A Longitudinal Study of Language Acquisition in Autistic and Down Syndrome Children[1]

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Abstract:
Findings from a longitudinal study of language acquisition in a group of autistic children are presented. Six autistic subjects and six children with Down syndrome, matched on age and MLU at the start of the study, were followed over a period of between 12 and 26 months. Language samples were collected in the children's homes while they interacted with their mothers. Samples of 100 spontaneous child utterances from the transcripts were analyzed using the following measures: MLU, Index of Productive Syntax, lexical diversity, and form class distribution. The results indicate that the majority of these autistic children followed the same general developmental path as the Down syndrome children in this study, and normal children reported in the literature, in the acquisition of grammatical and lexical aspects of language, and confirm previous findings suggesting that autism does not involve a fundamental impairment in formal aspects of language.

Article:
One of the primary characteristics of the autistic syndrome is impairment in language functioning. Over the past 20 years a considerable number of studies have been conducted to investigate the nature of the language impairment in autism, and several recent reviews summarize this work (Fay & Mermelstein, 1982; Paul, 1987; Swisher & Demetras, 1985; Tager-Flusberg, 1989a). Descriptive studies (e.g., Pronovost, Wakstein, & Wakstein, 1966; Wolf & Chess, 1965) provided support for the main clinical features of language in autism, including immediate and delayed echolalia or imitation; abnormal use of prosody: metaphorical language (cf. Kanner, 1946); pronominal reversals; and noncommunicative speech. More recent empirical studies, conducted within a psycholinguistic framework, have focused on identifying which aspects of language impairment are central to the deficit in autism.

Based on this body of work, there is now consensus that autism does not involve primary impairment in either phonology of syntax (see studies by Bartolucci & Pierce, 1977; Bartolucci, Pierce, Streiner, & Eppel, 1976; Boucher, 1976; Cantwell, Baker, & Rutter, 1978; Pierce &

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Bartolucci, 1977). There are however major deficits in pragmatic aspects of language use, both in the range of functions that autistic children express (e.g., Ball, 1978; Mermelstein, 1983; Wetherby & Prutting, 1984) and in their ability to communicate in a discourse setting (e.g., Curcio & Paccia, 1987; Paul & Cohen, 1984; Tager-Flusberg, 1982). Questions remain regarding the existence of a basic semantic deficit in autism: Although autistic children show no problems acquiring words that map onto concrete objects (Tager-Flusberg, 1985, 1986), it has been hypothesized that abstract or relational meaning is more seriously impared (Hobson, 1989; Menyuk & Quill, 1985).

One of the major limitations of the studies on which these conclusions are based is their cross-sectional design. Autistic children's productive language abilites have been assessed using relatively small language samples collected in a single session. These studies, therefore, do not provide any information about developmental patterns of language acquisition in children with autism nor how their language might change over time. Furthermore, many of these studies have collected language samples from autistic children interacting with teachers or researchers in a laboratory or school environment. In contrast, current psycholinguistic research on normally developing children typically relies on language samples collected in the home, with the children interacting with their mothers. Children, including autistic children (cf. Bernard-Opitz, 1982), are more verbal and use more advanced language with someone they know well in a familiar setting.

There have been two studies that investigated autistic children's language longitudinally. Cunningham's (1966) seminal paper presented a case study of a high-functioning autistic child who was followed for 5 years, from the age of 6 to 11. The methods and analyses used were based on McCarthy (1930), and they revealed that the child's utterances grew in length and his vocabulary increased over the first 6-month period at a rate comparable to that of normal children, but after that point there was no further growth and the child remained at a 30-month level. In a more recent paper, Layton and Baker (1981) reported on an 8-year-old mute autistic boy who was studied over a period of 18 months during which time he was trained in sign language. He too learned a core vocabulary and progressed from single signs to two-word signs, however his use of language was very limited and was restricted in semantic range. This child did not use the language he acquired creatively nor did he extend his semantic repertoire to go beyond his own immediate needs or the description of objects present in the environment. Furthermore his rate of development was slower than normal, which was related, perhaps, to his moderate level of mental retardation.

Because both these longitudinal studies focused on development in a single child it is difficult to generalize their findings. Neither child progressed very far in language development, yet we know that some autistic children, especially those who have higher IQ levels, do develop beyond the 30-month level. Thus we still do not know how language develops over time beyond the two-word stage. One key question is whether autistic children follow the same developmental path as do normally developing children. Simon (1975), for example, proposed that autistic children do not develop normally. Based on her observations of two children, she argued that autistic children do not show gradual growth in their mean length of utterance or the same order of emergence of grammatical structures that are among the hallmarks of normally developing language. Instead, both her subjects relied heavily on echolalia which she interpreted as indicating that they did not analyze what they heard or said. Simon's hypothesis, however, leaves unanswered how her subjects did acquire functional language.

