J. Child Psychol. Psychiat. Vol. 39, No. 6, pp. 817–827. 1998
Cambridge University Press

0021–9830/98 $15.00 + 0.00

The Emanuel Miller Memorial Lecture 1997
Change and Continuity in the Development of Children with Autism

Marian Sigman

University of California at Los Angeles, U.S.A.

The developmental approach to childhood psychopathology identifies deviations from typical patterns of development and stability of individual characteristics over time, and precursors in early life of later functions. The application of this approach to the social, communicative, and cognitive development of children with autism is discussed. Results from a longitudinal study of children with autism and other developmental disorders are described, indicating that children with autism have stable deficits in joint attention, representational play, and responsiveness to the emotions of others, and that early variations in these abilities are important for concurrent and subsequent language development and for peer engagement many years later.

Keywords: Autism, pervasive developmental disorder, mental handicap, Down syndrome, preschool children, school children.

Introduction

The study of psychopathology in children has been based on a variety of conceptualizations and models, many derived from theories and knowledge of adult psychopathology. There is much to be learned using models of adult psychopathology. However, the manifestations and consequences of psychopathology in children must ultimately be viewed in terms of the systematic developmental changes that occur throughout childhood. Although a lifespan approach may be useful for understanding adult disorders, a developmental perspective is absolutely critical for understanding childhood psychopathology. In this paper, I will illustrate the application of the developmental perspective to the investigation of autism. The underlying theme of the paper is that early development has consequences for later development, although each phase of development has its own characteristics and requirements that must be taken into account in planning interventions.

The developmental perspective on childhood psychopathology encompasses three different approaches (Sigman & Capps, 1997; Sroufe & Rutter, 1984). First, the behavior of children with a particular diagnosis is compared to that of mental age matched normal children in order to identify ways in which the disorder has caused deviation from the normal progression. Second, stability or instability in the characteristics of children with a particular disorder is described, either by comparing the same diagnostic groups of children at several ages or by charting the individual's relative position in a group on that characteristic over time. The third approach is to specify the precursors of characteristics and abilities by investigating the extent to which the ranking of a child within a group on a characteristic determines the child's ranking in the group on a different, but theoretically related, characteristic measured at some later time. All of these approaches are critical for assessing the course of childhood disorders and identifying important targets for intervention.

In the years since the foundational research of Hermelin and O'Connor (1970), the investigation of children with autism using a developmental perspective has grown rapidly. Following the example of Neil O'Connor and Beate Hermelin, the cognitive and social functioning of children with autism has been compared to that of comparison groups matched on developmental age. Although this research has been extremely important in delineating strengths and weaknesses of children with autism, the course of the disorder has been much less fully portrayed.

The aim of this paper is to summarize what we have learned about social competence in autistic children using the three developmental approaches. The basis for much of this discussion will be the results from a study of 70 children with autism, 93 children with Down syndrome, 59 children with heterogeneous developmental delays, and 108 typically developing children who were recruited and studied when they were between 1 and 5 years of age (Sigman & Ruskin, in press). Most of these children were re-evaluated a year later and 64% were observed 8 to 12 years later. Observations were carried out in the laboratory, in the school classroom, and on the school playground.

The focus on social competence has been selected because of its importance in the shaping of children's life experiences. Moreover, social competence has been neglected as an area of study and intervention among the

Requests for reprints to: Marian Sigman, Department of Psychiatry, UCLA School of Medicine, Los Angeles, California 90024-1759, U.S.A.

developmentally disabled. The underlying theme of this paper is that early achievements of communicative and representational skills influence later verbal and social capacities of children with autism, suggesting that early interventions should be targeted toward improving these important precursors. At the same time, evidence will be presented that the verbal and social development of these children in the mid-school years is often overlooked, with the implication that interventions need to be continued over longer periods of time than is now customary.

Deficits and Strengths in Components of Social Competence in Children with Autism

As discussed in the Introduction to this paper, an important approach in developmental psychopathology is to use what is known about normal development to guide investigations of children with clinical disorders. A predominant symptom of autism is markedly deficient language acquisition so that only about half of autistic individuals develop communicative speech, as Rutter (1978) pointed out in an influential chapter 20 years ago. Even among those individuals with productive speech, prosody and pragmatics are likely to be severely impaired. Research on language acquisition in typically developing children indicates that communicative and representational achievement are important prerequisites for language acquisition (Bruner & Sherwood, 1983). Thus, the fact that autistic children have such difficulty with language suggests that their nonverbal communication and representational play may be similarly impaired.

Nonverbal Communication and Representational Play

Studies of nonverbal communication and representational play confirm this hypothesis. The hypothesis was tested by videotaping and coding the children's behaviors during a structured interaction with an experimenter on the frequency of three mutually exclusive categories: joint attention, requesting, and social interaction (Bruner & Sherwood, 1983; Seibert, Hogan, & Mundy, 1982). The joint attention category involves the coordination of the child's and tester's attention to objects or events with the goal of sharing attention.

The requesting category includes behaviors used to direct attention to objects or events in order to request aid in obtaining the object or repetition of an event. The social interaction behaviors involve eliciting attention or physical contact from the tester and engaging in turn-taking with objects. A separate index of the child's capacities to respond appropriately to joint attention is also scored. Children with autism initiate and respond to bids for joint attention less than children with Down syndrome, children with heterogenous developmental delays, and typically developing children (Loveland & Landry, 1986; Mundy, Sigman, Ungerer, & Sherman, 1986). While they also request objects slightly less than children with developmental delays and typically developing children, the group differences are smaller than for joint attention (Sigman & Ruskin, in press). They initiate and respond to social bids as much as the developmentally delayed and typically developing children in this situation.

In addition, children with autism generally engage in less functional and symbolic use of objects during unstructured play situations than matched controls (Riguet, Taylor, Benroya, & Klein, 1981; Sigman & Ungerer, 1984a; Wing, Gould, Yeates, & Brierly, 1977). Functional play is the conventional use of objects but with toys rather than real objects. Symbolic play is distinguished from functional play in that the child pretends that some object stands for another object, that something actually absent is present, or attributes animacy to a doll or other substitute. Although the play of autistic children improves when their activities are structured by an adult (Lewis & Boucher, 1988), even in these situations children with autism engage in fewer symbolic play acts than children with Down syndrome, children with developmental delays, and typically developing children matched on mental and language ages (Baron-Cohen, 1987; Sigman & Ruskin, in press).

The deficit in joint attention seems particularly important in that the frequencies with which all the children in our study initiated joint attention and responded to bids for joint attention were concurrently associated with language skills. Thus, the link between joint attention and language, demonstrated for normal children (Bates, Bretherton, Carlson, Carpen, & Marcia, 1979), was also found for children with autism.

