention to the child or verbally acknowledging the act; however, the child does not acknowledge the adult's response.
5) Communicative act is produced in reference to a particular object, as evidenced by a demonstrative gesture or physical contiguity with the object.

The label category appears to serve a cognitive or self-communicative function of identifying the referent and pointing out that referent or objectifying the symbol that represents the referent. The act is noninteractive and may or may not have referential value. There is evidence of intentionality. Examples include pointing to an object, pointing and vocalizing, and naming an object. Labelling in an

interactive manner was displayed infrequently and was ascribed to the comment category.

Performative.

1) Child addresses object, as evidenced by eye gaze, body orientation, physical contact, and/or gesture, and the child does not address adult.

2) Child does not await response.

3) Communicative act must be a prereferential vocalization.

4) Adult may or may not respond by focusing attention to the child or verbally acknowledging the act; however, the child does not acknowledge the adult's response.

5) Communicative act is produced in conjunction with a particular action scheme so as to form a ritual.

The performative category appears to serve a cognitive or self-communicative function of imaginative play. In the normal child language literature, the term performative has been applied to a variety of behaviors, including speech acts that perform an action by being said (Austin, 1962; Searle, 1969; Dore, 1977), as well as prelinguistic gestures and vocalizations precursory to linguistic forms (e.g., Bates et al., 1975). The performative act, as used here, refers to performative sounds, i.e., sound effects that accompany action schemes applied to objects. Examples from the videotapes include vocalizing rmm rmm while pushing a toy car, vocalizing bye bye while closing a book, vocalizing pkkk while banging an airplane on the floor as if it were crashing, and vocalizing uh uh while trying to open the lid on a jar. The performative acts were usually ritualized in that the particular vocalization was produced every time that a specific action scheme was

carried out (e.g., every time one child closed a book, he uttered bye bye; on several occasions he reopened the book and closed it, apparently for the self-enjoyment of reuttering bye bye).

Exclamatory.

1) Child addresses object or event and may or may not address adult, as evidenced by eye gaze, body orientation, physical contact, and/or gesture.

2) Child does not await response.

3) Communicative act must be a nonpropositional vocalization or gesture.

4) Adult may or may not respond by focusing attention to the child or verbally acknowledging the act; however, the child does not acknowledge the adult's response.

5) Communicative act immediately succeeds a salient event.

The exclamatory category serves to express an emotional reaction to an event or situation. Referring to these expressions as communicative acts is perhaps a misnomer in that there is no clear evidence of communicative function nor intentionality. The act does not contain propositional information. The act appears to be to a certain degree an automatic emotional response to an event, including the expression of surprise, pleasure, frustration, and discontent. Examples from the videotapes include clapping and smiling after a wind-up kangaroo jumps, screaming and shaking both arms after the adult blows bubbles, vocalizing oops after the child drops a toy, and vocalizing yuck after tasting an undesirable food item.

Reactive.

1) Child addresses object, as evidenced by eye gaze, body orientation, physical contact, and/or gesture, and does not address adult.

2) Child does not await response.

3) Communicative act must be a nonpropositional vocalization.

4) Adult does not respond to the communicative act, but may subsequently attempt to involve the child in an alternate activity.

5) Communicative act is displayed while the child is physically manipulating or visually examining an object.

The reactive category may serve a self-stimulatory or practicing (Dore, 1974) function. The child vocalizes or babbles while interacting with or looking at an object. It is clearly a misnomer to refer to reactive acts as communicative; however, the initial segmentation of communicative acts from the transcript protocol included all vocal and verbal acts. The child is focusing attention to an object and appears to be reacting to that object, but there is no evidence of propositional value or intentionality. Included in this category are vocalizations produced while the child is engaged in self-stimulatory behavior with an object or body-part if the child is focusing attention to that object/body-part. Examples from the videotapes include vocalizing dododo while spinning the wheel of a toy car, vocalizing wewewenononо while holding and looking at the kangaroo, vocalizing bobu while putting hand inside jar, and vocalizing /i i i/ while watching a fire burn.

Nonfocused.

1) Child does not address object or adult.

2) Child does not await response.

3) Communicative act must be a nonpropositional vocal or verbal behavior.

4) Adult does not respond to the communicative act, but may subsequently attempt to involve the child in an alternate activity.

5) Communicative act is displayed while the child is not focusing attention to a person, object, or event.

The nonfocused category (Prizant & Duchan, 1981) may serve a self-stimulatory or practicing function, like the reactive category, or it may serve no apparent function. A vocal or verbal behavior is produced although the child is not focusing attention on any object or person; therefore, no propositional value can be attributed to the utterance. There is not evidence of intentionality or communicative function, and, like reactive acts, it is a misnomer to refer to nonfocused acts as communicative. There were some instances on the videotapes in which an utterance was initially produced in an interactional manner for a communicative function (e.g., child saying "good bye" while looking at the adult to protest sitting at the table with the adult) and subsequently repeated in a stereotypic manner meeting the criteria of the nonfocused category (e.g., child repeating "good bye good bye" while looking away and after having departed from the table). Nonfocused acts were often produced during an agitated state, as in the above example, or while the child was engaged in self-stimulatory behavior. Other examples include a child vocalizing wawawawa while rocking and looking away and a child uttering here here here here here while flapping her hand and looking away.

The critical features of the 15 categories of communicative function are summarized in Table 5.

Individual Subject Profiles

The number and percent of communicative acts in each functional category relative to the total number of acts by the autistic and normal groups are presented in Table 6. As shown in Figure 3, distinct profiles of communicative function become apparent for the two groups. The number and percent of acts in each category relative to the total number of communicative acts displayed by each subject are presented in Table 7. Individual subject profiles are portrayed in Figure 4 for the autistic subjects and in Figure 5 for the normal subjects. As can be seen, the autistic subjects displayed a more limited repertoire of communicative functions than the normal subjects.

The autistic subjects displayed a relatively homogeneous profile of communicative functions that was quantitatively and qualitatively different than the normal profile. The four autistic subjects displayed a high frequency of request object, request action, and protest functions and a low frequency of exclamatory, reactive, and nonfocused acts. All four autistic subjects showed an absence of acknowledgement of other, showing-off, comment, and label functions. Three out of four of the autistic subjects displayed the request social routine function. Of the two autistic subjects with referential speech (A3 and A4), one used the request permission function, one displayed a performative act, both displayed a low frequency of self-regulatory acts, and neither showed a request for information.

Table 5

Summary of Critical Features of Categories of Communicative Function

Function	Addresses Adult	Addresses Object/Event	Awaits Response	Adult's Response	Means
RO (request object)	May or may not	Yes	Yes	Environmental	Any
RA (request action)	Yes	May or may not	Yes	Environmental	Any
RS (request social routine)	Yes	No	Yes	Social	Any
RP (request permission)	Yes	No	Yes	Social	Any
RI (request information)	Yes	No	Yes	Social	Verbal
PR (protest)	May or may not	Yes	Yes	Environmental	Any
AO (acknowledgement of other)	Yes	No	Yes	Social	Any
S (showing-off)	Yes	No	Yes	Social	Gestural
C (comment)	Yes	Yes	Yes	Social	Any
SR (self-regulatory)	No	Yes	No	None	Verbal
L (label)	No	Yes	No	None	Any
P (performative)	No	Yes	No	None	Vocal
EX (Exclamatory)	May or may not	Yes	No	None	Vocal or gestural
RE (reactive)	No	Yes	No	None	Vocal or verbal
NF (nonfocused)	No	No	No	None	Vocal or verbal

Table 6
Total Number and Percentage of Communicative Acts for
Each of the Functional Categories for the Autistic and Normal Subjects

Function	Autistic Subjects	Normal Subjects
RO (request object)	282 (31.4%)	131 (15.7%)
RA (request action)	193 (21.5%)	138 (16.6%)
RS (request social routine)	20 (2.2%)	*
RP (request permission)	20 (2.2%)	5 (0.6%)
RI (request information)	*	13 (1.6%)
PR (protest)	205 (22.9%)	85 (10.2%)
AO (acknowledgement of other)	*	30 (3.6%)
S (showing-off)	*	38 (4.6%)
C (comment)	*	114 (13.7%)
SR (self-regulatory)	4 (0.4%)	31 (3.7%)
L (label)	*	138 (16.6%)
P (performative)	1 (0.1%)	33 (4.0%)
EX (Exclamatory)	47 (5.2%)	34 (4.1%)
RE (reactive)	49 (5.5%)	40 (4.8%)
NF (nonfocused)	76 (8.5%)	2 (0.2%)
	897	832

Note: *No occurrence of this behavior

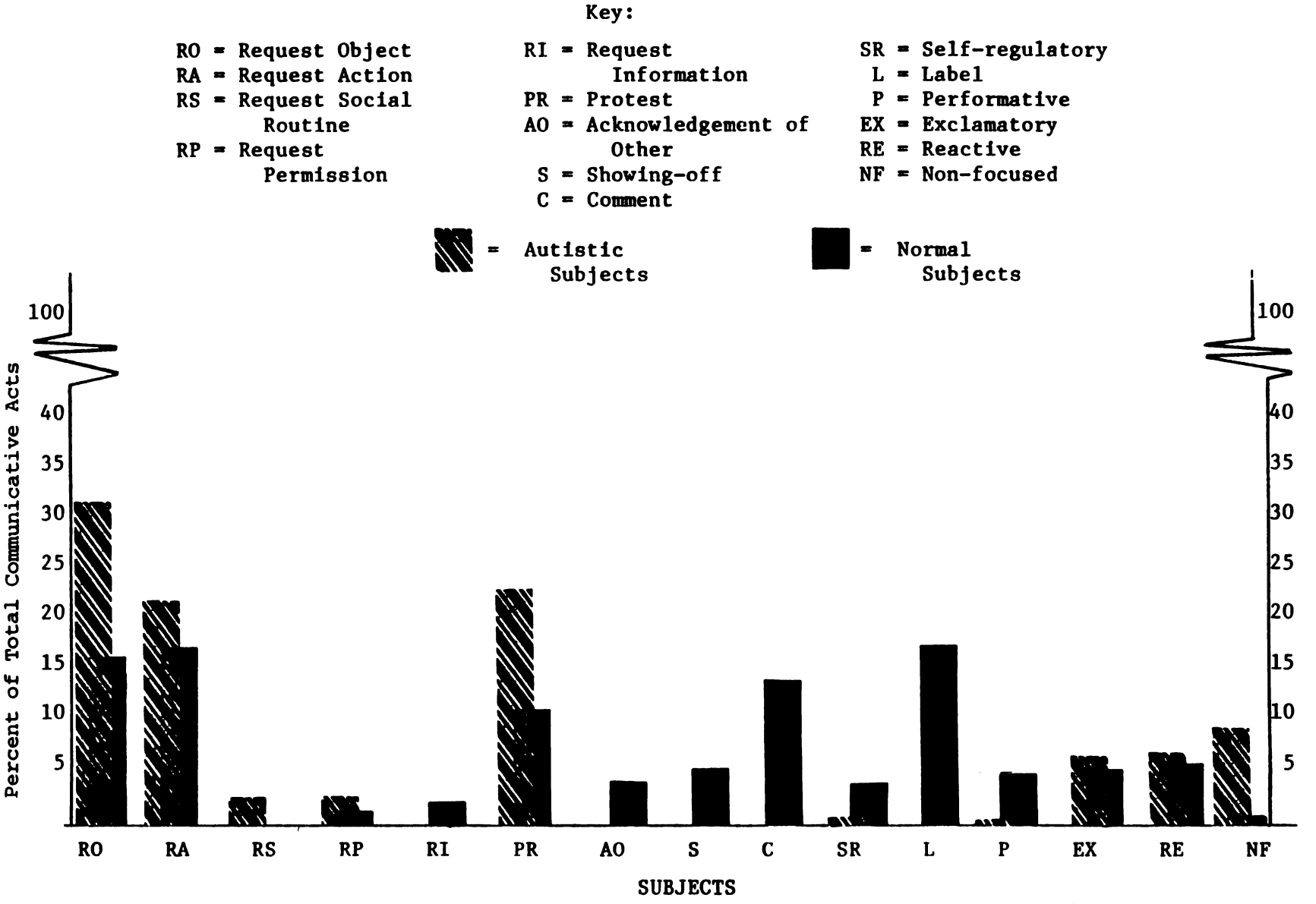

Figure 3. Profiles of Communicative Functions for the Autistic and Normal Subjects

Table 7
Number and Percentage of Comunicative Acts for Each Functional Category

Function	Autistic				Normal			
	A1	A2	A3	A4	N1	N2	N3	N4
RO	64 (29.9%)	82 (39.2%)	104 (32.3%)	32 (21.1%)	14 (7.7%)	39 (25.7%)	49 (17.7%)	29 (13.1%)
RA	63 (29.4%)	44 (21.1%)	29 (9.0%)	57 (37.5%)	24 (13.2%)	9 (5.9%)	69 (24.9%)	36 (16.3%)
RS	3 (1.4%)	7 (3.3%)	10 (3.1%)	*	*	*	*	*
RP	*	*	20 (6.2%)	*	*	*	2 (0.7%)	3 (1.4%)
RI	*	*	*	*	*	*	*	13 (5.9%)
PR	64 (29.9%)	35 (16.7%)	66 (20.5%)	40 (26.3%)	11 (6.0%)	32 (21.1%)	26 (9.4%)	16 (7.2%)
AO	*	*	*	*	14 (7.7%)	2 (1.3%)	11 (4.0%)	3 (1.4%)
S	*	*	*	*	18 (9.9%)	3 (2.0%)	2 (0.7%)	15 (6.8%)
C	*	*	*	*	16 (8.8%)	21 (13.8%)	31 (11.2%)	46 (20.8%)
SR	*	*	3 (0.9%)	1 (0.7%)	*	*	19 (6.9%)	12 (5.4%)
L	*	*	*	*	29 (15.9%)	29 (19.1%)	53 (19.1%)	27 (12.2%)
P	*	*	*	1 (0.7%)	11 (6.0%)	*	5 (1.8%)	17 (7.7%)
EX	2 (0.9%)	15 (7.2%)	23 (7.1%)	7 (4.6%)	14 (7.7%)	8 (5.3%)	8 (2.9%)	4 (1.8%)
RE	3 (1.4%)	16 (7.7%)	24 (7.5%)	6 (3.9%)	29 (15.9%)	9 (5.9%)	2 (0.7%)	*
NF	15 (7.0%)	10 (4.8%)	43 (13.4%)	8 (5.3%)	2 (1.1%)	*	*	*
Totals	214	209	322	152	182	152	277	221