Language abilities were also associated with representational play in all the groups of children. Given that joint attention and representational play skills were significantly intercorrelated and both were associated with language abilities in our study, the question arose whether one of these skills was particularly responsible for the associations with language. A series of hierarchical regressions was calculated in which the two joint attention variables (initiates and responds) were entered as a block and the two play variables (number of different functional and symbolic acts) were entered as a block with language age as the dependent measure (Sigman & Ruskin, in press). Both joint attention and representational play skills contributed significantly to the hierarchical regression, no matter in what order they were entered, and accounted for 62% of the variance in language scores.

Responsiveness to the Facial Expressions of Others

Representational play may be deficient in children with autism not only because of their deficiencies in symbolic capacities but also because of their social isolation. Most of the themes of children's imaginary play are focused on affectively charged social interactions. In order to pretend, children need to observe the actions and interactions of others, just as a playwright or comedian needs to be sensitive to interpersonal transactions. Similarly, children with autism may not initiate or respond to bids for joint attention because they do not attend to other people.

In contrast to other children, autistic children look less at another person, whether the person is showing neutral affect, distress after hitting her finger with a toy hammer or her knee on the edge of a table, fear or amusement at the sight of a small moving robot, discomfort, or anger during a pretend telephone call (Corona, Dissanayake,

Arbelle, Wellington, & Sigman, in press; Dissanayake, Sigman, & Kasari, 1996; Sigman, Kasari, Kwon, & Yirmiya, 1992). Autistic children also are rated as less empathic or concerned in the presence of a distressed experimenter. The same pattern is observed whether the social partner is an unfamiliar adult or the familiar caregiver. In a study of the verbal responses of high-functioning autistic children to the experimenter recounting a story about losing her wallet, the children with autism were less sympathetic than the developmentally disabled comparison group (Loveland & Tunali, 1991).

One possible explanation for this lack of response to the affects of others would be a limitation in the capacity of the children with autism to differentiate between others' affective expressions. However, the children with autism in our studies seemed to discriminate between emotions in that they attended more and appeared more empathic when an experimenter showed distress than when her affect was more neutral. Another hypothesis is that people with autism do not respond to the emotions of others because these emotions are overly arousing. In a recent investigation of the behaviour and heart-rate responses of a group of young autistic children to an experimenter showing distress after hitting her knee, the children with autism showed no significant change in heart rate compared to baseline (Corona et al., in press). In comparison, children of the same mental and chronological age, with heterogeneous developmental disorders, showed a decrease in heart rate relative to baseline, thereby manifesting a cardiac orienting response. In neither group of children was there an increase in heart rate compared to baseline, as would be expected if the children were aroused by the situation.

Thus, children with autism seem simply less interested in the responses of others. The deficits in joint attention and representational play may stem from this lack of interest, or, alternatively, they may be less interested in other people because they are born with a disruption in the mechanism underlying attentional and affective sharing (Hobson, 1993) or in understanding meta-representations (Baron-Cohen, Leslie, & Frith, 1985; Leslie, 1987). Alternatively, the children may be less able to comprehend the significance of others' reactions because of a more general impairment in processing of relational information (Davies, Bishop, Manstead, & Tantam, 1994).

Summary

The purpose of this review was to summarize the outcome of comparisons of children with autism and mental age matched comparison children in areas of social competence that we know to be important from the research literature on typically developing children. These studies have identified deficits in all areas of social competence. Children with autism are less likely to share attention with others, to represent social situations in symbolic play, and to attend to another's face even when the person is showing strong affect. When understanding of others and the self are investigated in verbal individuals, this understanding is usually more restricted than that of comparison subjects (Yirmiya, Sigman, Kasari, & Mundy, 1992). At the same time, there are some areas that are less disturbed. For example, children with autism request objects or assistance with objects nearly as much as other children, and their social interactions and symbolic play are improved when adults help structure their activities.

Stability of Development within the Autistic Group

A second approach to the investigation of developmental processes is to determine the longitudinal stability of characteristics both within diagnostic groups and within individual children. Many children may outgrow difficulties because they acquire compensatory skills or because environmental requirements change so that previous limitations may no longer be so handicapping. Alternatively, new developmental stages may stress children's abilities so much that they can no longer cope with the demands of their school and home environments and difficulties may be exacerbated. Longitudinal studies are clearly the only way to investigate individual stability. In terms of group stability, longitudinal studies are preferable to cross-sectional studies of children at different ages since the latter always involve different groups of children. In this section of the paper, I will discuss stability of diagnosis, intelligence, nonverbal and verbal communicative skills, representational play, and responsiveness to the emotions of others in children with autism. Because there have been so few longitudinal studies of the processes of development in children with autism, almost all of the discussion will be based on my own longitudinal study (Sigman & Ruskin, in press).

Stability of Diagnosis in Children with Autism

A critical issue is the extent to which children diagnosed with autism remain affected with the disorder throughout their lives. Several investigators have examined a group of autistic children in early childhood and followed them into early or late adolescence (Cantwell, Baker, Rutter, & Mawhood, 1989; Chung, Luk, & Lee, 1990; DeMyer et al., 1973; Eisenberg, 1956; Gillberg & Steffenburg, 1987; Kanner, 1971; Lord & Schopler, 1989b; Lotter, 1978; Venter, Lord, & Schopler, 1992). Based on diagnoses made by the same clinician or group of clinicians at two time points or a global classification scheme that categorizes life adjustment from good to very poor (Lotter, 1978), most individuals with autism in these studies remain as severely affected by the disorder in adolescence as in childhood. Taken together, these studies report that 10–15% of adults with autism have good outcomes; 15–25% have fair outcomes; 15–25% have poor outcomes; and 30–50% have very poor outcomes.

Although these studies show that the life adaptation of most individuals with autism does not improve as they age, there have been few studies of the stability of the diagnosis of autism or of particular symptoms over time. The major reason for the paucity of studies of diagnostic stability is that, until recently, diagnoses were made by clinicians who frequently used varying criteria for the disorder. Even after diagnostic systems had been formulated and circulated, standardized interviews and observations were lacking so that comparability between

diagnosed groups could not be assumed. Observational measures, such as the Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1986) and the Autism Behavior Checklist (Krug, Arick, & Almond, 1980) have not been very widely used. Moreover, these systems are appropriate for the diagnosis of young children and do not apply to many older individuals, particularly those who are autistic but not mentally retarded. The recent creation of the Autism Diagnostic Interview (LeCouteur et al., 1989) and the Autism Diagnostic Observation Schedule (Lord et al., 1989), which are designed for diagnosis across the full range of intellectual and chronological development, should facilitate studies of diagnostic and symptom stability.