Note: *No occurrence of this behavior

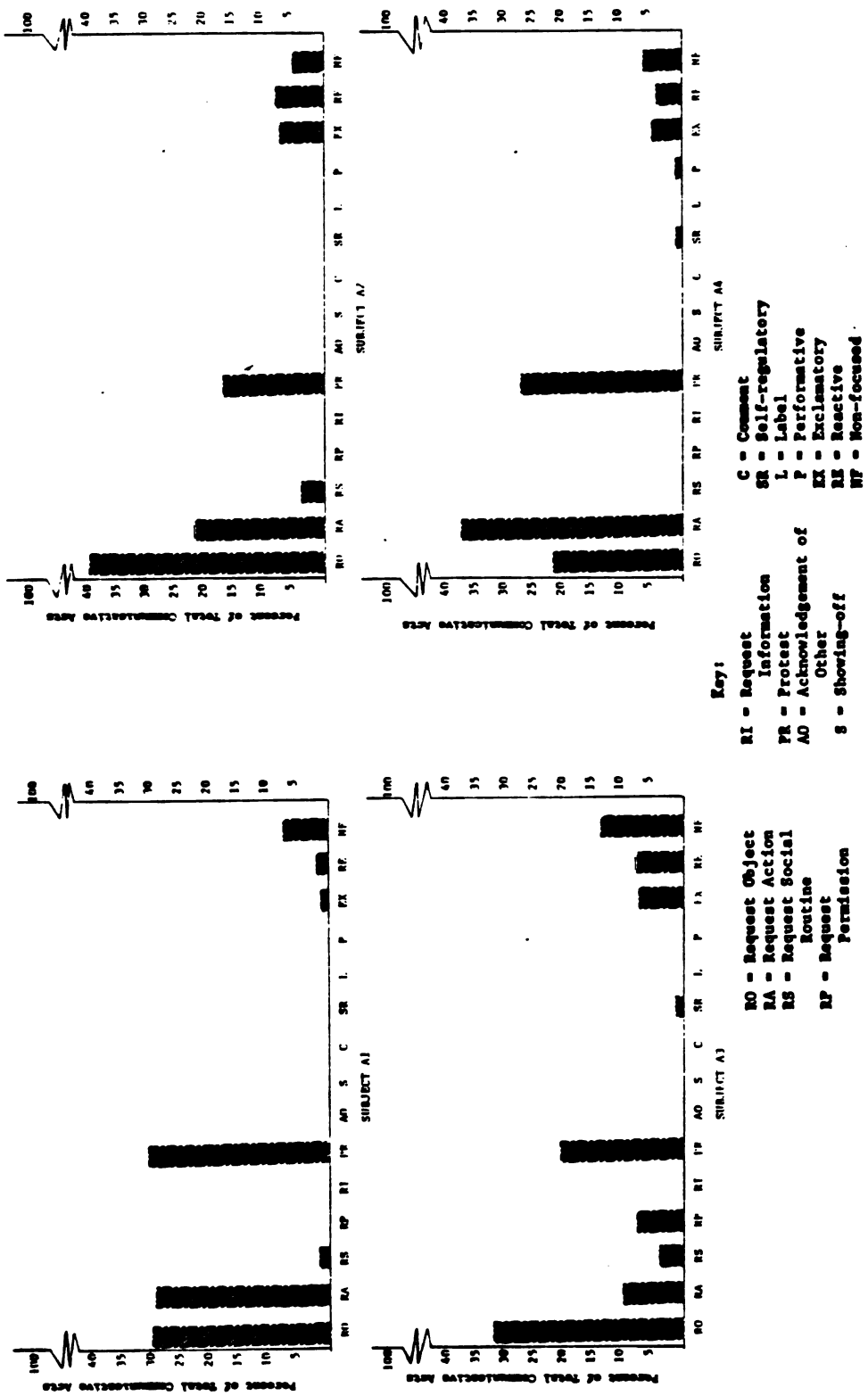

Figure 4. Individual Subject Profiles of Communicative Function for the Autistic Subjects

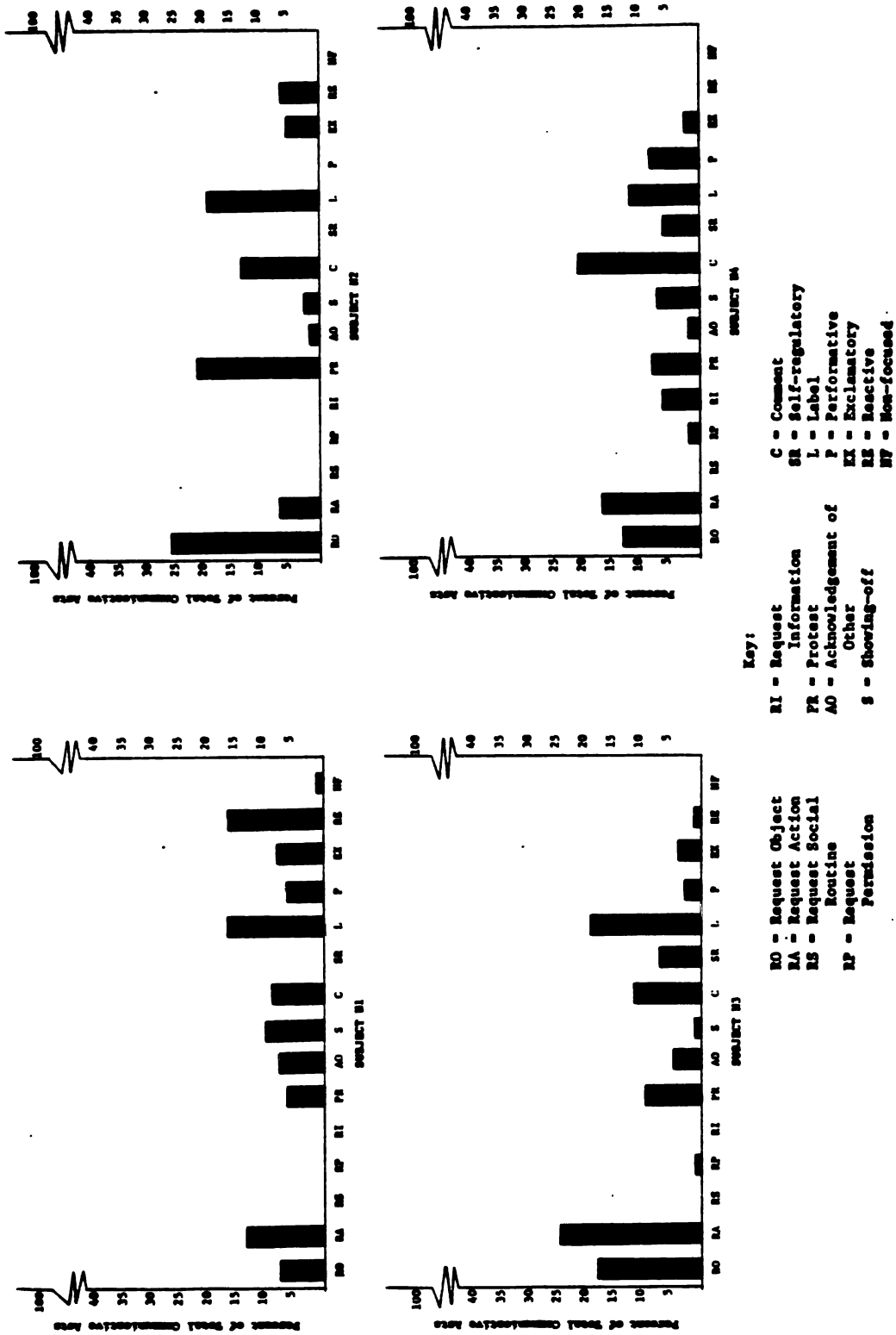

Figure 5. Individual Subject Profiles of Communicative Function for the Normal Subjects

The normal subjects displayed individual variation in profile of communicative function that is suggestive of a developmental pattern. That is, with advancing age and developmental level, there was an increase in the relative frequency of request permission, request information, and self-regulatory functions, and a decrease in the relative frequency of exclamatory, reactive, and nonfocused acts. The normal children showed an absence of request social routine acts. Nonfocused acts were displayed only by the youngest normal child.

Group Patterns

Group patterns emerge as the data are compared in alternate ways. Table 8 and Figure 6 compare the proportion of communicative acts produced in an interactive manner, i.e., by addressing an adult or object and awaiting adult response (RO, RA, RS, RP, RI, PR, AO, S, C), versus noninteractive manner (SR, L, P, EX, RE, NF) for each of the subjects. The autistic subjects displayed significantly more interactive acts than the normal subjects ($U = 1$; $p < .029$).

The finding that the autistic subjects produced as many or more interactive acts than the normal subjects was further examined by comparing the nature of the adult's response for the interactive acts (i.e., RO, RA, RS, RP, RI, PR, AO, S, C). A comparison of interactive acts leading to an environmental consequence, i.e., a response satisfying a physical want or need (RO, RA, PR) versus a social consequence, i.e., a verbal and/or nonverbal response involving the adult focusing attention to the child (RS, RP, RI, AO, S, C) is shown in Table 9 and Figure 7. All subjects displayed a higher proportion of interactive acts leading to an environmental response than to a social

Table 8
Number and Percentage of Interactive (RO, RA, RS, RP, RI, PR, AO, S, C) versus Noninteractive (SR, L, P, EX, RE, NF) Communicative Acts for Each of the Autistic and Normal Subjects

	Interactive	Noninteractive
	Austic Subjects	
A1	194 (90.7%)	20 (9.3%)
A2	168 (80.4%)	41 (19.6%)
A3	229 (71.1%)	93 (28.9%)
A4	129 (84.9%)	23 (15.1%)
Total	720 (80.3%)	177 (19.7%)
	Normal Subjects	
N1	97 (53.3%)	85 (46.7%)
N2	106 (69.7%)	46 (30.3%)
N3	190 (68.6%)	87 (31.4%)
N4	161 (72.9%)	60 (27.1%)
Total	554 (66.6%)	278 (33.4%)

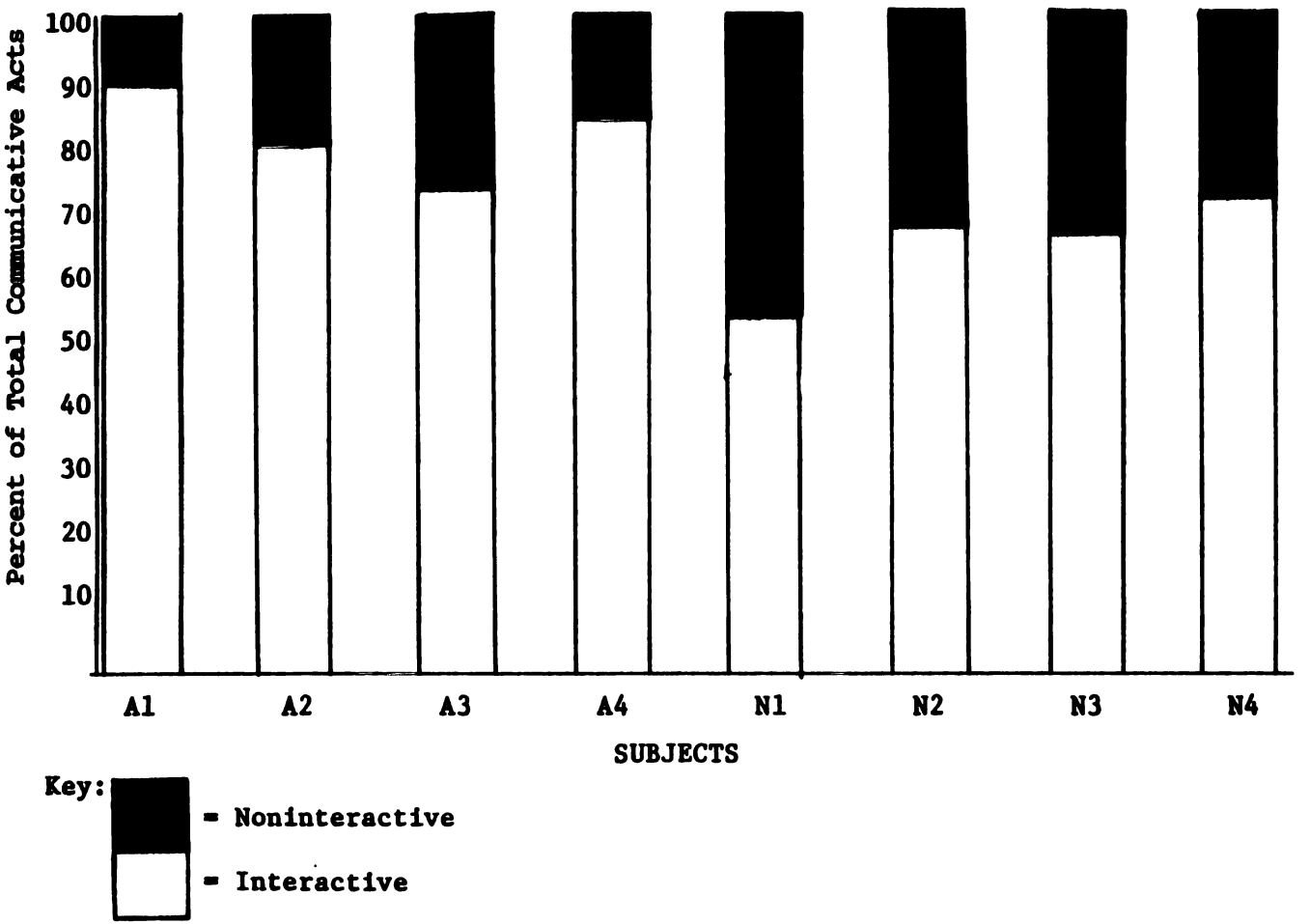

Figure 6. Individual Subject Profiles for Interactive versus Noninteractive Communicative Functions

Table 9
Number and Percentage of Interactive Acts Leading to Environmental (RO, RA, PR) versus Social (RS, RP, RI, AO, S, C) Responses for Each of the Autistic and Normal Subjects

	Environmental	Social
	Austic Subjects	
A1	191 (98.5%)	3 (1.5%)
A2	161 (95.8%)	7 (4.2%)
A3	199 (86.9%)	30 (13.1%)
A4	129 (100.0%)	*
Total	680 (94.4%)	40 (5.6%)
	Normal Subjects	
N1	49 (50.5%)	48 (49.5%)
N2	80 (75.5%)	26 (24.5%)
N3	144 (75.8%)	46 (24.3%)
N4	81 (50.3%)	80 (49.7%)
Total	354 (63.9%)	200 (36.1%)

Note: *No occurrence of this behavior

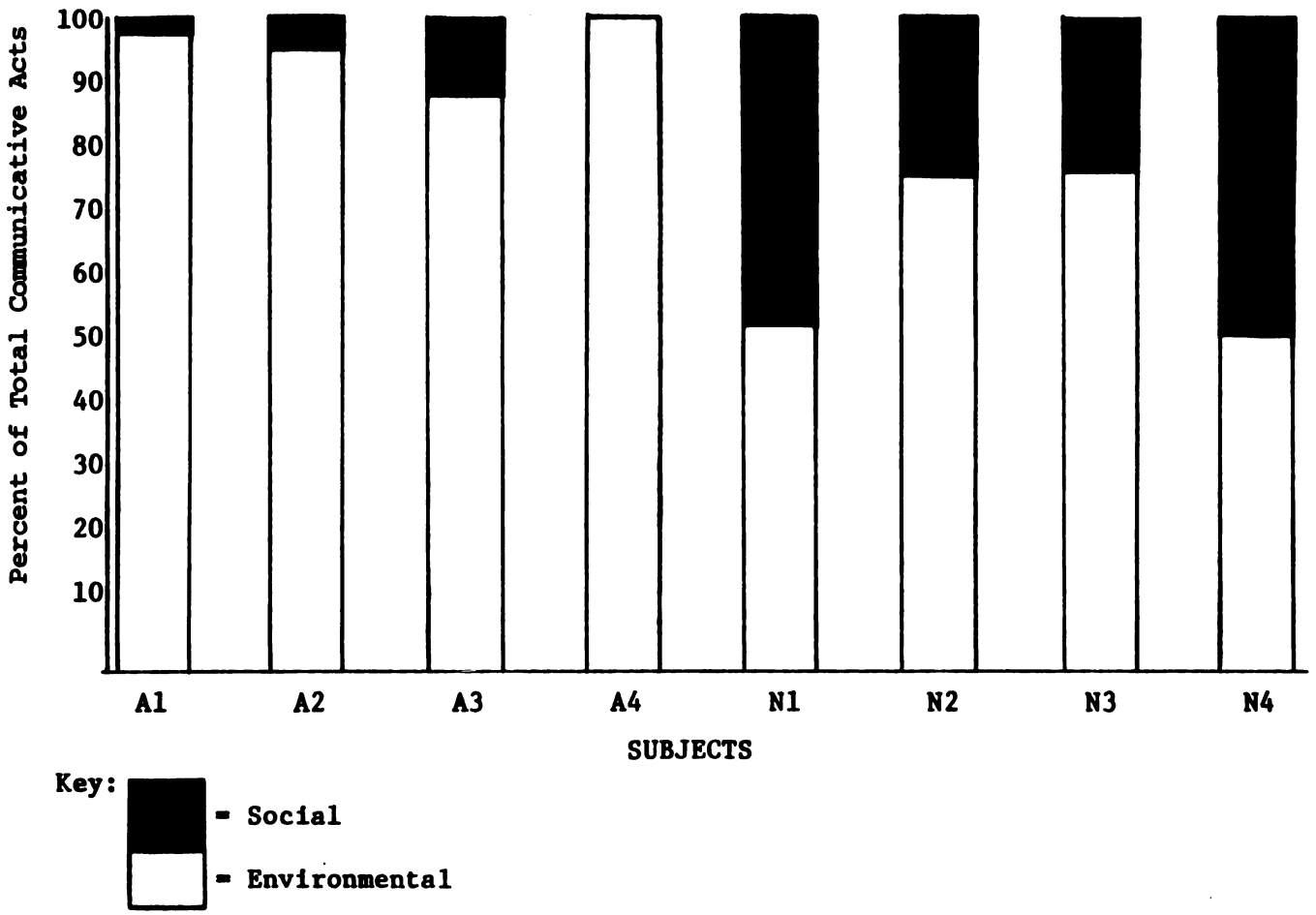

Figure 7. Individual Subject Profiles for Environmental versus Social Responses for Interactive Communicative Functions

response. However, all four autistic subjects displayed a higher proportion of environmental acts than the four normal subjects, and therefore, this difference was statistically significant ($U = 0$; $p < .014$). The normal subjects showed a wide range of variation in the percentage of social interactive acts, from 25% to 50%. Social interactive acts were displayed infrequently by the autistic subjects.

Cognitive/Social Assessment

The results of the cognitive-social assessment of the areas of communicative intent, tool use, imitation, and play are presented in Table 10. Each scale was designed to be an ordinal measure of developmental ability; however, the scales are not equivalent across areas of assessment, e.g., a composite score of six on the assessment of communicative intent does not reflect the same developmental level as a score of six on the play assessment. Of particular interest was the sensorimotor stage level designated by the composite score. The normal literature (Piaget, 1952, 1954, 1962; Uzgiris & Hunt, 1975; Miller et al., 1980) was used as a guide to differentiate between Stage IV (eight to 12 months), Stage V (12 to 18 months), and Stage VI (18 to 24 months) level of sensorimotor development. The stage level designated to each composite score is shown in parenthesis in Table 10.

The results of the cognitive-social assessment indicate scattered development for the autistic children; that is, each of the autistic subjects demonstrated abilities ranging from Stage IV to Stage VI. All of the autistic subjects evidenced Stage VI level of performance in tool use and combinatorial play, while none of the autistic subjects showed Stage VI behavior in symbolic play. The major differences between the

Table 10
Results of Assessment of Communicative Intent, Tool Use, Imitation, and Play

Age	Communicative Intent		Tool Use	Imitation		Play	
	Gest	Voc		Gest	Voc	Comb	Symb
			Austic Subjects				
A1 10-6	5(1V)	4(IV)	4(VI)	2(V)	0(<IV)	5(VI)	4(V)
A2 11-10	6(V)*	4(IV)	4(VI)	4(VI)	0(<IV)	6(VI	3,5(V)
A3 8-11	5(IV)	6(V)	3(VI)	2(V)	4(VI)	5(VI)	3(IV)
A4 6-11	5(IV)	6(V)	4(VI)	4(VI)	4(VI)	6(VI)	4(V)
			Normal Subjects				
N1 1-0	6(V)	6(V)	1(V)	2(V)	1(IV)	3(V)	4(V)
N2 1-5	6(V)	6(V)	1(V)	4(VI)	3(V)	3(V)	4(V)
N3 1-9	6(V)	6(V)	2(VI)	4(VI)	4(VI)	5(VI)	5(VI)
N4 2-2	6(V)	6(V)	2(VI)	4(VI)	4(VI)	5(VI)	6(VI)
			Total Possible				
	6(V)	6(V)	4(VI)	4(VI)	4(VI)	6(VI)	6(VI)

Note: *sensorimotor stage

preverbal (Subjects A1 and A2) and the verbal (Subjects A3 and A4) autistic subjects are that the latter demonstrated Stage V functioning in vocal communicative intent and Stage VI functioning in vocal imitation, suggesting that these abilities may be precursory to referential speech in autistic children. It is interesting to note that Stage V functioning in symbolic play and gestural communicative intent do not appear to be necessary for referential speech since Subject A3 evidenced Stage IV functioning in symbolic play and both Subjects A3 and A4 demonstrated Stage IV functioning in gestural communicative intent.

The results of the cognitive-social assessment indicate a developmental pattern consistent with chronological age for the normal subjects. That is, Subject N1 was functioning at the Stage V level in all areas except vocal imitation. Subject N2 was functioning at the Stage V level in all areas except gestural imitation. Subjects N3 and N4 were functioning at the Stage VI level in all areas (i.e., except communicative, which only measured through Stage V).

Language Comprehension Assessment

The results of the assessment of language comprehension are presented in Table 11. A sensorimotor Stage level was designated to each total score, based on the normative data of Miller and associates (1980). The autistic subjects displayed a wide variation in performance which does not correspond with a normal developmental profile. That is, the preverbal autistic subjects evidenced language comprehension at or below Stage IV level of functioning. Paradoxically, Subject A3, who exhibited a productive use of referential speech, did not display any single-word language comprehension. In contrast, Subject A4 displayed

Table 11
Results of the Language Comprehension Assessment

	I Person	II Object	III Absent person/ object	IV Action	V Posses- sion	VI Action/ object	VII Agent/ action	VIII Agent/ action/ object	Total
A1	-	-	-	-	-	-	-	-	0(<IV)
A2	-	+	-	-	-	-	-	-	1(IV)*
A3	-	-	-	-	-	-	-	-	0(<IV)
A4	+	+	+	+	+	+	+	+	8(VI)
N1	-	+	-	-	-	-	-	-	1(IV)
N2	+	+	+	+	+	-	-	-	5(V/VI)
N3	+	+	+	+	+	+	+	+	8(VI)
N4	+	+	+	+	+	+	+	+	8(VI)

Note: *sensorimotor stage

comprehension of all eight semantic relations assessed, indicating functioning in at least Stage VI.

The normal subjects displayed variation in performance consistent with a developmental pattern. Subject N1 was able to demonstrate single-word comprehension of object names only. Subject N2 was able to demonstrate single-word comprehension of five semantic relations, but no multiword comprehension. Subjects N3 and N4 were able to comprehend all eight semantic relations, indicating at least Stage VI functioning.

CHAPTER IV

DISCUSSION

The corpus of communicative acts from the autistic and normal children yielded a data base that was comparable in frequency for the two groups. Only self-initiated acts were included in the data base. However, there was a wide range of variation in structural aspects of the acts displayed by each subject, such as in the degree of conformity (i.e., conventional, idiosyncratic, or aberrant behaviors) and the linguistic complexity (i.e, nonreferential, prereferential, or referential acts). For example, a communicative act might consist of the child pushing an object away, reaching with an open hand, shaking his/her head up and down, slapping his/her face, vocalizing /titi/, or saying "want more bubbles."

These structural variations were evident both within and across groups and were reflected, to a certain degree, in the analysis of communicative means. The normal subjects displayed more vocal behavior than kinesic behavior, and more verbal behavior than nonverbal behavior. The results of only one autistic subject (A4) followed this developmental pattern. In contrast, the two preverbal autistic subjects (A1 and A2) displayed more kinesic behavior than vocal behavior, while Subject A3 displayed more vocal behavior than verbal behavior. Thus, the autistic subjects evidenced a wide variation in mode of communicative means.

Profile of Communicative Functions

In spite of the variability in communicative means both within and across groups, certain patterns emerge from the data analysis of communicative functions. The autistic subjects displayed significantly more interactive communicative acts than the normal subjects. This finding indicates that these autistic children evidenced communicative intent in self-initiated acts and is inconsistent with anecdotal reports in the literature that autistic children lack the spontaneous use of communication. Three factors may account for this disparity. First, the nature of the communicative context during data collection was such that the investigator was purposely nondirective, allowing for and perhaps promoting the subject to take the role of the initiator, rather than the respondent. The nonconstraining nature of the social context may have contributed to the autistic subjects' use of spontaneous communication. Second, certain aberrant behaviors (such as self-injury), typically considered to be noncommunicative, were demonstrated to be intentional, interactive, and communicative, as evidenced by specific behavioral criteria. And finally, the only way in which it is possible to attribute a communicative function to a behavior is to study that behavior as part of an interaction within a social context. The use of a videotape analysis allowed for the attribution of function to behaviors which otherwise may have gone unnoticed or have been considered noncommunicative, by studying the behaviors in context.

The autistic subjects displayed a relatively homogeneous profile of communicative functions that was both quantitatively and qualitatively different from normal children. The homogeneity of the autistic subjects' profile of communicative functions is particularly striking in

view of the variability in degree of mental retardation and level of linguistic development. The pattern that emerged from the results of the autistic children was a high frequency of request object, request action, and protest functions, a low frequency of exclamatory, reactive, and nonfocused acts, and an absence of acknowledgement of other, showing-off, comment, and label functions. The autistic subjects demonstrated a more limited repertoire of communicative functions than normal children which cannot be solely attributed to a delay in pragmatic development.

Communicative intent normally emerges between nine and 13 months of age (Bates, 1979c). The normal infant simultaneously acquires the ability to communicate through gestural and vocal means for the following purposes: 1) to attract and maintain another's attention to one's self (i.e., RS, AO, S); 2) to direct another's attention to an object/event (i.e., C); and 3) to regulate another's behavior to achieve an environmental end (i.e., RO, RA, PR)(Bates et al., 1979; Seibert & Oller, 1981). The normal infant is also concurrently developing the self-communicative function of identifying and focusing one's own attention to a referent (i.e., L, P). Thus, normal communicative development does not proceed from unitary to multidimensional, but rather progresses in the complexity of structural dimensions mapped onto a variety of functions that are present from the very outset of intentionality. The results of the normal subjects exemplify this normal developmental process.

Interactive Functions

Each autistic subject showed a proficiency in the ability to regulate the adult's behavior to obtain an environmental end, and a lack of or a deficiency in the ability to attract and direct the adult's attention to him/herself or an object, as an end in-and-of itself. This pattern of functioning is consistent with the findings of Curcio (1978) with prelinguistic autistic children. However, Prizant and Rydell (1981) demonstrated communicative functions to achieve both environmental and social ends in the delayed echolalia of autistic children at more advanced stages of language development. Thus, in contrast to the normal developmental process, communicative intent appears to begin as a unitary phenomenon and develop into a manifold system.