In our recent longitudinal follow-up, 51 of the 70 children originally diagnosed with autism at ages 3–5 years, using a variety of procedures, were available for rediagnosis. The Autism Diagnostic Interview-Revised (Lord, Rutter, & LeCouteur, 1994) was administered to the parents about 8–9 years after the original diagnosis (Sigman & Ruskin, in press). No standardized diagnostic observation was administered since none that was applicable to all of our subjects was available at the start of our follow-up study. The Autism Diagnostic Interview is designed so that a determination can be made as to whether the individual ever met the criteria for diagnosis as well as whether the individual currently needs the criteria. Fifty of the 51 subjects met the "ever" criteria (one missed one criterion by one point). Of these 50 children, 45 subjects also met the "current" criteria for diagnosis. One child missed one criterion by one point, and all five subjects who did not meet the current criteria for diagnosis continued to suffer from significant disabilities.

These results showed that most children diagnosed with autism between 3–5 years continued to show all the symptoms of autism later in childhood and adolescence. This was true despite the fact that all the children participated in early intervention programs for at least some period of time. An obvious limitation of this study is that the follow-up diagnosis depended solely on the parental interview. In a few cases, parents were recollecting qualities of their children with whom they no longer lived and saw infrequently. In addition, standardized diagnostic information was only available for part of the sample at intake and the same diagnostic instruments were not used at both intake and follow-up. Furthermore, the results may be generalizable only to children with classical forms of autism, as relatively strict diagnostic standards were used at intake. There may be less continuity among children whose diagnosis is less evident.

Even if children continue to be diagnosed as autistic, the nature of their symptoms may change over time. As an example, some cross-sectional studies suggest that older children show less stereotypic behavior than younger children and this may be particularly true for high-functioning children with autism. However, one investigation of adults with autism noted a very high rate of stereotyped behavior, with some of the high-functioning subjects inhibiting or disguising these behaviors in public (Rumsey, Rapoport, & Sceery, 1985). If a child develops language, a lack of verbal skills may be replaced by language that is stilted, lacking in prosody, and marked by pronominal reversals (e.g. saying "you," "she," or "he" instead of "I"). Longitudinal studies that measured the same symptoms over time are needed to determine how much change there is in the symptoms shown by children as they develop.

Stability of Intelligence Test Scores in Children with Autism

A second critical issue for those concerned with autistic children is whether their level of tested intelligence alters as they age. About 75–80% of individuals with autism are mentally retarded so that they score more than 2 *SD*s below the mean on general intelligence tests that assess verbal and performance skills. Individuals with autism who score higher have more interactive social relationships and are more capable of independent functioning at all ages than lower-scoring individuals with autism.

One preliminary question is whether intelligence tests can be administered accurately to young children with autism because of difficulties with maintaining their attention and assessing their responses. In order to address this issue, 1-year repeat reliability was evaluated in groups of 3–5-year-old children (Sigman & Ruskin, in press). Most of the children were tested with the Cattell Developmental Scale except for the small number of children who had sufficient skills to be assessed with the Stanford-Binet Intelligence Test. One-year test–retest reliability was similar for the children with autism and those with developmental delays, $r(21) = .62$ and $r(28) = .66$ respectively, and slightly lower than for the children with Down syndrome and the typically developing children, $r(42) = .76$ and $r(21) = .75$, respectively. There is an impression among some researchers and clinicians that the assessment of intelligence in children with autism is fraught with difficulty. However, these results show that test–retest reliability is not so different across groups.

Long-term stability in intelligence has been measured in three ways. First, stability has been examined with correlations between intelligence test (IQ) scores at different ages. Second, changes in mean IQ scores for the sample with autism has been contrasted with changes in samples with other disorders followed over roughly the same time period. Third, the extent of individual change has been compared across diagnostic groups.

Because of their particular problem with language development, samples of autistic individuals often have higher scores on measures of performance abilities than verbal abilities. Investigators have varied as to whether they have used measures of performance IQ, verbal IQ, or general IQ, and the consistency of this use. However, the results have been similar in the studies that have compared the stability of performance and verbal IQs or items (Freeman, Ritvo, Needleman, & Yokota, 1985; Lockyer & Rutter, 1969; Lord & Schopler, 1989a, b).

The results of these studies suggest that the stability of IQ scores as measured by correlations is about as high for autistic children as for typically developing, behaviorally disordered, and mentally handicapped groups of children (DeMeyer et al., 1974; Freeman et al., 1985; Lockyer & Rutter, 1969; Lord & Schopler, 1989a, b; Mittler, Gilles, & Jukes, 1966). In our longitudinal study (Sigman & Ruskin, in press), stability was somewhat lower ($r = .44$)

than that reported in previous studies (*r*s range from .58 to .79), probably due to the earlier age of intake in our study. Lord and Schopler (1989a) have shown that stability is lower in children followed from younger ages. In addition, the length of follow-up was longer in our study than some of the previous studies, which may also account for the lower stability over time.

Like other studies, there was little change in mean IQ scores for the autistic group or the developmentally delayed group. Mean IQ scores decreased only 2–3 points for the children with autism and developmental delays. In contrast to the stability in group means, individual children with autism showed great change in their intelligence scores. The intelligence test scores of about half the children with autism (22 of 43) and developmental delays (14 of 32) increased markedly while the other half declined. For the children who gained in intelligence scores, the mean increase was 22.38 points for the children with autism and 17.21 points for the children with developmental delays. For the children who declined in intelligence scores, the mean loss was 23 points for both groups.

The most hopeful result of this investigation was that a surprising number of children with autism who tested in the mentally retarded range at intake had scores above that range at follow-up some 8–9 years later. Thus, 11 children with autism who had scored in the mentally retarded range on the developmental scale (below an IQ of 70) were in the borderline to average range (above an IQ of 70) on the follow-up IQ test. Only one child with autism had an IQ test score that declined from above 70 to below 70. In the developmentally delayed group, some of whose members had language delays but were not mentally retarded, an equivalent number of children moved in ($N = 4$) and out ($N = 5$) of the mentally retarded range. The improvement in intellectual performance in our group of children with autism is greater than that of previous studies, most of which followed children from older ages. Lord and Schopler (1989a) did report as much change in IQ scores in a sample of comparable age, with 35% of their sample moving from mild retardation to the nonretarded classification.

Stability of Communication Skills in Children with Autism

Nonverbal communication. In order to determine the extent of stability in nonverbal communication skills, a revised version of the original assessment measure was administered to the children at follow-up. The Early Social Communication Scale (Seibert et al., 1982) was slightly modified so that the activities and toys were more appropriate for older children. This was done because, in our pilot work for the follow-up study, we realized that some of the materials we had used when the children were younger seemed too immature to some of the subjects tested at older ages. Moreover, parents and caregivers who were encouraging their children to maintain more mature behavior patterns were often uncomfortable with toys designed for infants. The administration of the scales was videotaped and the child's nonverbal responses were coded in the same way as had been done earlier. We did not attempt to elicit or code the initiation or response to social interaction but limited the coding to the frequency of initiation of joint attention and requesting and responses to bids for joint attention, recorded as percentage scores.