In the present study, the autistic subjects' sole attempt at obtaining a social end consisted of the function of request social routine, displayed by three out of the four autistic subjects. Although none of the normal subjects exhibited the request social routine function, this function is typically displayed by normal infants younger than the normal subjects participating in this study. Bruner (1975) gave specific examples from normal infants nine to 11 months old of communicative acts which appear to meet the criteria of the request social routine category. Bruner (1978) argued that the need for intentionality, reference, and predication is derived from the child's regulation of joint attention and joint action in the adult-infant dyad within the context of a ritualized social game. It appears that the autistic child initially acquires the intentionality to communicate outside of the context of social interaction in order to achieve an

environmental end. For instance, an autistic child may take the hand of an adult to obtain a desired object, as though the adult's hand was an inanimate object. However, like normal infants, the autistic child appears to learn about the use of language to achieve a social end through joint preparation in a ritualized social context.

The autistic subjects' use of the request social routine function represents the rudimentary use of communication for a social end. The request social routine function reflects delayed development of the social use of communication in relation to the autistic subjects' use of communication to achieve an environmental end. Thus, although these functions emerge simultaneously in normal development, they appear to develop independently in autistic children, as evidenced by heterochrony in acquisition. Furthermore, the degree to which the autistic child acquires the use of communication to achieve a social end may vary from a complete failure to the use of delayed echolalia or creative utterances for this purpose, and appears to lag behind his/her use of communication to obtain an environmental end.

Noninteractive Functions

With regard to noninteractive functions, the autistic children showed a lack of or a deficiency in the self-communicative function of identifying and focusing one's own attention to salient features of a referent. The work of Prizant and Duchan (1981) and Prizant and Rydell (1981) indicated that some autistic children eventually acquire the noninteractive labelling function at later stages of language development through immediate and/or delayed echolalia. This is another instance of departure from the normal developmental process in that this

self-communicative function develops concurrently with interactive communicative functions in normal children. In contrast, the noninteractive label function appears to be a later-emerging pragmatic function in autistic children, and had not yet been acquired by the autistic children in the present study, at least not in the role in initiator. (The discrepancy between the autistic child's use of communication as initiator and as respondent will be examined later in the discussion.)

The normal subjects evidenced a decrease in the frequency of noncommunicative functions (EX, RE, NF) with advancing linguistic development. Similarly, Prizant and Duchan (1981) found that the percentage of nonfocused immediate echolalia decreased as a function of the autistic child's linguistic abilities. However, the proportion of nonfocused acts was not found to be directly related to linguistic development for the autistic subjects in the present study. Subject A3 exhibited the highest percentage of nonfocused acts, and yet she clearly showed more advanced linguistic development than Subjects A1 and A2. It appears that the percentage of nonfocused acts reflects degree of mental retardation, rather than level of linguistic development, for these autistic subjects and may be related to the rate of motoric self-stimulatory behavior in some autistic children.

In a review of the noncommunicative functions used by normal children (i.e., noninteractive functions in the present study), Rees (1973) stated that:

> . . .the sources of the child's motivations for learning language are more satisfactorily found in these noncommunicative functions than in the traditional function of communicating ideas and feelings. (p. 109)

While the normal subjects displayed self-communicative functions from the very outset of intentionality, the autistic subjects showed a lack of or deficiency in the noncommunicative functions described by Rees, including the concept-formation function (i.e., L), the directive function (i.e., SR), and the magical function (i.e., P). The autistic subjects appear to lack the motivation or understanding of the use of language as "a tool for knowing" (Werner & Kaplan, 1963). These self-communicative functions are not absent in the autistic syndrome, but rather appear to be later-emerging pragmatic skills for autistic children; self-communicative functions were evidenced in the spontaneous acts of Subjects A3 and A4 at a very low frequency, and in the delayed echolalia of the autistic subjects by Prizant and Rydell (1981). The autistic child's initial motivation for noninteractive functions appears to be one of self-stimulation or vocal play. This discordant development of noninteractive functions in autistic children represents another departure from the normal developmental process.

In summary, the autistic children displayed a communicative profile that was quantitatively and qualitatively different from normal development in the use of interactive as well as noninteractive functions. Nevertheless, the autistic children did not exhibit a lack of spontaneous use of communication, as is generally reported in the literature. One major implication of this finding is that the nature of the communicative deficit associated with autism needs to be redefined within a pragmatic framework. The results of this study demonstrate that autistic children possess the intentionality to communicate. However, the capacity for intentionality has apparently emerged outside of the social context of joint attention, mutual regard, and reciprocal

interaction with another person. Issues relevant to these results are found in the literature on communicative behavior of nonhuman primates and will be examined in the next section.

Primate Studies

The primate literature contains descriptions of communicative behaviors that are strikingly similar to those of autistic children. Therefore, it is relevant to compare the communicative abilities of autistic children with those of nonhuman primates. Whether or not the capacity for language is unique to humans remains an unresolved issue; however, there is general agreement that lower species possess the ability to communicate with nonlinguistic means. Of particular interest is the question, what kinds of things do nonhuman primates do with communication? More specifically, what does the communicative profile of a great ape look like, and how does this compare to the communicative profile of the autistic child?

There has been only one study reported in the literature of communicative functions displayed by domesticated nonhuman primates in a social context. Miles (1976) analyzed the communicative use of sign language by a chimpanzee during videotaped interactions with a human partner. The communicative acts were classified according to a modified version of the categories described by Dore (1974). The results for solicited (i.e., in response to a wh-question) and unsolicited communicative acts were presented separately. Of the chimpanzee's self-initiated unsolicited acts, 47% were action requests, 30% were labels, and the remaining 23% included attention devices, internal reports, questions, descriptions, and statements. Miles concluded that

this chimpanzee's communicative competence resembled the message-oriented style identified by Dore (1974) and is quantitatively but not qualitatively different from normal human infants. Anecdotal reports of communicative behavior of signing and nonsigning nonhuman primates interacting with a human partner have exemplified the use of interactive communicative functions, including request object, request action, request permission, protest, acknowledgement of other, showing-off, and comment, as well as the noninteractive function of label (Kellogg, 1968; Chevalier-Skolnikoff, 1981).

The communicative needs of nonhuman primates living in the wild are very different from those raised in captivity. Communication is used predominantly to express information about the motivational state of the animals and less frequently to convey information about the physical state of their environment (Lancaster, 1968). Communication occurs in the context of long-term social relationships. Nonhuman primates in the wild have been reported to use a variety of communicative functions, including request social routine, protest, greeting, calling, and warning (Lancaster, 1968; Plooij, 1979).

Nonhuman primates apparently possess the understanding and motivation to communicate for a variety of interactive and noninteractive functions. The communicative profile of a home-raised chimpanzee is more diversified than that of many autistic children. However, anecdotal reports of communicative interactions with nonhuman primates are reminiscent of those with some autistic children, particularly in regard to the nature of naturally-emerging gestural signals. Kellogg (1968) described the following incident with the chimpanzee Gua:

> The animal was seated upon the floor with legs spread apart, and a bottle of Coca Cola with cap removed was

> placed between her feet. . . Finally, after staring at the bottle and looking up at the experimenter, she took his hand in one of her own and drew it gently down to the base of the bottle. (p. 426)

There are many examples in the literature of nonhuman primates leading a human by the hand to a desired source or manipulating a human's hand to request assistance. The use of untrained gestures by nonhuman primates, as well as by many autistic children, is contextually restricted by physical contiguity with an object or person. The following episode described by Hayes and Hayes (1954) about an interaction with the chimpanzee Viki is strikingly similar to videotaped segments of the autistic subjects in this study.

> If she wants to go outside, she leads us to the drawer where the key is kept and places our hand on the drawer pull. If we don't open it promptly, she gives our wrist a tug. When the drawer is open, she puts our hand to the key, and when we grasp it, she moves our hand to the key hole. If we continue to lag, she moves our hand till the key enters the key hole and finally twists our wrist to indicate the unlocking movement. (p. 299)

Similar contextually-restricted gestures were displayed by all of the autistic subjects but were not displayed by any of the normal subjects. Such gestures may be used in desperation by normal children subsequent to an unsuccessful communicative attempt; however, this communicative means is not a characteristic feature of normal prelinguistic development. The use of contextually-restricted gestures may be viewed as enactive representation, rather than symbolic representation (Schuler, 1980), and may reflect a deficit in the decontextualization process underlying symbolic development.

The limited linguistic and communicative capacities of the nonhuman primate may provide clues as to the nature of the language breakdown associated with autism. Attempts to teach speech to nonhuman primates

have been abandoned because of limited volitional control over their vocalizations. A teacher working with autistic children has probably shared the frustrations expressed by Hayes and Hayes (1954) about their concerted efforts to teach speech to the chimpanzee Viki.

> Viki used her words only for the practical purpose of getting what she wants. She does not engage in purely sociable conversation, or egocentric expression. She does not even use her words for practical purposes, if she can show us what she wants without them. When she wants a cup of cocoa, for instance, she silently leads us to the kitchen and hands us the ingredients. Only if we refuse to be led and stubbornly ask, "What do you want?" does she say, "ch." (p. 298)

This lack of spontaneous use of speech is paradigmatic of the autistic syndrome. These excerpts taken from the primate literature are strikingly similar to clinical observations of autistic children. The limited generalization of spontaneous speech may be another manifestation of an underlying deficit in the decontextualization process of symbolic development in autism.

The contextual inflexibility characteristic of learning in the autistic child is evident to some degree in the nonhuman primate. Bates (1979c) proposed that in normal children the gradual process of decontextualization in the emergence of symbols is parallel and synchronous across the cognitive, social, and linguistic domains. Contextual inflexibility of communication in autistic children may reflect heterochrony in the decontextualization process of cognitive capacities dissociable in ontogeny and phylogeny (e.g., tool use, play, imitation). The next section will examine some sources that may account for the limited communicative behaviors of autistic children.

Explanatory Hypotheses for the Communicative Profile

The study of normal child language acquisition has demonstrated individual variation in learning styles. In characterizing the nature of this variation, a number of dichotomous styles have been described in the literature, such as referential/expressive (Nelson, 1973), word-babies/intonation-babies (Dore, 1974), code-oriented/message-oriented (Dore, 1974), and analytic/gestalt (Peters, 1977). These different learning strategies have been explained by differences inherent to the child, such as cognitive factors (e.g., Bates, 1979c) or hemispheric specialization (e.g., Peters, 1977), as well as differences in the language environment of the child, such as maternal input and social context (Nelson, 1981). Similarly, factors inherent to the child as well as factors related to the language-learning environment may explain the communicative profiles of the autistic children.

The individual variation seen in the normal subjects' results is consistent with the notion of dichotomous learning strategies. Subjects N1 and N4 displayed more interactive acts to achieve a social end and more self-communicative performatives, which may be likened to Nelson's expressive style or Dore's message-oriented intonation-babies. In contrast, Subjects N2 and N3 showed more interactive acts to achieve an environmental end and more self-communicative labels, similar to Nelson's referential style and Dore's code-oriented word-babies. In addition to differences in language styles, the social context of the communicative interactions influenced the functions displayed by the normal children, as found by Peters (1977). For example, the normal children displayed more noninteractive labels while looking at a book

with the adult and more request action or comment functions while interacting with the wind-up toy.

The profile of communicative functions displayed by the autistic subjects does not resemble an earlier stage of normal development or an extreme form of normal learning styles reported in the literature. The heterochronous development of pragmatic functions normally emerging simultaneously represents a deviation from normal development. This deviation from the normal model is evident in both interactive and noninteractive pragmatic functions. Autistic children develop a communicative profile that is quantitatively and qualitatively distinct from normal children. Although all pragmatic functions displayed by autistic children are also seen at some point in normal development, it is the relative timing of emergence that is disparate from the normal developmental process. While some autistic children may never develop certain "later-emerging" pragmatic functions (i.e., later for autistic children), the lack of certain pragmatic functions is not inherent to the autistic syndrome.

The distinct profile of communicative functions displayed by the autistic subjects can be at least partially explained by factors inherent to the child, as well as in the language environment of the child. Before considering various explanations inherent to the child to account for their distinct profile, factors relating to the language environment will be considered.

The Language-learning Environment

Some investigators have explained language deficits in terms of differences in the child's language-learning environment. Since the

language deficit(s) is(are) a primary characteristic of the autistic syndrome, it can be assumed that the autistic child does not develop language in the first years of life, from social interactions with the care-giver, as the normal infant does (e.g., Bruner, 1978; Newson, 1979). That is, the autistic child typically does not acquire language the first time around, and concerted educational efforts are generally needed. Therefore, it is necessary to look beyond the maternal or care-giver input to the influence of educational treatment. Thus, it may be asked whether the distinct communicative profile is characteristic of the autistic syndrome or is a result of treatment effects.

In an eloquent review of environmental effects on spontaneous language of normal and disordered children, Hubbel (1977) evidenced the detrimental effect of constraint, in the form of interrogatives and directives, on spontaneous talking, as well as the facilitative effect of nonconstraining activities that follow the child's lead. Duchan (in press) analyzed the quality of adult interactions with an autistic child. She found that the child's mother, his teacher, and an unfamiliar clinician interacted with the child in a "teaching" mode. That is, all three adults directed the interactions with the child and dictated the object or event of mutual reference. Furthermore, the adults rarely made a comment that was semantically contingent upon the child's action or previous utterance.

Seibert and Oller (1981) pointed out that certain aspects of behavioral treatment programs typically used with autistic children may be pragmatically counterproductive, and may inhibit, disrupt, or terminate social interaction. For example, the use of positive

reinforcement (e.g., saying "good talking" or giving the child a piece of food), the use of verbal questions as stimuli that the adult already knows the answer to, and the use of imitation techniques to elicit verbal responses predetermined by the adult are pragmatically unnatural situations and ignore the communicative intentions of the child.

It appears that the inherent structure of traditional treatment programs based on principles of behavior modification may not facilitate, and may even thwart, the development of some pragmatic functions. For example, the use of pragmatically irrelevant reinforcers, such as a piece of food, does not allow the child to understand the use of communication to achieve a social end. Thus, the communicative profile of the autistic subjects may be heightened, and perhaps even aggravated, by certain language-learning environments.

The social context surrounding the communicative acts of the autistic and normal subjects was designed to be relatively homogeneous across subjects. Therefore, the quality of the adult's interactions cannot account for the differences in communicative strategies within or across groups. However, the influence of the quality of the adult's interactions may be examined by comparing the autistic child's use of communication in the initiator and the respondent roles. The communicative profile derived for the autistic subjects in this study is representative of these children in the initiator role. Analysis of the functions of communicative acts in response to verbal utterances of the adult may have resulted in a different communicative profile. For example, although Subject A4 did not initiate the use of the label function, he would label most common objects when asked, "What is this?" in one of three ways, either with a single-word label response,

immediate echolalia of the question, or a request phrase such as "want some ____," and subsequent anticipation of obtaining that item.

The degree of discrepancy between the child's communicative profile as initiator and respondent may be a function of language comprehension. That is, an autistic child with good language comprehension, such as Subject A4, may show a different communicative profile as respondent than as initiator. This discrepancy may also be due to the nature of language training programs, in that the primary focus of most intervention programs is on receptive and expressive respondent training (e.g., pointing to objects by name; labelling or requesting objects in response to questions). Because of the autistic child's lack of spontaneous generalization, it cannot be assumed that the autistic child will transfer learning from the communicative role of respondent to initiator (Prizant, 1982). Autistic adolescents with advanced linguistic abilities continue to have difficulty switching between speaker and listener roles (Baltaxe, 1977).

The autistic child may show a more diversified communicative profile in the respondent role. However, based on the findings of Hubbell (1977), the frequency of communicative acts would be expected to be diminished in the respondent role. Research is needed to examine the quality and quantity of communicative acts of autistic children in the respondent role, in comparison to the initiator role.

The Child's Inherent Composition

There has been much interest in explaining language deficits in terms of neurological and cognitive factors inherent to the child's individual makeup. Bates (1979c) has hypothesized that the child's

cognitive makeup influences the normal variation in style of language acquisition. She proposed that variations in the relative timing of the emergence of cognitive skills may result in differences in language-learning strategies. Similarly, asymmetric development of cognitive abilities may influence the communicative profile of autistic children. For example, the autistic subjects' relatively advanced development in tool use may be related to their proficiency in the use of communication to achieve an environmental end. This theory will be examined in a later section on nonlinguistic prerequisites to referential speech.

The dichotomous strategies identified in normal language acquisition (e.g., referential/expressive, analytic/gestalt) have been likened to the asymmetrical functions of the cerebral hemispheres (Bates, 1979c; Peters, 1977). Variations in the developmental timing of cerebral lateralization of higher cortical functions may be related to the different processing modes underlying the divergent language-learning strategies of normal children.

It is very tempting to attribute the communicative and linguistic profile of autistic children to a disruption in or a deviation from the normal process of cerebral lateralization. There is some behavioral and physiological evidence to support this speculation. For example, the autistic child's tendency to concatenate words in echolalia and creative language and to imitate and exaggerate intonation contours may be related to a gestalt or "right-hemisphere" processing mode. The accumulating evidence of a left or language-dominant hemisphere dysfunction (see Wetherby, Koegel, & Mendel, 1981) and a directional reversal in the typical left-hemisphere specialization for language functions (Blackstock, 1978; Dawson, Warrenburg, & Fuller, 1982) in

autistic individuals provides preliminary support for a gestalt theory of language acquisition. However, this is an extremely simplified explanation for a very complex process. Except perhaps in the acallosal brain, the right hemisphere does not function in unison, but rather functions in dynamic interaction with the left albeit damaged hemisphere and subcortical structures. A model of the neural representation of language functions in autistic children will be proposed later in the discussion. It seems warranted to conclude that heterochrony in neural development may be related to the heterochrony evidenced in the communicative and cognitive development of these autistic children.

Patterns of Cognitive/Social Development

The results of the cognitive-social assessment in the areas of communicative intent, tool use, imitation, and play indicate scattered development for the autistic subjects, with skill levels ranging from below sensorimotor Stage IV to above Stage VI. Bates and associates (1979) have demonstrated that these achievements emerge in synchrony in normal children both across modalities and across domains. The results of the normal subjects in this study are exemplary of synchronous, parallel development, and are consistent with the findings of Bates and associates.

The "homology through shared origins" model, supported by the findings of Bates and associates (1979) and Steckol and Leonard (1981) with normal children, predicts that the specific capacities that are present when language emerges may be absent or below threshold when language fails to emerge in disordered children. And, when the capacity in one domain is present, then the cognitive substrate necessary for the

emergence of symbols must also be present. Within a homology model, the results of the autistic subjects indicate that the necessary cognitive substrate is present in all four subjects, as evidenced by their skill levels in tool use and combinatorial play. Failure to reach a critical level in other areas may be due to a "blockage" in the system inhibiting access to the cognitive substrate for the deficient areas. The theoretical notion of "blockage," as used by Bates (1979a), implies that some other factor is blocking or inhibiting the use of the cognitive substrate or the transfer from one domain to another. The results of these autistic children may provide some clues as to the nature of such a blockage.

Heterochrony in Cognitive/Social Development

The autistic subjects' scattered performance on the cognitive-social assessment lends itself nicely to a comparison with their profile of communicative functions. The heterochrony in pragmatic development may be at least partly explained by the differential timing of acquisition of cognitive skills. That is, the relative proportions of component skills available at varying times in development may influence the communicative profile.

All of the autistic subjects displayed more advanced development in tool use than the normal subjects. The autistic subjects' relative precocity in tool use may be related to their preponderance of the use of communication to achieve an environmental end. Support for the existence of a relationship, whether through homology or analogy, comes from the finding of Curcio (1978) that gestural communicative intent was

not displayed by mute autistic children functioning below Stage V in means-end behavior. Further support for this relationship comes from the autistic child's use of contextually-restricted gestures; i.e., the autistic child often manipulates the adult's hand, as if it were an inanimate object, as a means to obtain a desired end. Thus, the development of "object" tool use (i.e., using an object as a means to obtain an environmental end) and "person" tool use (i.e., using a person as a means to obtain a desired environmental end) appear to emerge simultaneously and in advance of other component skills in autistic children. For the autistic child, the development of object tool use and person tool use may be one and the same. In other words, the autistic child's use of object tool use and person tool use may be equivalent and may reflect nonsocial tool use. In normal children, person tool use generally consists of conventional gestures, such as giving and pointing, used with vocalizations and presumably reflects social tool use. The qualitative difference between the autistic and normal children's use of person tool use may be attributed to the distinct interaction of component skills that are available to the autistic child, but do not co-occur in normal development.

Discordant development of combinatorial and symbolic play was evidenced for all the autistic subjects. Bates (1979c) has likened symbolic play to enactive or gestural naming. In the longitudinal study of normal children, Bates and associates (1979) found parallel developments in the lexical content and decontextualization process for vocal and gestural naming. For example, a child may indicate the quality of "spoonness" through vocal naming (i.e., a verbal approximation of the word spoon) or gestural naming (i.e., a stirring motion

with the object). The naming act, whether vocal or gestural, initially occurs only while the child is using a real spoon during mealtime and ultimately occurs outside of the mealtime context with an abstract object such as a stick.

The relationship found between vocal and gestural naming has direct implications for the profiles of the autistic subjects. The autistic subjects may lack the understanding or motivation to identify and objectify a referent outside of a communicative context. This noninteractive use of naming is a shared feature of symbolic play and the label function and appears to be a "later-emerging" or absent development in autistic children. Within the framework of a homology model, there may be a blockage in the system prohibiting access to the underlying cognitive substrate and selectively impairing both vocal and gestural naming.

Bates (1979c) has described two approaches to problem-solving that contribute differentially to the emergence of symbols in ontogeny and phylogeny--observational learning and trail-and-error problem-solving. In observational learning, the child directly copies another person's solution to the problem and may or may not understand the relationship between the means and the end. The child imitates the unanalyzed whole before reaching an understanding of the means-end relationship and imitates only the necessary analyzed components once the means-end relationship is understood. In trial-and-error problem-solving, the child discovers the relationship between the means and the end by deriving the solution to the problem from exploration with the environment. Bates suggested that symbolic play, like imitation, is acquired through observational learning and that combinatorial play,

like tool use, may be acquired through observational learning and/or trial-and-error problem-solving.

Asymmetrical development of these dichotomous approaches to problem-solving may explain, to a certain degree, the profiles of communicative and cognitive abilities displayed by the autistic subjects. Relatively advanced abilities in person and object tool use and combinatorial play may be due to a developmental propensity for trial-and-error problem-solving. The contextually-restricted gestures displayed by the autistic subjects can emerge naturally from exploration with the child's own body through trial-and-error learning strategies. Conventional communicative gestures (e.g., waving, shaking head back and forth), gestural and vocal naming, and referential speech can be derived only through observational learning in a social context. The capacity for or motivation of observational learning may lag behind that for trial-and-error problem-solving. In other words, the autistic child may be selectively impaired in social imitation, i.e., the ability to learn from observing another person. Schuler (1980) suggests:

> It is as if autistic children have been unable to learn from interaction with and imitation of the other, creating a developmental stagnation of a complexity that cannot be attributed to one single aspect of development. (p. 134)

The gradual process of decontextualization may be asynchronous for observational learning and trial-and-error problem-solving in autistic children, in contrast to synchronous development in normal children. However, this explanation cannot account for the lack of pointing, showing, and showing-off gestures by the autistic subjects. These gestures are presumed to emerge naturally from solitary exploration with the child's own body rather than through imitation (Bates, 1979c). The

autistic child apparently has difficulty applying trial-and-error learning strategies when the means-end relationship involves a purely social end. The implication of this finding appears to be that the autistic child is selectively impaired in certain aspects of the social domain that are rooted in the context of joint participation in social interaction.

The results of the autistic children evidenced asynchronous development between the gestural and vocal modalities for both imitation and communicative intent. This is qualitatively divergent from the parallel and simultaneous development across modalities found in normal children (Bates et al., 1979). While in normal children the emergence of symbols is relatively modality-free, autistic children appear to excel in, and hence show bias toward, one modality over the other. Subjects A1 and A2 displayed more advanced gestural development than vocal, while Subjects A3 and A4 demonstrated more advanced vocal development than gestural. This disparity between the vocal and gestural modalities is consistent with the notion of a blockage in the system inhibiting access to the cognitive substrate for certain developments.

The results of the assessment of language comprehension indicated a dissociation between comprehension and production in the emergence of speech in autistic children. Comprehension was found to be in advance of, to be equivalent to, and to lag behind production. This finding of the independence of comprehension and production is consistent with the results of Snyder, Bates, and Bretherton (1981) with normal infants. However, Snyder and associates did not find the pattern of comprehension lagging behind production in normal infants. The pattern of production

preceding comprehension may be discrepant with the normal developmental process of decontextualization of comprehension occurring prior to or simultaneously with production. The asynchrony between language comprehension and production is suggestive of a selective impairment within the linguistic domain and appears to reflect heterochrony in the decontextualization process underlying the emergency of speech.

In conclusion, the autistic subjects displayed heterochrony in cognitive-social development which may be related to the heterochronous development evident in their communicative profile. Quantitative variations in the relative timing of the emergence of component skills may result in qualitative differences in development from the interplay among the available component skills (Bates, 1979c). The particular heterochronous process that occurs in the autistic child appears to lead to a qualitatively distinct profile of communicative and cognitive development. Based on the results of the autistic subjects, it is hypothesized that the autistic child is selectively impaired in the decontextualization process of the social and linguistic domains, as compared with contextual flexibility evidenced in the cognitive domain. Furthermore, it is hypothesized that the heterochrony in development stems from an impairment in the species-specific social predisposition for language. The presumably innate social impairment has a disruptive effect upon the development of language as a social tool.

Nonlinguistic Prerequisites to Referential Speech

Certain conclusions can be drawn in regard to the emergence of referential speech in autistic children based on the results of these four autistic children. Subjects A1 and A2 did not display the

referential use of speech; Subjects A3 and A4 clearly and unambiguously evidenced the productive use of referential speech (i.e., lexicon of at least 50 referential words). Therefore, the combination of component skills displayed by Subjects A1 and A2 may be necessary but are not sufficient for the use of referential speech. Constituent skills that were displayed by Subjects A3 and A4 but not by Subjects A1 and A2 may be necessary for the use of referential speech, but may not be sufficient because some other prerequisite skill may be missing. And finally, component skills that were not displayed by Subjects A3 and A4 are not necessary for referential speech.

Bates (1979c) proposed that a certain critical threshold level must be reached in each of the three domains of imitation, tool use, and communicative intent for the emergence of referential speech. The results of the normal and autistic subjects strongly suggest that functioning below sensorimotor Stage V in any one of these three domains precludes the use of referential speech. Functioning within at least Stage V in all three domains appears to be necessary, and perhaps sufficient, for the emergence of symbols. However, the cognitive substrate apparently must be accessible to the output modality governing referential use. This conclusion is supported by examination of the results of individual subjects.

Subjects A3 and A4 evidenced at least Stage V functioning in vocal communicative intent and vocal imitation, while Subjects A1 and A2 evidenced functioning below Stage V in these areas within the vocal modality. Therefore, functioning within at least Stage V in vocal communicative intent and vocal imitation appears to be a precursor to referential speech. Subject A2 displayed at least Stage V functioning

in gestural communicative intent and gestural imitation, while Subject A1 evidenced functioning below Stage V in gestural communicative intent. Thus, Stage V functioning in gestural communicative intent, and presumably gestural imitation, appear to be precursory to referential sign language in that Subject A2 displayed a rudimentary use of referential signs.

These findings demonstrate the discrepancy between performance in the vocal and gestural modalities and indicate that Stage V functioning is necessary in the output modality governing referential use. That is, Stage V functioning in vocal communicative intent and vocal imitation is necessary for referential speech, but not for referential sign language. And, Stage V functioning in gestural communicative intent and gestural imitation is necessary for referential sign language but not referential speech.