Because of changes in the procedures, neither mean differences nor individual differences in scores could be compared over time. However, stability of group differences and of individual behaviors could be evaluated. The results of the group comparisons were similar to the results when the children were younger; there were significant group differences in the frequency of initiating joint attention and behavior regulation and the percentage of responding to bids for joint attention. The children with autism initiated fewer bids for joint attention and requested objects or assistance with objects less than the children with Down syndrome and the children with development delays. The children with autism also responded to bids for joint attention less than the developmentally delayed group, but did not differ from the children with Down syndrome. Therefore, at follow-up, the children with autism were somewhat more deficient in behavior regulation and somewhat less deficient in the capacity to respond to bids for joint attention than at intake.

In terms of individual stability, the extent to which the children with autism and the children with developmental delays initiated joint attention was significantly correlated across the two time points, but this was not true for their frequency of initiating behavior regulation or responding to joint attention. Thus, there was stability at both the group and individual level among children with autism in nonverbal communication behaviors.

Language skills. The methods for assessing language skills changed over time, as was the case for the assessments of intelligence and nonverbal communication skills. Although the majority of the children were tested with the Reynell Scales at both age points, the language abilities of some children improved enough that a more advanced language assessment was required. However, because all language scales are standardized for age, it was possible to assign language ages to all the children at both points in time.

In terms of change over time, all the groups showed increases in mean language ages, although very much less than would be expected for typically developing children. At follow-up, some 8–9 years after intake, the mean gain in language age was 28 months for the children with autism, 23 months for the children with Down syndrome, and 36 months for the children with developmental delays. A comparison of the gain in language skills across time showed that the amount of gain made by the developmentally delayed children was significantly higher than for the other two groups.

Correlations between initial and follow-up language ages were calculated for the three groups of children. As would be expected, early language age predicted later language age. The correlations (with initial chronological age covaried) are $r(39) = .56$, $r(59) = .49$, and $r(29) = .71$ for the children with autism, Down syndrome, and developmental delay respectively.

Lord and Schopler (1989b) have examined the continuity of language skills in children with autism by defining the criterion for the beginning of language

https://doi.org/10.1017/S0021963098002935 Published online by Cambridge University Press

understanding as a receptive language age equivalent to that of a 2-year-old. Using the same criterion as Lord and Schopler, we found that 23% of the children with autism demonstrated a 2-year level of understanding of language at recruitment and follow-up, 56% of the children did not understand language at this level at recruitment but did so at follow-up, and 23% of the children never demonstrated a 2-year level of understanding of verbal labels. The children with autism in our study who gained this level of understanding of language did not differ in initial intelligence, measured by the Cattell Developmental Scale or the Stanford-Binet, from the children who never came to understand language. Thus, the early assessment of intelligence was not predictive of later language skills in children with autism.

In contrast, the improvement in intelligence over time was accompanied by a marked increase in language skills. Only 1 of the 11 children whose intelligence scores moved out of the mentally retarded range started this study with receptive language capacities better than the 2-year level but all eventually developed receptive language capacities equivalent to those of 6–9-year-old children. The mean gain in language age was 66 months for these 11 children whereas it was 11 months for the children who remained in the mentally retarded range of functioning.

Stability of Representational Play in Children with Autism

In typically developing children, solitary pretend play is replaced by group play. At the mental age at which these children were seen at follow-up, typically developing children are constructing elaborate social games in which they take dramatic pretend roles. Our intention was to assess pretend play in the school playground, since this seemed more appropriate than in a structured situation with the experimenter. In fact, none of the developmentally disabled children spent much time in pretend games with their peers. This may have been due to the lack of toys available on the school playground, although typically developing children engage in pretend play in the absence of props. Because there was no follow-up data concerning representational play, stability of group deficits in representational play and of individual tendencies to engage in such play could not be examined.

Stability of Responses to the Distress of Others in Children with Autism

The children's response to the experimenter's distress was observed using a procedure modified from that used at intake. Rather than hitting her finger with a small hammer as occurred at intake, the experimenter pretended to bump his or her knee on the table, exclaimed loudly, and feigned pain through facial expressions and body movements for 30 seconds. The experimenter then reassured the child that the knee felt better and showed neutral affect for 10 seconds. The child and experimenter were videotaped.

The children looked at the experimenter's face for a much longer time period when they were older than when they were younger. However, the children with autism continued to look at the experimenter's face a smaller percentage of time than the other groups of children, as had been true when the children were younger. This cannot really be called avoidance as the groups of children did not differ in the proportion of time that they oriented their bodies away from the experimenter. The children with autism were rated as less concerned than the other two groups of children. Although they looked less, their facial expressions were not rated as less interested. Thus, the children with autism were somewhat engaged by the distress of the experimenter but they looked less at the experimenter's face and seemed less concerned.

With a behavioral coding system similar to the one used at intake, total duration of looking to the experimenter and empathy scores during the experimenter distress procedure predicted empathy scores in the follow-up distress procedure for the children with autism (Dissanayake et al., 1996). This association remains significant even when intake mental age was covaried. There was no stability in responsiveness to the emotions of others in the other developmentally disabled groups. Thus, the autistic children who were more emotionally responsive at age 3–5 years were also more responsive later.

Summary

Overall, there was considerable stability in the development of the children with autism. Diagnostic status changed very little, with most children continuing to show all the signs of the disorder over time. As a group, the children with autism continued to communicate nonverbally and to respond to the emotions of others less than other children. Individually, children who engaged in more nonverbal communication and were more attentive and empathic towards a distressed adult continued to be so 8–9 years later. However, the intelligence test scores and language abilities of some of the children with autism changed a great deal. Most important, intelligence scores rose sufficiently for about one third of very young children with autism so that they could no longer be considered mentally retarded at later ages. In the next section of this paper, precursors of the gains made in language and intelligence scores will be considered along with predictors of future prosocial behaviors and peer engagement.

Nonverbal Communication and Play as Predictors of Later Abilities and Characteristics

Prediction of Short-term and Long-term Gains in Language

The hypothesis that nonverbal communication and representational play skills would predict gains in language over time has strong theoretical and empirical support. Given the theory that mastery of procedures for joint action provides the precursors for the child's grasp of initial grammatical forms, children who are more engaged in joint attention would have more of a structure on which to model language. As Bruner and Sherwood (1983) point out, a great deal of prelinguistic communication is devoted to the achievement of a joint

attentional focus and the elaboration of this focus in the form of joint topic-comment structures. Moreover, children exploit joint attention in order to assign novel words to meanings quickly (Baldwin, 1991; Tomasello, 1995). Thus, children with autism who were participating in these prelinguistic activities would be expected to learn to communicate verbally in a way not possible for autistic children who did not participate in communicative reciprocal activities.