In regard to component skills that are not necessary for referential speech, the results of Subject A3 indicate that Stage V functioning in symbolic play (i.e., functional use of objects) is not necessary for referential speech. Additionally, Stage V functioning in language comprehension (i.e., single-word comprehension) is not necessary for the productive use of referential speech, at least not for the limited communicative functions displayed by this subject.

It appears that functioning in at least sensorimotor Stage V in the three areas of vocal communicative intent, tool use, and vocal imitation are prerequisite to referential speech in autistic children. It cannot be determined from the results of these subjects whether the capacity for tool use is in fact necessary for referential speech. However, a critical level of vocal communicative intent and vocal imitation does

appear to be precursory to referential speech. It may be that, as proposed by Bates (1979c), the interaction of these three capacities produces the symbolic function and is manifested in referential speech.

Implications for a Homology Model

Bates (1979a) has described the "homology through shared origins" model in which two or more structures emerge from some third source (i.e., a shared cognitive substrate of the symbolic capacity). She contrasted this model with the "homology through direct causation" model in which one structure is a necessary, but perhaps insufficient input, to the symbolic capacity. One major difference between these two models is that the shared base model predicts that transfer from one structure to another is bidirectional, whereas the direct causal model predicts that transfer is unidirectional. Additionally, the direct cause model imposes a prescribed sequence of development, whereas the shared base model allows for variations in sequence. And finally, the direct causal model permits a blockage in one direction only, and the shared base model permits a blockage in either direction.

A model of the emergence symbols must be able to account for the behavior of any and all organisms exhibiting the capacity for symbols. Thus, a model must be able to account for the performance of the normal subjects, as well as the quantitative and qualitative differences displayed by the autistic subjects. This section will examine the explanatory power of these two homology models and discuss implications for a broad theoretical construct.

The scattered development displayed by the autistic children is more consistent with the "homology through shared origins" model than

with the "homology through direct causation" model for several reasons. First, the heterochrony in development evidenced by the autistic subjects across domains lends credence to the theory of dissociation of component skills in ontogeny and phylogeny. This finding indicates that the assessment was in fact measuring four independent component skills. Second, the autistic subjects and, to a lesser extent, the normal subjects demonstrated variations in the relative timing of development both across domains and across modalities. These variations in sequence were multiform, supporting the shared base model (i.e., imitation in advance of tool use and vice versa; vocal communicative intent in advance of gestural communicative intent and vice versa). And third, the pattern of scattered development displayed by the autistic subjects is suggestive of the notion of a blockage in the system prohibiting the use of the cognitive substrate for one or more domains and for one or both modalities. The blockage appears to be bidirectional, supporting the shared base model. Thus, the "homology through shared origins" model is better able to account for the patterns of cognitive-social development displayed by the normal and the autistic children than the direct causal model.

The mutual assumption of these two models is that of homologous structures, i.e., linguistic and nonlinguistic systems are structurally similar because they are derived from a common genetic or ancestral origin. The notion of prerequisite skills is implicit in both homology models. A homology model assumes that language is derived or constructed out of nonlinguistic capacities. As predicted by a homology model, a critical level of competence in nonlinguistic capacities (e.g., communicative intent, imitation, and tool use) is prerequisite to the

emergence of speech. The results of the normal and autistic children are consistent with this prediction.

The scattered profiles of communicative and cognitive-social development displayed by the autistic subjects hold implications for broadening the theoretical construct of the homology model described by Bates (1979a). As suggested by Curtiss (1981b), dissociations between linguistic and nonlinguistic development in disordered children may help elucidate the interdependencies and independencies of these systems. The extreme heterochrony in development evidenced by the autistic subjects is consistent with the concept of multiple "local homologies" (Bates et al., in press), i.e., specific capacities in nonlinguistic and linguistic domains are derived from shared structures. The results of the autistic subjects suggest at least two independent "local homologies," one relating to cognitive influences and the other to social influences on language acquisition. The autistic subjects provide a natural phenomena in which the effect of cognitive influences on language acquisition can be witnessed in the absence of social influences. The result is an organism proficient in figuring out how things in the environment work, and deficient in sharing that knowledge with others as well as acquiring knowledge from others.

Proposed Model of Pragmatic Development in Autism

The distinct communicative profile displayed by the autistic subjects has been explained by heterochrony in cognitive-social development. Asynchronous development was evident both across the cognitive and social domains and across the vocal and gestural modalities. The scattered developmental profile characteristic of

autism appears to reflect a qualitatively distinct interaction among available component skills. That is, heterochrony in the gradual process of decontextualization may lead to a distinct combination of available components and result in qualitative differences from normal development. This section will first examine the developmental consequences of heterochrony in a proposed model of the ontogeny of communicative functions in autism. Subsequently, an explanatory model of the neural mechanisms operating to produce heterochrony in development will be proposed.

Ontogeny of Communicative Functions

The emergence of linguistic and cognitive capacities in normal children has been described in a stage process model (Prutting, 1979). The normal child advances through a series of qualitatively distinct stages, at least on a gross level (e.g., sensorimotor to symbolic representation; prelinguistic to one-word stage to two-word stage). The degree of homogeneity of functioning within a stage may be influenced by endogenous and exogenous factors. Homogeneity of cognitive or linguistic level may be most evident at the beginning and ending phases of a stage, and heterogeneity may prevail in the middle phases of an acquisitional sequence (Flavell, 1982).

A working model of the emergence of pragmatic functions in autistic children may be derived from the results of this study, in conjunction with other investigations of communicative functions in autistic children. In contrast to the normal developmental process, it appears that the autistic child acquires the communicative functions of language one function at a time. There is some consistency in the order of

emergence of communicative functions. The emergence of a communicative function in the autistic child may be characterized by a cyclical process from contextually-restricted forms to contextually-flexible forms. This process is repeated in the acquisition of each new function.

There appears to be a natural evolution of decontextualization recurring in the emergence of each communicative function for the autistic child. A communicative function first emerges through the use of contextually-restricted gestures, e.g., leading the adult by the hand or physically manipulating the adult's hand. Subsequently, the autistic child may develop the use of stereotypic behaviors that are strictly tied to one context and which may take the form of idiosyncratic gestures or contextually-restricted echolalic utterances. There may be further development in the decontextualization process to the use of conventional gestures and referential speech or signs, first used rigidly in the acquisition context, and later used creatively in a contextually-flexible manner.

There also appears to be a natural developmental sequence of the acquisition of communicative functions in autistic children. The developmental sequence may be related, through a mutual cognitive structure, to achievements in the cognitive and social domains. The autistic child initially acquires competence in the use of communication to achieve an environmental end, first to request an object, then to request an action and protest, and subsequently to request permission. The results of this study and the findings of Curcio (1978) support this conclusion. The decontextualization process of person tool use may parallel that of object tool use.

Subsequently, the autistic child may acquire competence in the use of attracting and maintaining another's attention to oneself, first to request a social routine, then for the acknowledgement of other function. The showing-off function would hypothetically emerge last; however, there have been no instances of autistic individuals exhibiting the showing-off function reported in the literature. Competence in gaining and directing another's attention may be viewed as a transition between using language to achieve an environmental end and using language to achieve a social end. In other words, the autistic child's initial efforts to gain another's attention are still tied to environmental ends (e.g., request social routine and calling function). Later efforts may be more closely tied to purely social ends (e.g., greetings and politeness markers). However, some autistic children develop the use of greeting and politeness markers as part of a ritual, and the motivation for using the phrase is to complete the ritual. This latter example appears to be more closely tied to an environmental end than the social end of gaining another's attention.

Although the autistic child may have progressed to the use of contextually-flexible means in person tool use, the evolution of decontextualization for each new function is repeated from the beginning, and thus is cyclical in nature. For example, the request social routine initially emerges with conceptually-restricted gestures (e.g., child pulling the adult's hands up in the position for pat-a-cake), and ultimately is used creatively in a flexible context (e.g., child initiating the phrase "play ouch" in a new context with no gestural or verbal prompts from the adult). Since the time of this study, the investigator has had the opportunity to observe the emergence

of the calling function (i.e., a subcategory of A0) in Subject A3. Although this subject was able to use referential speech in a flexible context for person tool use and the request social routine function, her initial acquisition of the calling function was in the primitive form of contextually-restricted gestures, e.g., physically pulling the adult's chin toward her or holding the adult's hand until the adult focused attention to her. The proposed model would predict that the calling function may next evolve to contextually-restricted echolalia for this subject, and ultimately to the use of the adult's name in a flexible context to gain the attention of another person. This subject had subsequently developed the use of the echolalic utterance, "are you ready" to gain the attention of another person within the context of her classroom, but the calling function had not yet progressed beyond the contextually-restricted echolalic production.

The autistic child may next acquire the self-communicative function of regulating one's own behavior. The self-regulatory function is commonly noted in the autism literature (e.g., Cantwell et al., 1978; Kanner, 1946; Prizant & Duchan, 1981), usually in the form of immediate or delayed echolalia. The self-regulatory function may be followed by the acquisition of identifying and focusing one's own attention to a referent, first through the use of performatives, and later through the label function. There is preliminary evidence that the decontextualization process of the performative and label functions parallels that of symbolic play in the autistic child (Shapiro et al., 1974). The autistic child may lastly acquire the function of directing another's attention to an object/event for a social end, perhaps first through the comment function, and later through the request function.

This proposed model of pragmatic development is speculative in nature, and needs further empirical support from longitudinal and cross-sectional studies of autistic children. The emergence of communicative functions in the autistic child may be stagelike, in the sense of a developmental relationship to a shared cognitive structure (Flavell, 1982). However, the proposed acquisitional sequence is not meant to be stagelike in the sense of a stepwise progression with developmental discontinuity (Lewis & Starr, 1979); i.e., the intermediate or final phases of the acquisition of one function need not be achieved prior to the initial phase of the acquisition of the next function. The findings of this study and that of Prizant (1978) indicate that pragmatic development in the autistic child is characterized by a gradual unfolding of communicative functions evolving from contextually-restricted to contextually-flexible forms. The autistic child's use of contextually-flexible forms to achieve a social end indicates that the child is on the road to communicative competence. The autistic child's potential for developing communicative competence may be regulated by neural mechanisms. The next section will examine how the communicative profile of the autistic children may be governed by a distinct neural representation of language.

Neural Representation of Language in Autism

The heterochronous processes evident in the communicative and cognitive development of autistic children may be regulated by the biological timetable of neural maturation. A theory of the neural representation of language function in autistic children will be outlined below. This theory has been derived from the monumental

contributions of Luria (1966) on the functional organization of the brain and Lenneberg (1967) on the biological foundations of language. This theory is speculative in nature but is based on the documented premise of a neurogenic etiology of autism (e.g., Hauser, DeLong, & Rosman, 1975; Damasio, Maurer, Damasio, & Chui, 1980).

The phylogenetic principle of encephalization is recapitulated in ontogeny (Milner, 1976). Phylogenetically newer structures emerge cephalically, reduplicate the topographic organization of older centers, and assume functional dominance over older centers. This hierarchical organization of the brain evolves in ontogeny. Phylogenetically older centers differentiate first and newer centers differentiate last. At birth, the human brain is relatively immature and is mediated primarily by the lower centers (i.e., hindbrain and midbrain structures and some thalamic and limbic system participation). Lenneberg (1967) hypothesized that the capacity for language acquisition is related to the protracted postnatal maturational history unique to the human brain.

The hierarchical organization of the brain leads to structural variation of higher cortical functions at different stages of ontogeny. The theory of dynamic localization of higher cortical functions, described by Luria (1966), states that neural substrata of higher cortical functions do not remain constant in ontogeny, but rather higher cortical functions are mediated by different constellations of cortical areas at different stages of development. This theory implies that the sequalae of cerebral damage sustained at different stages of ontogeny will be manifested differentially. Furthermore, a lesion sustained in a particular cortical region during early childhood may have a systemic effect on higher cortical centers superposed above it in ontogeny.

Thus, the onset time, as well as the location and extent of cerebral damage, influence the functional organization of neural centers mediating higher cortical functions. The plasticity of the immature brain allows for inter- and intrahemispheric reorganization of function following early cerebral damage. And yet paradoxically, early cerebral damage to a portion of one hemisphere may result in more severe functional deficits than surgical removal of the entire hemisphere in early life (Kinsbourne, 1975). This is presumably due to the damaged hemisphere exerting inhibitory control over the intact hemisphere.

Two mechanisms may be operating to influence the neural representation of language functions in autistic children: differences in onset time of cortical damage, and variations in the location and extent of the damage. Brain damage associated with autism may be sustained pre-, peri-, or postnatally, or may be idiopathic in nature. Multiple etiologies may disrupt early social development and produce a relatively consistent symptomatology (Wing, 1981). Based on the theory of dynamic localization, the earlier the onset time, the more global are the resultant functional deficits. However, in dynamic opposition to this principle, the earlier the onset time, the more potential there is for reorganization of function by cortical areas which have not yet been committed to other functions (Woods & Carey, 1978).

The location and extent of early cerebral damage has been evidenced to influence the nature of the reorganization of language functions (Rasmussen & Milner, 1977). Early left hemisphere damage to either Broca's area or Wernicke's area may lead to interhemispheric reorganization of language functions, i.e., right hemisphere or bilateral representation of language. Furthermore, language functions

may be represented asymmetrically between the two hemispheres in some cases of bilateral representation of language, i.e., Broca's area may be lateralized to one hemisphere and Wernicke's area to the other. Early left hemisphere damage that does not significantly encroach upon either Broca's or Wernicke's area may lead to intrahemispheric reorganization of language functions, e.g., an upward displacement of Wernicke's area in the parietal lobe.