Similarly, autistic children who used objects in functional and symbolic ways during play demonstrate a conceptual understanding of these objects that seems missing in those children who only shake objects or stack one on another. Both pretend play and language require the capacity for representation, and possibly metarepresentation (Leslie, 1987; Piaget, 1954). The functional and symbolic use of objects in play is an early marker of the conceptual understanding necessary for the understanding and use of language.

Given these theoretical considerations and the evidence in typically developing children that communicative and play skills are precursors of verbal abilities, it was not surprising that the language skills of the children with autism were concurrently associated with their nonverbal communication and pretend play, as discussed above. In fact, all the nonverbal communication behaviors except the frequency of initiating social interaction (and none of the play behaviors) were predictors of the gain in language skills over the course of the children's next year of life. Long-term gains in language skills 8–9 years later were predicted both by the children's responsiveness to others' bids for joint attention as well as their diverse use of functional play acts. Thus, early nonverbal communication and representational play may be necessary not only for the acquisition of language but also for the consolidation of language skills (Sigman & Ruskin, in press).

Prediction of Long-term Change in Intelligence Scores

As discussed above, 11 children in the autistic group had intelligence test scores in the mentally retarded range at intake but not at follow-up. A comparison of the nonverbal communication and play behaviors of these children with those of children who remained in the mentally retarded range showed that the former group was more responsive to the bids of others for joint attention, made more requests, and used a greater number of functional play acts. Even when initial intelligence test scores were statistically constrained, nonverbal communication behaviors differentiated the two groups.

Prediction of Prosocial Behaviors, Social Understanding, and Interpersonal Relationships

Prosocial behaviors are critical for children's relationships as they mature. Children who do not cooperate with others, assist others when they need help, or share with others are unlikely to have friends or even sustained interactions with peers. Most studies of prosocial behaviors in individuals with autism have focused on increasing specific prosocial behaviours through interventions (Egan, Zlomke, & Bush, 1993; Redefer & Goodman, 1993). There have been very few studies comparing the prosocial behaviors of autistic children to those of developmentally delayed children. In our longitudinal study, during the serving of refreshments, the children with autism helped the experimenter find room on a small table for a tray, and shared food that was out of the experimenters' reach, less than the other developmentally disabled children did.

Prosocial behaviors may be limited in children with autism partly because these children are unable to understand the needs of others. We had hoped to assess social understanding in the autistic subjects in our study. However, only about 15 children with autism in the follow-up had sufficient verbal capacities to be able to respond to questions about their understanding of social situations. The data from this subsample have not been analyzed at this point.

Early interest and skills in communicating with others and responsiveness to the emotions of others would seem to be important for the later prosocial behaviors and, in fact, this was true. Children with autism who initiated social interaction and responded to bids for social interaction and joint attention more at intake were more helpful to the experimenter at follow-up than were children with autism who showed fewer of these communicative acts. Furthermore, preschool children with autism who were rated as more empathic used more prosocial behaviors during a snack with the experimenter during the mid-school years than did autistic children who had been rated as less empathic.

Given the difficulties shown by young children with autism in nonverbal communication, pretend play, and reactions to the emotions of others, one would expect that their relationships with others would suffer. Although anecdotal evidence seems to support this, there is a dearth of studies on the interpersonal relationships of individuals with autism. This is a serious omission in that we tend to make judgements based on anecdotal and clinical evidence that are not always valid. A striking example concerns the ability of children with autism to form attachments with others. For many years, the claim was made in the literature that children with autism were unable to form such attachments (Cohen, Paul, & Volkmar, 1987). However, the empirical evidence contradicts this claim. Several studies have shown that young children with autism use their caregivers as a secure base, sometimes becoming distressed when the caregiver leaves them alone in an unfamiliar room and almost always showing either increased verbal or physical contact at reunion (Dissanayake & Crossley, 1997; Rogers, Ozonoff, & Maslin-Cole, 1991; Shapiro, Sherman, Calamari, & Koch, 1987; Sigman & Mundy, 1989; Sigman & Ungerer, 1984b). The reactions of the children with autism as a group do not differ from those of other developmentally delayed children of equivalent mental and chronological age, although they do differ from those of typically developing children who have equivalent mental abilities but are, perforce, much younger and thereby less experienced with separations. Moreover, a proportion of children with autism are even judged to be securely attached to their caregivers, using somewhat modified strange situation procedure and scoring techniques (Capps, Sigman, & Mundy, 1994; Rogers et al.,

1991; Shapiro et al., 1987). Although no-one would claim that the attachments of autistic children are entirely the same as those of other children, empirical evidence was necessary to elucidate what had been taken for granted in the clinical literature.

Interactions of autistic children with peers have been investigated somewhat more than other relationships. Developmentally disabled children have been observed to spend the vast majority of their time in school playing on their own (Guralnick & Groom, 1985; Strain, 1995). Hauck, Fein, Waterhouse, and Feinstein (1995) reported that children with autism initiated peer interactions much less frequently than did language-matched children with developmental delays. The children with autism tended to greet or give information whereas the children with developmental delays made bids to enter into play or seek information. In a study by Stone and Caro-Martinez (1990), children with autism only communicated spontaneously about three to four times per hour during unstructured situations in school.

In our follow-up study, children with autism who were about 12 years of age were observed in both unstructured and structured situations on the playground and in the classroom (Sigman & Ruskin, in press). The children with autism spent more time alone and less time in social interaction with peers than did comparison groups of children with developmental delays and children with Down syndrome. This was true even if the children with autism were high-functioning. High-functioning children with autism were more socially isolated than the group of children recruited with a variety of disorders who were of equivalent language age. The social isolation of the children with autism seems to be of their own doing in that they initiated fewer social bids and rejected more of the bids directed to them than did the other children. They were not more rejected than the other children in that an equivalent number of social bids were directed to them and their bids were accepted as much as those of other children. Thus, the children with autism were not as socially engaged as we had hoped nor as socially rejected as we had feared.

Most striking in these school observations was the scarcity of social initiations made by all the developmentally disabled children, teachers, and teachers' aides both in the classroom and on the playground. Peers initiated interactions with each other about 1 to 4% of the time and adults initiated interactions about 5 to 6% of the time. Although this may be understandable in the classroom, the children seem to be very isolated from both themselves and the adults even on the playground.

The level of social engagement of the autistic children was a function of their school environment and their own characteristics. Children with autism who had some contact during the school day with typically developing children were more socially engaged than those who did not. Furthermore, the extent to which the children helped the experimenter during the laboratory snack and showed concern for her when she hit her knee was concurrently associated with peer engagement. Finally, early levels of nonverbal communication, representational play, and emotional responsiveness were predictors of amount of peer engagement at school. Amount of peer social interaction was predicted by the frequency with which the preschool autistic children initiated joint attention and used functional play acts as well as by their empathy ratings, even when early intelligence scores were statistically constrained.

Summary

Although children with autism are deficient in their joint attention and play skills as well as their responsiveness to the emotions of others, there are individual differences in these characteristics. This review shows that these individual differences have consequences for later development. Children who are more generally communicative in the nonverbal domain gain more language skills over the short-term, and children who are able to follow the gaze of others make more long-term gains in language. Prosocial behaviors and peer engagement are also predicted by early characteristics, in that more communicative, empathic children are more likely to help others and are more socially engaged with peers during the mid-school years. The impact of these early individual differences in communication, play, and empathy is independent of the contribution of the child's early intelligence level, although clearly both intelligence and language abilities influence social competence and involvement both predictively and concurrently. Thus, these findings point to the importance of achievements in the early years for predicting later development.

Differentiation of Patterns of Results between Children with Autism and Children with Down Syndrome

The patterns of results are very different in our studies for children with Down syndrome. Individuals with Down syndrome also have severe problems with language development (Fowler, 1995; Miller & Chapman, 1984), although a much smaller proportion lack functional speech than is true for the autistic group. However, children with Down syndrome show no deficits in nonverbal communication, representational play, and responsiveness to other emotions in comparison to mental age matched developmentally delayed or typically developing children. Although children with Down syndrome request objects and assistance with objects less than typically developing children, this is true for all the developmentally disabled children. Surprisingly, at intake, the children with Down syndrome were rated as somewhat less empathic to the experimenter's distress than the developmentally delayed children, but this difference was not maintained over time. The children with Down syndrome were similar to the other developmentally delayed children in their prosocial behaviors and their peer interactions.

In terms of stability, the children with Down syndrome did not show individual stability in their nonverbal communication behaviors and responsiveness to the distress of others. Moreover, the children with Down syndrome showed the marked decline in intelligence test scores and the leveling off of language gains that have been described in many studies (Piper, Gendron, & Mazer, 1986; Rauh et al., 1991; Wishart & Duffy, 1990). This pattern cannot be attributed to individual de-

ficiencies in nonverbal communication and play skills. Although these functions are associated with concurrent language skills, they account for much less of the variance than is true for the children with autism and the children with developmental delays, and they do not predict long-term gains in language skills. There is some continuity in the development of the children with Down syndrome in that those preschool children who initiate social interactions with the experimenter also initiate interactions more with their peers in elementary school. At this point, we have not identified predictors of language gains in the children with Down syndrome.

The differences in predictive patterns for the children with autism and those with Down syndrome may be due to a difference in the severity of language problems within each group. Children with Down syndrome in our follow-up did not have the same degree of language difficulty as many of the low-functioning children with autism. The percentage of children with autism who had language ages less than 30 months (45%) was greater than the percentage of children with Down syndrome (25%) whose language was this low. Thus, the children with Down syndrome appear to have the communication and representational play skills needed to acquire basic abilities to understand language and use speech. This suggests that nonverbal communication and play skills may be necessary but not sufficient for the acquisition of advanced language skills and that children with Down syndrome are deficient in some other way that handicaps their language development. One possibility is that the limited short-term auditory memory observed in children with Down syndrome (Wang & Bellugi, 1994) may contribute to their problem in language development.

Research and Clinical Implications

Given the links between early and later achievements in children with autism, the identification of the roots of these early achievements is important. The determination of those characteristics in the child and the environment that foster the development of nonverbal communication and play skills could be useful in planning interventions targeted at improving the quality of life of children with autism. For this reason, my colleagues and I at UCLA are now beginning an investigation of the characteristics of the home and school environments of autistic children that are associated with gains in the development of joint attention and pretend play over the course of a year. In conjunction, Connie Kasari and her students are conducting an experimental intervention directed at increasing the children's capacity for joint attention with others. With this two-pronged approach, we aim to identify the most effective ways of changing the early communicative and representational abilities of children with autism. Of course, it is possible that these functions are immutable in autistic children. Teaching children to think in a radically different way may be impossible, as the studies aiming to accelerate understanding of conservation in the 1960s and 1970s largely showed (Piaget, 1964). However, without empirical investigations, there is no way to know the extent of plasticity in these systems in autistic children.

Early interventions are not the only entry point in improving the lives of developmentally disabled children; there needs to be more focus on the development of social competence in the mid-school years. For example, the school playground would seem to be an excellent place to help developmentally disabled children, including those with autism, acquire skills for entering and maintaining play interactions. However, with some exceptions, the teachers and teachers' aides whom we observed on the playgrounds made few attempts to foster peer engagement. This may be because of a tendency to overlook the importance that social capacities and involvement have for these children and see school solely as a place to learn academic skills. The opportunities afforded by school experience need to be used to accomplish social learning. Moreover, the observations of interactions between autistic children and their siblings (Knott, Lewis, & Williams, 1995) suggests that other social relationships should also be fostered. In addition, intensive language interventions need to be continued beyond the preschool period. The plateau reached in language after an initial period of growth, in both low-functioning autistic children and children with Down syndrome, may be due to the cessation of language interventions that often occurs in the mid-school years.

Finally, our understanding of the deficits in nonverbal communication, representational play, and emotional responsiveness needs to be amplified. We need to pinpoint the early forms of these difficulties, and the early diagnosis projects (Baron-Cohen et al., 1996; Charman et al., 1997; Osterling & Dawson, 1994) are accomplishing a great deal in this direction. In line with this, information is needed about the areas of brain activity that accompany social responses and thinking, and the availability of functional magnetic resonance technology should facilitate investigations of these parallel processes. Such studies will also provide a broader appreciation of the normal processes of development of representational and social abilities and will enhance the significance of the developmental perspective to the understanding of childhood psychopathology.

Acknowledgements—This paper is dedicated to the memory of Dr Emanuel Miller and two UCLA Professors who followed his tradition, Dr Dennis Cantwell and Dr Michael Goldstein. The following postdoctoral fellows and graduate students contributed to some of the research discussed in this paper: Shoshana Arbelle, Lisa Capps, Rosalie Corona, Cheryl Dissanayake, Michael Espinosa, Connie Kasari, Norman Kim, Cindy Littleford, Alma Lopez, Peter Mundy, Ellen Ruskin, Judy Ungerer, and Nurit Yirmiya. This research has been supported by grants from the National Institute of Neurological Disorders, Grant NS25243; National Institute of Mental Health, MH 33815; and National Institute of Child Health and Human Development, Grant HD17662 and Program Project Grant HD35470.