The heterochronous development evident in the communicative and cognitive-social profiles of the autistic subjects may be produced by the dynamic interaction of the encephalization process and reorganization of function following early cerebral damage. The limited capacity for intentional communication in the autistic child may be viewed as a disruption in or protraction of the process of encephalization. It is proposed that the limbic system is the primary mediator of vocal communication in the autistic child. The limbic system regulates emotional, motivational, and instinctual behaviors in man and subhuman species (Robinson, 1976). Vocalizations that are emotional reactions, incidental accompaniments to actions, and self-stimulatory responses (i.e., EX, RE, NF) are presumed to be controlled by the limbic system. Support for this postulation comes from evidence that the limbic system mediates vocalizations in lower species (Jaynes, 1976; Robinson, 1976). Furthermore, electrical excitation of implanted electrodes in the human limbic system has been found to elicit self-stimulatory behavior and other responses related to motivation and emotion (Robinson, 1976). Some nonverbal autistic children (e.g., Subjects A1 and A2) may not develop volitional control of vocal signals beyond that which is mediated by subcortical connections with the limbic

system. Furthermore, some verbal autistic children displaying high rates of self-stimulatory echolalia may develop only limited volitional control of speech.

The development of intentional signalling in the autistic child emerges first through the gestural modality. In phylogeny the encephalization process of gestural communication is dissociable from that of vocal communication. It has been postulated that gestural communication is a primordial means to verbal language in phylogeny (Hewes, 1976). The nonhuman primate has well developed volitional control over the hands and body, in contrast to poor volitional use of facial expression and vocalization (Myers, 1976), indicating that the former is phylogenetically older than the latter. The encephalization process of the neural system subserving volitional control of the hands is relatively advanced in the autistic child, as evidenced by their adept abilities in person and object tool use and combinatorial play.

The encephalization of intentional vocalization in man is viewed as a separate and distinct neural mechanism which has functional dominance over the emotional vocalizations of the limbic system (Jaynes, 1976; Meyers, 1976). It is hypothesized that this phylogenetically newer process of vocal encephalization is disrupted in the autistic child, resulting in a lack of cortical inhibition of limbic vocalizations. The pathological release of limbic mediation of vocalizations would lead to a qualitatively distinct neural representation of language functions. The transfer to cortical control over vocalizations may gradually develop in the autistic child through inter- and intrahemispheric reorganization of language functions.

The neural substrate of gestural communication may be used as a heuristic means to develop vocal communication in the autistic child, via neural interconnections vis a vis the limbic system, the thalamus, and the frontal lobe. This hypothesis is supported by the cyclic emergence of communicative functions in the autistic child from contextually-restricted gestures to contextually-flexible creative utterances. The gradual transfer from limbic to cortical control is consistent with the developmental progression of echolalia from automatic to intention, described by Prizant (1978). Additionally, the emergence of the productive use of referential speech independent of language comprehension, as evidenced by the results of Subject A3, is support for the hypothesis of a qualitatively distinct neural representation of language functions associated with autism. The hypothesized role of the limbic system in the neural organization of language in autism may account for the distinct communicative profile displayed by the autistic subjects, i.e., proficient use of communication to achieve environmental needs, and deficient use of communication for social and self-communicative purposes.

The compensatory mechanism of the right hemisphere following early left-hemisphere damage may play a role in the reorganization of language functions in the autistic child. However, the theory of right-hemisphere language acquisition is not sufficient to explain the communicative and linguistic profile characteristic of autistic children. It has been evidenced that the right (i.e., nondominant) hemisphere cannot achieve the level of linguistic proficiency attained by the left hemisphere, mainly within the syntactic domain (Curtiss, 1977; Curtiss, 1981b; Dennis, 1980; Dennis & Whitaker, 1976). In

contrast, autistic children who develop verbal skills display relatively advanced syntactic abilities in comparison with pragmatic and semantic deficits. Curtiss (1981b) hypothesized that a language-specific acquisition mechanism exists and may be selectively intact or impaired. An analogous mechanism may exist that subserves a social-specific acquisition mechanism. Wing (1981) presented evidence to suggest that a social-specific acquisition mechanism exists and may be selectively intact, as found in some Down's syndrome children, or selectively impaired, as found in some autistic children.

The hypothesis of a pathological release of limbic control over vocalizations, perhaps due to left-hemisphere damage, may better account for the communicative and linguistic profile of autistic children. The particular language deficits displayed by the autistic child, ranging on a continuum form a lack of volitional control over vocalization, to contextually-restricted use of echolalia, to idiosyncratic use of spontaneous speech, may be determined by the degree of cortical inhibition over limbic vocalizations. The degree of cortical control developed through the encephalization process may be influenced by intra- and interhemispheric reorganization of language functions.

The heterogeneity in the linguistic abilities of autistic children may reflect individual variation in the reorganization of function. Subgroups of the autistic population may be identified through the study of language deficits within a neurolinguistic framework. For example, Wetherby and associates (1981) found two patterns of deficits suggestive of anterior versus posterior dysfunction in the language-dominant hemisphere of echolalic autistic individuals. The particular pattern of behavioral deficits may reflect the distinct interaction of variations

in the underlying neurological deficit and the reorganization of function. That is, this distinct interaction of neural mechanisms regulates the heterochronous process of communicative and cognitive-social development.

Thus, it is hypothesized that the limbic system initially prevails as the mediator of vocalization in the autistic child. The limbic system is capable only of transmitting vocal signals of low information value (Robinson, 1976). The emergence of referential speech in the autistic child is subserved by a distinct neural circuitry, comprised of limbic-thalamic, limbic-cortical, and ultimately cortical-cortical reciprocal connections. The degree of cortical control over vocalizations attained in development, perhaps through functional reorganization, will set an upper limit on the capacity for symbol development and, hence, language acquisition in the autistic child. The variations in level of linguistic development seen in the autistic population may be viewed on a continuum ranging from no volitional control of vocalization to advanced syntactic abilities. The level of linguistic deficit may directly reflect the degree of encephalization, ranging from no cortical control over vocalizations to complete cortical control with the language-specific acquisition mechanism selectively intact and lateralized to the left hemisphere.

Research and Clinical Implications

The results of this study indicated a distinct communicative profile for the autistic subjects. Replication of these findings in a larger sample of autistic children would have important implications for the early detection of autism. The communicative profile displayed by

these autistic subjects is qualitatively distinct from normal prelinguistic development, and thus, may be identified during the first year of life.

Future research should be directed toward examining communicative functions in a larger sample of autistic children, in comparison with those of other language-disordered populations. An empirical measure of communicative functions may be instrumental in the differential diagnosis of autism. There is some evidence to indicate that the communicative profile displayed by the autistic children is distinct from that of other language-disordered populations. For example, Curtiss, Prutting, and Lowell (1979) reported that by the age of two hearing-impaired children developed as wide a variety of pragmatic functions as normal hearing children. Snyder (1978) found that pragmatic development of language-delayed children was comparable to that of normal children in the use of nonverbal means, but was deficient in the use of linguistic means. Pragmatic development in mentally retarded children has generally been reported to be delayed in rate but similar in sequence to that of normal children; however, some qualitative differences have recently been noted in communicative means (Greenwald & Leonard, 1979; Jones, 1980; Bricker & Carlson, 1980; Gaines, 1981). The autistic subjects in the present study displayed a relatively homogeneous communicative profile, in spite of their wide variation in degree of mental retardation and level of linguistic abilities. Further comparative data are needed between autistic and nonautistic mentally-retarded children matched for chronological and mental age, to isolate the cognitive and social factors contributing to the communicative profile of autistic children. A comparison of the

communicative profiles of autistic and Down's syndrome children, matched for chronological and mental age, may reveal dissociations between social and nonsocial influences on language acquisition. In regard to the notion of a social-specific acquisition mechanism, it is hypothesized that social competence is selectively impaired in some autistic children and selectively intact in some Down's syndrome children.

The language and communicative deficits associated with autism may be viewed in apposition to those associated with specific developmental language disorders, within the broad theoretical framework proposed by Kirchner and Skarakis-Doyle (1982). Within the proposed framework for understanding developmental language disorders, they suggested that the necessary competence is intact; but, due to heterochrony within the language domain, the language-disordered child has performance deficits resulting from task constraints and compensatory strategies. Within the proposed framework, the language impairments associated with autism may be viewed as deficits in both competence and performance, due to heterochrony across nonlinguistic domains and within the linguistic domain. Furthermore, the accumulation of quantitative differences within the linguistic domain resulted in qualitative differences in linguistic development of specific language-disordered and normal children. Similarly, the cumulative effect of variations in the relative timing across the linguistic and nonlinguistic domains and within the linguistic domain results in a qualitatively distinct interaction among linguistic, cognitive, and social development in autistic children.

The results of this study may help to elucidate the nature of the language breakdown associated with autism. The intentionality to communicate was evidenced in these autistic subjects, but intentionality has apparently emerged independent of the context of social interactions with other persons. In accordance with the position of Bruner (1975, 1978), it is hypothesized that the linguistic and communicative deficits of autistic children are rooted in the ability, or rather disability, to regulate joint attention and reciprocate joint action.

As early as four months of age a normal infant begins to follow the adult's line of regard and establish a joint focus of attention on an object or event (Bruner, 1978). The mutual system for joint attention forms the basis for the development of indicating strategies such as pointing and showing and the concept of a label. The development of joint attention, which may be innately predisposed or learned through imitation, appears to be disrupted in the autistic child, both in the ability to follow the adult's line of regard and to signal the child's own line of regard to the adult.

Joint action between the child and adult forms the social context of normal language acquisition (Bruner, 1978). Joint action first appears as a give-and-take exchange format in which the child serves both as the agent and the recipient of action. Joint participation in action serves to establish a concept of reciprocal roles, thus forming the groundwork for the conventional usage of language in the regulation of joint action. A specific deficit in the social domain that affects participation in joint action may account for the elusiveness of conventional meanings and conversational rules for the autistic child.

A richer understanding of the pervasive deficits associated with autism will emerge from the study of the interactions vis a vis linguistic, cognitive, and social development. The distinct communicative profile of autistic children may evolve from a particular proficiency in solitary exploration in conjunction with a profound deficiency in social interaction involving joint attention and joint action. The results of this study are suggestive of a developmental continuity in autism that permeates the discovery of indicating strategies, from ostensive indicating, e.g., pointing and showing gestures, to referential indicating, e.g., use of referential speech to comment and label. Intentionality is not absent in these autistic children, but rather, it is initially motivated solely by environmental needs. It has been speculated that this motivational force is derived from the prepotent role of the limbic system in the neural representation of language in autism. The autistic child is apparently ill equipped to share in and learn from joint participation in social interactions, and is thus impaired in the development of indicating strategies.

The results of this study have several direct implications for the design of language intervention programs for autistic children. First, the notion of intentionality should be the focus of language intervention efforts. Intentionality in the gestural and vocal modalities was found to emerge asynchronously in these autistic children. Therefore, gestural and vocal communicative intent need to be assessed separately, and the child's optimal modality should be used in the selection of a referential system (e.g., speech versus sign language).

The results of this study indicated that vocal communicative intent and vocal imitation are prerequisite to referential speech. While most behavioral intervention programs teach speech imitation skills through shaping and prompting techniques, such programs may involve thousands of teaching trials and may have only limited success in the generalized use of spontaneous speech (e.g., Lovaas, 1977). In conjunction with speech imitation skills, the issue of intentionality needs to be addressed in language intervention. While volitional control of vocalization is necessary for speech, the understanding that a particular vocalization can influence the behavior of another person in a prescribed way is central to the use of speech as a means to communicate. Future research should investigate whether vocal communicative intent can be taught and whether the capacity for vocal communicative intent may expedite the acquisition of referential speech.

A second clinical implication of this study regards the use of the normal developmental model in the design of language intervention programs with autistic children. The results of this study indicate heterochrony in communicative and cognitive-social development. It is the relative timing of the emergence of component skills that is disparate from normal development, resulting in a scattered developmental profile. Therefore, it seems appropriate to use the normal developmental model as a guide to the content and sequence of language remediation (Prutting, 1979) in order to develop a more uniform profile of functioning across domains. That is, deficient constituent skills may be brought up to par with proficient skills in accordance with the developmental model.

The course of communicative development for the autistic child is different from that of normal children in regard to the issue of complexity. That is, certain communicative functions are more complex than others for the autistic child, in a manner discordant with normal development. Language intervention programs should diverge from the normal model and reflect the course of communicative development from least complex to most complex for the autistic child. For example, intervention should begin with the request object function. A preliminary model of the sequence of emergence of communicative functions in autistic children was presented above. Research is needed to further define the course of communicative development in autistic children.

Language intervention programs should consider the developmental interplay between communicative means and communicative function in autistic children. More conventional and contextually-flexible means should be mapped onto existing functions, and new functions should initially be taught through rudimentary means (e.g., contextually-restricted gestures). The natural evolution of communicative functions in the autistic child should form the basis of remediation.

A third clinical implication of this study regards the social context of communication. The autistic child may have an inherent deficit in the ability to regulate joint attention and joint action. However, similar to normal development, the social functions of communication appear to emerge within the context of ritualized social games. The autistic child's understanding of reciprocal roles within a dyad may be facilitated by structuring intervention around turn-taking

games and joint participation in social interaction. The autistic child's predilection for ritualized behavior may be capitalized upon to establish social routines (Prizant, 1982).

The language-learning context should be designed to facilitate the spontaneous use of communication through conventional means. The degree of constraint imposed upon the communicative context may influence the caliber of spontaneity exhibited by the autistic child. A quasi-structured nondirective context was utilized in the data collection of this study. It would be useful to study the effects of constraint in social context on the communicative behavior of autistic children in order to determine the optimal level of constraint to facilitate spontaneity. In order to promote generalization, other factors to be considered in the language-learning context are the need to establish reciprocity in initiator/respondent roles, the effect of varying the partner in the communicative dyad, and the importance of emphasizing the functions of communication rather than merely teaching linguistic structures. Fay and Schuler (1980) and Prizant (1981) provide guidelines for implementing communicative-based language intervention with autistic children.

The nature of the language breakdown associated with autism has been examined within a pragmatic framework. The domain of pragmatics has provided the foundation for understanding language within a social context. In discussing the complexities of studying the social context of communicative behavior, Prutting (1982) stated,

> Its breadth, boundary-free nature, elusiveness, and fluctuating aspects separately, and in combination, provide the researcher with a most humbling experience when dealing with context in the study of communication. (p. 126)

Just as social context has eluded researchers in the study of communication, the social context has similarly eluded the autistic child in the acquisition of communication. And, as researchers are better able to attend to all levels of context, so will the autistic child.