References

Baldwin, D. A. (1991). Infants' contribution to the achievement of joint reference. *Child Development*, *62*, 875–890.

Baron-Cohen, S. (1987). Autism and symbolic play. *British Journal of Developmental Psychology*, *5*, 139–148.

Baron-Cohen, S., Cox, A., Baird, G., Sweetenham, J., Nightingale, N., Morgan, K., Drew, A., & Charman, T. (1996). Psychological markers in the detection of autism in

infancy in a large population. *British Journal of Psychiatry*, *168*, 158–163.
Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition*, *21*, 37–46.
Bates, E., Bretherton, I., Carlson, V., Carpen, K., & Marcia, R. (1979). Next steps: Follow-up study and some pilot research. In E. Bates (Ed.), *The emergence of symbols: Cognition and communication in infancy* (pp. 271–314). New York: Academic Press.
Bruner, J., & Sherwood, V. (1983). Thought, language, and intersection in infancy. In J. D. Call, E. Galenson, & R. L. Tyson (Eds.), *Frontiers of infant psychiatry* (pp. 38–52). New York: Basic Books.
Cantwell, D. P., Baker, L., Rutter, M., & Mawhood, L. (1989). Infantile autism and developmental receptive dysphasia: A comparative follow-up into middle childhood. *Journal of Child Psychology and Psychiatry*, *19*, 19–33.
Capps, L., Sigman, M., & Mundy, P. (1994). Attachment security in children with autism. *Development and Psychopathology*, *6*, 249–261.
Carr, J. (1988). Six weeks to twenty-one years old: A longitudinal study of children with Down syndrome and their families. *Journal of Child Psychology and Psychiatry*, *29*, 407–431.
Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G., & Drew, A. (1997). Infants with autism: An investigation of empathy, pretend play, joint attention, and imitation. *Developmental Psychology*, *33*, 781–789.
Chung, S. Y., Luk, S. L., & Lee, W. H. (1990). A follow-up study of infantile autism in Hong Kong. *Journal of Autism and Developmental Disorders*, *20*, 221–232.
Cohen, D. J., Paul, M. R., & Volkmar, F. R. (1987). Issues in the classification of pervasive developmental disorders and other conditions. In D. J. Cohen, A. M. Donnelan, & M. R. Paul (Eds.), *Handbook of autism and pervasive developmental disorders* (pp. 221–243). New York: Wiley.
Corona, R., Dissanayake, C., Arbelle, S., Wellington, P., & Sigman, M. (in press). Is affect aversive to young children with autism: Behavioral and cardiac responses to experimenter distress. *Child Development*.
Davies, S., Bishop, D., Manstead, A. S. R., & Tantam, D. (1994). Face perception in children with autism and Asperger's Syndrome. *Journal of Child Psychology and Psychiatry*, *35*, 1033–1057.
DeMyer, M., Barton, S., Alpern, G., Kimberlin, C., Allen, J., Yang, E., & Steele, R. (1974). The measured intelligence of autistic children. *Journal of Autism and Childhood Schizophrenia*, *4*, 42–60.
DeMyer, M. K., Barton, S., DeMyer, W. E., Norton, J. A., Allen, J., & Steel, R. (1973). Prognosis in autism: A follow-up study. *Journal of Autism and Childhood Schizophrenia*, *3*, 199–245.
Dissanayake, C., & Crossley, S. (1997). Proximity and sociable behaviors in autism: Evidence for attachment. *Journal of Child Psychology and Psychiatry*, *37*, 149–156.
Dissanayake, C., Sigman, M., & Kasari, C. (1996). Long-term stability of individual differences in the emotional responsiveness of children with autism. *Journal of Child Psychology and Psychiatry*, *37*, 461–467.
Egan, P. J., Zlomke, L. C., & Bush, B. R. (1993). Utilizing functional assessment, behavioral consultation, and videotape review of treatment to reduce aggression: A case study. *Special Services in the Schools*, *7*, 27–37.
Eisenberg, L. (1956). The autistic child in adolescence. *American Journal of Psychiatry*, *112*, 607–612.
Fowler, A. E. (1995). Linguistic variability in persons with Down syndrome: Research and implications. In L. Nadel & D. Rosenthal (Eds.), *Down syndrome: Living and learning in the community* (pp. 121–131). New York: Wiley-Liss.
Fowler, A. E., Gelman, R., & Gleitman, L. R. (1994). The course of language learning in children with Down syndrome. In H. Tager-Flusberg (Ed.), *Constraints on language learning: Studies of atypical children* (pp. 91–140). Hillsdale, NJ: Lawrence Erlbaum.
Freeman, B. J., Ritvo, E. R., Needleman, R., & Yokota, A. (1985). The stability of cognitive and linguistic parameters in autism: A five-year prospective study. *Journal of the American Academy of Child Psychiatry*, *24*, 459–464.
Gillberg, C., & Steffenburg, S. (1987). Outcome and prognostic factors in infantile autism and similar conditions: A population-based study of 46 cases followed through puberty. *Journal of Autism and Developmental Disorders*, *17*, 273–288.
Guralnick, M. J., & Groom, J. M. (1985). Correlates of peer-related social competence of developmentally delayed preschool children. *American Journal of Mental Deficiency*, *90*, 140–150.
Hauck, M., Fein, D., Waterhouse, L., & Feinsten, C. (1995). Social initiations by autistic children to adults and other children. *Journal of Autism and Developmental Disorders*, *25*, 579–595.
Hermelin, B., & O'Connor, N. (1970). *Psychological experiments with autistic children*. New York: Pergamon Press.
Hobson, R. P. (1993). *Autism and the development of mind*. Hove, U.K.: Lawrence Erlbaum.
Kanner, L. (1971). Follow-up study of 11 autistic children originally reported in 1943. *Journal of Autism and Childhood Schizophrenia*, *1*, 119–145.
Knott, F., Lewis, C. & Williams, T. (1995). Sibling interaction in children with learning disabilities: A comparison of autism and Down's syndrome. *Journal of Child Psychology and Psychiatry*, *36*, 965–975.
Krug, D. A., Arick, J. R., & Almond, P. J. (1980). *Autism screening instrument for education planning*. Portland, OR: AISEP Educational Company.
LeCouteur, A., Rutter, M., Lord, C., Rios, P., Robertson, S., Holdrafer, M., & McLennan, J. (1989). Autism diagnostic interview: A standardized investigator-based instrument. *Journal of Autism and Developmental Disorders*, *19*, 363–387.
Leslie, A. M. (1987). Pretense and representation: The origins of "theory of mind". *Psychological Review*, *94*, 412–426.
Lewis, V., & Boucher, J. (1988). Spontaneous, instructed and elicited play in relatively able autistic children. *British Journal of Developmental Psychology*, *6*, 325–339.
Lockyer, L., & Rutter, M. (1969). A five-to-fifteen year follow-up study of infantile psychosis. III. Psychological aspects. *British Journal of Psychiatry*, *115*, 865–882.
Lord, C., Rutter, M., & LeCouteur, A. (1994). Autism Diagnostic Instrument-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, *24*, 659–685.
Lord, C., Rutter, M., Susan, G., Heemsbergen, J., Jordan, H., Mawhood, L., & Schopler, E. (1989). Autism diagnostic observation schedule: A standardized observation of communicative and social behavior. *Journal of Autism and Developmental Disorders*, *19*, 185–209.
Lord, C., & Schopler, E. (1989a). The role of age at assessment, development level, and test in the stability of intelligence scores in young autistic children. *Journal of Autism and Developmental Disorders*, *19*, 483–499.
Lord, C., & Schopler, E. (1989b). Stability of assessment results of autistic and non-autistic language-impaired children from preschool years to early school age. *Journal of Child Psychology and Psychiatry*, *30*, 575–590.
Lotter, V. (1978). Follow-up studies. In M. Rutter & E. Schopler (Eds.), *Autism: A reappraisal of concepts and treatment* (pp. 475–495). New York: Plenum Press.