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APPENDICES

APPENDIX A

Sets of Toys and Objects

1) Doll and miniature doll-size utensils, including 2 spoons, 2 plates, 2 teacups, 1 pitcher, 1 comb, 1 hair brush, and 1 mirror.

2) Realistic objects, including a cup, spoon, hair brush, comb, mirror, and toothbrush.

3) Doll and abstract objects, including a cloth, 2 popsickle sticks, 2 red blocks, and 2 green blocks.

4) Common toys, including a realistic-size plastic telephone, a small plastic hammer, a plastic airplane with wheels, a plastic car with wheels, and a small rubber clown.

5) Six wooden blocks, a ring stacker and 6 rings of decreasing size, a string and 6 beads, and 6 nesting cups.

APPENDIX B

Communicative Temptations

1) Eating a consumable item that the child likes in front of the child, without offering the food to the child.

2) Activating and deactivating a wind-up toy.

3) Looking at a Pat the Bunny book, a Richard Scarry Animal book, and a book that belongs to the child.

4) Opening a jar of bubbles, blowing bubbles, and closing the jar of bubbles.

5) Placing a desired object in a clear glass jar that the child cannot open and giving the jar to the child.

6) Blowing up and deflating a balloon.

7) Offering the child a consumable item that the child dislikes.

8) Initiating a familiar and an unfamiliar social routine (e.g., pat-a-cate, a-boom, peek-a-boo).

APPENDIX C

Assessment Scales for Comunicative Intent, Tool Use, Imitation, and Play

Communicative Intent (derived from the findings of Bates et al., 1979)

Gestural Communicative Intent

1) Child manipulates or examines object and does not address adult; e.g., spinning wheel of toy care; turning key of wind-up toy.

2) Child expresses emotional reaction to object/event, including clapping, smiling, scowling, and hitting; e.g., clapping after balloon deflates; smiling after jack-in-the-box pops up; scowling after tasing food that child dislikes.

3) Child emits gestural signal that is contiguous with the goal, the child's own body, or the adult's body; child addresses adult; e.g., manipulating adult's hand; giving; showing; pointing directly on object; pushing object away; slapping child's own face.

4) Child repeats same gestural signal until goal has been met; child addresses adult; e.g., child puts adult's hand on lid to open it, adult takes hand away, child puts adult's hand back on lid.

5) Child modifies form of gestural signal until goal has been met; i.e., the child repeats the same signal with some added feature; child addresses adult; e.g., child pulls adult's hand toward bubbles, adult puts hand down, child pulls adult's hand closer to bubbles; child holds up cup to show adult, adult does not attend to child, child holds up cup and waves cup to show.

6) Child emits ritualized gestural signal that is not contiguous with the goal or the adult's or child's own body; i.e., the same signal must be used on at least two occasions in the same communicative context to qualify as a ritual; child addresses adult; e.g., opening and closing hand while extending arm toward object out of reach; distant pointing toward object; waving to person leaving room; shaking head back and forth when offered an object that child dislikes.

Vocal Communicative Intent

1) Child vocalizes while manipulating or examining an object or while not attending to an object and does not address adult; e.g., vocalizing /a/ while spinning wheel of toy car.

2) Child expresses emotional reaction to object/event, including screaming, laughing, whining, crying; e.g., crying after desired object is removed; laughing after balloon pops.

APPENDIX C (Cont.)

3) Child emits vocal signal while addressing object or adult; the same signal must be used in at least two different communicative contexts; e.g., child vocalizes /da/ while adult is offering a bottle, while opening a book, and while pointing to the window.

4) Child repeats the same vocal signal until goal has been met; child addresses adult; e.g., child vocalizes /da/ while adult is holding a cheerio, adult holds cereal, child again vocalizes /da/.

5) Child modifies the form of the vocal signal until the goal has been met; child addresses adult; e.g., child vocalizes /da/ while adult is offering a cheerio, adult holds cereal, child vocalizes /da/ louder or /da da da/.

6) Child emits ritualized vocal sound, i.e., the same signal must be used on at least two occasions in the same communicative context to qualify as a ritual; child addresses adult; e.g., child vocalizes /ba/ when opening a book; child vocalizes /dada/ while reaching toward cheerio; child vocalizes /ba ba / when person leaves room.

Tool Use (Uzgiris & Hunt, 1975)

1) Child uses a familiar tool that is contiguous with the goal as a means to obtain the goal; e.g., string tied to goal; cloth under goal.

2) Child uses a familiar tool that is noncontiguous with the goal as a means to obtain the goal; e.g., chair or couch near goal on shelf.

3) Child uses an unfamiliar tool that is contingous with the goal as a means to obtain the goal; e.g., hoop or cane around goal.

4) Child uses an unfamiliar tool that is noncontiguous with the goal as a means to obtain the goal; e.g., cane or stick next to goal.

Imitation (Uzgiris & Hunt, 1975)

Gestural Imitation

1) Child imitates familiar action scheme; e.g., hitting hands together.

2) Child imitates complex gesture composed of familiar action scheme; e.g., hitting two blocks together.

3) Child imitates unfamiliar visible gesture; e.g., opening and closing hand; spreading fingers apart and together.

4) Child imitates unfamiliar invisible gesture and matches adult's model on first trial when model is no longer present; e.g., opening and closing mouth; pulling down on ear lobe.

APPENDIX C (Cont.)

Vocal Imitation

1) Child imitates familiar babbling sounds.

2) Child imitates familiar words.

3) Child imitates unfamiliar sound patterns.

4) Child imitates unfamiliar words and matches adult's model on first trial when model is no longer present.

Play (derived from the findings of Bates et al., 1979)

Combinatorial Play*

1) Child uses simple motor schemes on objects; e.g., bangs, rubs, drops.

2) Child manipulates physical properties of objects; e.g., squeezes, shakes, spins, throws.

3) Child combines 2 objects relationally; e.g. stacks, piles, nests, strings, puts together/takes apart.

4) Child combines 3 or more objects relationally, but in no sequential order.

5) Child combines at least three objects relationally in ordinal sequence; i.e., small to large or large to small.

6) Child combines at least 6 objects relationally in ordinal sequence.

Symbolic Play*

1) Child uses simple motor schemes on objects.

2) Child manipulates physical properties of objects.

3) Child uses realistic objects conventionally; may or may not use invisible substance; applies scheme to self only; e.g., combs hair, brushes teeth, eats from spoon.

4) Child uses miniature objects conventionally; may or may not use invisible substance; applies scheme to self or other; e.g., rolls toy car, drinks from doll's cup; pounds toy hammer.

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* -½ for using action scheme only after modeling; must apply action scheme with new object or to new agent; e.g., 3.5 indicates that child did not display level 4 spontaneously but did display level 4 after adult modeled and used new object or with new agent.

APPENDIX C (Cont.)

5) Child uses objects conventionally with invisible substance; applies scheme to self and other; e.g., feeds doll with bottle then puts bottle to own mouth.

6) Child uses one object to stand for another; applies scheme to self and other; e.g., uses stick as toothbrush and brushes own teeth and adult's teeth; uses block as food and feeds block to adult with spoon and then feeds block to self.

APPENDIX D

Notation System*

SYMBOL	REFERENT
Participants	
a	adult examiner
c	child
fa	father
m	mother
t	teacher
Objects	
ap	airplane
ba	ball
bn	balloon
bl	blocks
b	book (multiple books are b_1, b_2, b_3, etc.)
bt	bottle
br	brush
bb	bubbles
c	car
cl	clown
co	comb
cu	cup
dl	doll
d	drink (multiple drinks are d_1, d_2, d_3, etc.)
fc	face
f	food (multiple food items are f_1, f_2, f_3, etc.)
h	hand
j	jar (glass with lid)
k	kangaroo (wind-up toy)
l	lid
nc	nesting cups
r	rings (that stack on pole)
sp	spoon
te	telephone
tbr	toothbrush
Actions	
A	approaches (crawls or walks toward; climbs on)
B	bangs (strikes with object)
BL	blows
C	cries, frets, whines
D	departs (crawls or walks away)
DR	drops
G	gives

*Notation system was adapted from Sugarman-Bell (1978) and Gaines (1981)

HI	hits (strikes object or body-part with hand)
H	holds
L	laughs
O	looks at
X	looks away (gaze directed away from object/person)
M	mouths
PI	picks up
P	points
PL	pulls
PS	pushes
PU	puts down, on, or in
R	reaches (extends hand or arm toward object/person)
S	says (followed by verbalization in quotation marks)
SC	screams (when excited)
SH	shakes (object or body-part)
SI	signes (followed by utterance in quotation marks)
SM	smiles
SP	spins (object)
TA	takes
TH	throws
T	touches
V	vocalizes (may be followed by IPA in slashes)
TU	turns

Vocalizations were transcribed using the International Phonetic Alphabet (IPA) where possible.

Verbalizations and all uncoded participants, objects, and actions were written out in orthographic transcription.

Sequence

Behavioral elements were transcribed in an Agent-Action-Object sequence or with a ( ) within the element to denote possession; e.g., cT(a)h indicates that the child touches the adult's hand.

Sequential behavioral elements are marked (A)--(B).

Co-occurring behaviors were marked (C)*(D).

APPENDIX E

Samples of Transcript Protocol

Sample 1: Subject N3

a sits on couch--

c S "sit down, sit down" · O a--

1*

a S "okay, there ya go" · PU c on couch--

a PU d_1 (juice) and d_2 (vinegar) on table--

c P to d_1 · S "juice, oh, this" · O d_2

2

a G d_2 to c · S "okay"--

c S "no, no, back" · PS d_2 away · O d_2

3

a PU d_2 on table--

c R toward d_1 · S "oh, juice" · O d_1-- a G d_1 to c-- c drinks d_1--

4

Sample 2: Subject A2

Bowl of f_1 (bugle snack chips) on table--

c PS (a) arm toward table · V /na na na na/ · O table--

1

a PU arm down--

c SI "cracker" · V /na na na na/ · O a--

2

a shrugs shoulder--

c PS (a) arm toward bowl of f_1 · V /i i/ · O f_1--

3

a PI bowl of f_1--

c SI "cracker" · O a--

4

a H f_1 toward c--

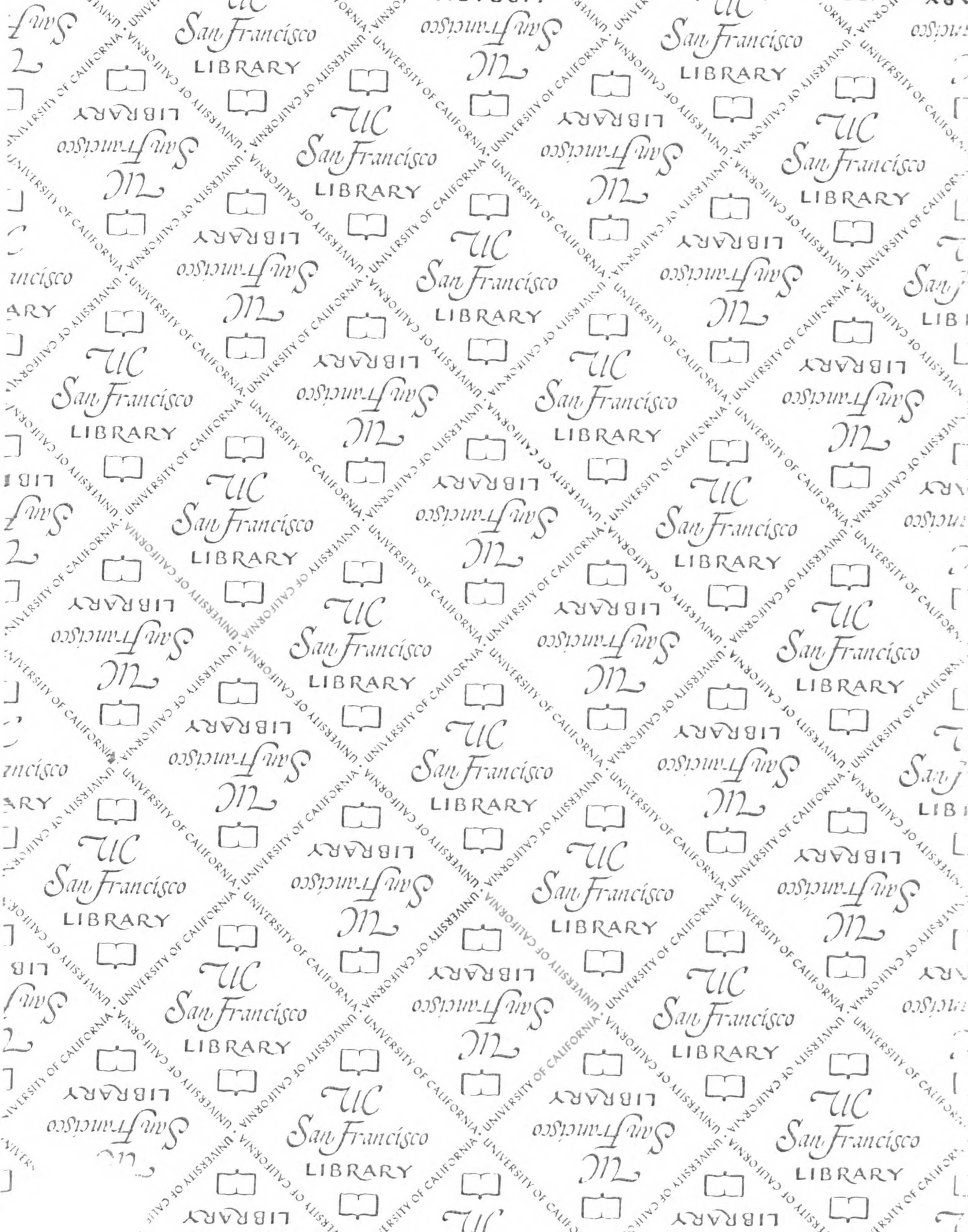
c O f_1-- c SI "nut, apple, apple, nut" · O a--

5

A H f_1 toward a--

c SI "cracker" · O f_1-- a G f_1 to c-- c eats f_1--

*segmented communicative act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