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

Loveland, K. A. & Tunali, B. (1991). Social scripts for conversational interactions in autism and Down syndrome. *Journal of Autism and Developmental Disorders*, *21*, 177–186.

Miller, J. F., & Chapman, R. S. (1984). Disorders of communication: Investigating the development of language of mentally retarded children. *American Journal of Mental Deficiency*, *88*, 536–545.

Mittler, P., Gilles, S., & Jukes, E. (1966). Prognosis in psychotic children: Report of a follow-up study. *Mental Deficiency*, *10*, 73–83.

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

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, *24*, 247–257.

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.

Piaget, J. (1964). Development and learning. In R. E. Ripple & V. N. Rockcastle (Eds.) *Piaget rediscovered* (pp. 7–20). Cambridge, MA: Harvard University Press.

Piper, M. C., Gendron, M., & Mazer, B. (1986). Developmental profile of Down's syndrome infants receiving early intervention. *Child: Care, Health and Development*, *12*, 183–194.

Rauh, H., Rudinger, G., Bowman, T. G., Berry, P., Gunn, P. V., & Hayes, A. (1991). The development of Down's syndrome children. In M. D. Lamb & H. Keller (Eds.), *Infant development: Perspectives from German-speaking countries* (pp. 320–355). Hillsdale, NJ: Lawrence Erlbaum.

Redefer, L. A., & Goodman, J. F. (1993). Pet-facilitated therapy with autistic children. *Journal of Autism and Developmental Disabilities*, *19*, 461–467.

Riguet, C. B., Taylor, N. D., Benroya, S., & Klein, L. S. (1981). Symbolic play in autistic, Down's, and normal children of equivalent mental age. *Journal of Autism and Developmental Disorders*, *11*, 439–448.

Rogers, S. J., Ozonoff, S., & Maslin-Cole, C. (1991). A comparative study of attachment behavior in young children with autism or other psychiatric disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *30*, 483–488.

Rumsey, J. M., Rapoport, M. D., & Sceery, W. R. (1985). Autistic children as adults: Psychiatric, social, and behavioral outcomes. *Journal of the American Academy of Child Psychiatry*, *24*, 465–473.

Rutter, M. (1978). Diagnosis and definition of childhood autism. In M. Rutter & E. Schopler (Eds.), *Autism: A reappraisal of concepts and treatment* (pp. 1–27). New York: Plenum.

Schopler, E., Reichler, R. J., & Renner, B. R. (1986). *The childhood autism rating scale*. New York: Irvington Publishers.

Seibert, J., Hogan, A. J., & Mundy, P. (1982). Assessing interactional competencies: The early social communication scales. *Infant Mental Health Journal*, *3*, 244–258.

Shapiro, T., Sherman, M., Calamari, G., & Koch, D. (1987). Attachment in autism and other developmental disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *226*, 485–590.

Sigman, M., & Capps, L. (1997). *Children with autism: A development perspective*. Cambridge, MA: Harvard University Press.

Sigman, M., Kasari, C., Kwon, J., & Yirmiya, N. (1992). Responses to the negative emotions of others by autistic, mentally retarded, and normal children. *Child Development*, *63*, 796–807.

Sigman, M., & Mundy, P. (1989). Social attachments in autistic children. *Journal of the American Academy of Child and Adolescent Psychiatry*, *28*, 74–81.

Sigman, M., & Ruskin, E. (in press). *Social competence in children with autism, Down syndrome, and other developmental delays: A longitudinal study*. Monograph of the Society for Research in Child Development. Chicago, IL: University of Chicago Press.

Sigman, M., & Ungerer, J. A. (1984a). Cognitive and language skills in autistic, mentally retarded, and normal children. *Developmental Psychology*, *20*, 293–302.

Sigman, M., & Ungerer, J. A. (1984b). Attachment behaviors in autistic children. *Journal of Autism and Developmental Disorders*, *14*, 231–244.

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development*, *55*, 17–29.

Stone, W. L., & Caro-Martinez, L. M. (1990). Naturalistic observations of spontaneous communication in autistic children. *Journal of Autism and Developmental Disorders*, *20*, 437–453.

Strain, P. S. (1995). Social and nonsocial determinants of acceptability in handicapped preschool children. *Topics in Early Childhood Special Education*, *4*, 47–58.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103–130). Hillsdale, NJ: Lawrence Erlbaum.

Venter, A., Lord, C., & Schopler, E. (1992). A follow-up study of high-functioning autistic children. *Journal of Child Psychology and Psychiatry*, *33*, 489–507.

Wang, P., & Bellugi, U. (1994). Evidence from two genetic syndromes for a dissociation between verbal and visual-spatial short-term memory. *Journal of Clinical and Experimental Neuropsychology*, *16*, 317–322.

Wing, L., Gould, L., Yeates, S. R., & Brierly, L. M. (1977). Symbolic play in severely mentally retarded and autistic children. *Journal of Child Psychology and Psychiatry*, *18*, 167–178.

Wishart, J. G., & Duffy, L. (1990). Instability of performance on cognitive tests in infants and young children with Down's syndrome. *British Journal of Educational Psychology*, *60*, 10–22.

Yirmiya, N., Sigman, M., Kasari, C., & Mundy, P. (1992). Empathy and cognition in high-functioning children with autism. *Child Development*, *63*, 150–160.

Manuscript accepted 5 May 1998