The aim of the present study was to provide longitudinal data from a group of young higher functioning autistic children who were in the process of acquiring language in order to address the main issue of how these children's language develops over time. Spontaneous speech samples were collected at bimonthly intervals, in the children's homes, while they were interacting with their mothers. Thus the data collected were comparable to standard studies of normally developing children (cf. Brown, 1973). Using the same methods, language samples were also collected from a group of Down syndrome children who were matched on chronological age and language level to the autistic children at the beginning of the study. In this way, we could compare our autistic subjects to a nonautistic group of children who were also delayed in acquiring language, thus ensuring that any differences in developmental patterns in the autistic children could not simply be attibuted to later onset.

Studies of Down syndrome children (e.g., Fowler, 1984; Rondal, 1978) suggest that they follow the same general path in acquiring language as do normally developing children, although their language lags behind their nonverbal cognitive abilities and may proceed at a slower rate, Some diffeences emerge in their use of language: Specifically, Down syndrome children tend to rely somewhat more on imitation, routines, and pronominal forms than do normally developing children at the same level (Dooley, 1976). Nevertheless, the broad picture of language development in Down syndrome children supports the view that it is essentially similar to language development in nonretarded children.

In addressing the question of how language develops in aututistic children, we focused on reliable measures of language that show patterns of change over time in the domains of grammatical and lexical development. Our goal is to provide an overview of these aspects of language acquisition in autistic children in order to assess whether its development is similar or different to that in Down syndrome or normally developing children.

METHOD

Subjects

The subjects for this study included 6 boys who had been diagnosed autistic, using Rutter's (1978) criteria, and consistent with current DSM-III criteria. Following Rutter and more recent proposals for defining autism (Cohen, Paul, & Volkmar, 1986, 1987; Denckla, 1986), the autistic children were identified by the presence or definite history of all of the following characteristics: onset prior to 30 months; gross and sustained impariements in socialization and social relations; delays and deficits in language and communicative development; and ritualistic, obsessive, or compulsive behaviors.

The children were all living at home with their families, and were either attending special day school programs or were involved in a home-based intervention program. The children were located for participaton in this study through the programs they attended. Because the focus of the study was on the course of language acquisition, autistic children were selected for having already acquired some language. The IQ scores of the autistic subjects were assessed using the Leiter International Performance Scale. Although the children were not preselected for higher levels of functioning, in fact five of the six autistic children fell in the normal or low-normal IQ range.

The Down syndrome (DS) children, 4 boys and 2 girls, were located through hospital records. They came from similar family and educational backgrounds as the autistic children, and like the autistic subjects, their socioeconomic status ranged from lower to upper middle class. The DS children were also chosen to match the autistic children on chronological age and language level, as measured by mean length of utterance (MLU), at the start of the study. They were not, however, matched on IQ or nonverbal mental age levels. Details about the two groups of subjects participating in the study are presented in Table I.

Table I. Subject Characteristics

Child	Age	IQ	MLU	Length of time followed (months)	No. of visits
Autistic					
Stuart	3-4	61	1.17	15	8
Roger	3-9	105	2.31	22	10
Brett	5-8	108	3.74	22	10
Mark	7-7	75	1.46	26	13
Rick	4-7	94	1.73	22	11
Jack	6-9	91	3.03	25	12
Down syndrome					
Charlie	3-3	46	1.21	13	6
Kate	4-1	65	2.98	12	6
Penny	5-1	63	2.69	15	7
Martin	5-4	47	1.63	24	11
Billy	5-7	49	1.68	25	13
Jerry	6-9	54	2.86	24	11

T tests were conducted to check for differences between the groups on age, MLU at the start of the study, and IQ. Neither age, $t(10) = 0.31$, nor MLU, $t(10) = 0.13$, revealed significant group differences, demonstrating that the autistic and DS subjects were well matched initially on these variables. However, the autistic subjects had significantly higher IQ levels than the DS subjects, $t(10) = 4.32$, $p < .001$.

Procedure

Spontaneous speech protocols were collected during bimonthly visits to the children's homes. The same procedures for collecting, analyzing, and coding the language samples were followed for both groups of subjects. Each visit was carried out by two researchers, one of whom was responsible for recording the visit while the other took notes on the ongoing conversation. Generally, the mothers prepared in advance activitities, toys, or games to play with, and the visit centered around these activities. The mothers were encouraged to select their own activities that would best suit the individual interests of their children.

On arrival at a child's home, the researchers set up the recording equipment, including a Panasonic WV-3400 video camera and NV-8420 portable video cassette recorder, and a portable Panasonic RQ-350 mini audio cassette recorder with a Sony ECM-16T microphone. The mother and child then entered the room and were asked to begin playing together. Recording began as soon as they had settled into their activities. The researchers remained uninvolved in the ongoing interaction and only responded briefly when spoken to. The recording sessions were scheduled for 1 hr, however the length of a visit varied somewhat according to the individual needs and temperaments of the children. The recording times varied from 40 to 70 min.

In order to provide some comparability across recording sessions and across children, during each visit one of the researchers gave a gift to the child. Mothers were asked to help the child play with the gift, to minimize the interaction between the researcher and the child. The presentation, unwrapping, and initial play with the gift thus afforded some similarity in the conversational context for every session. The gifts were selected from among the following examples: crayons, paints, or markers and coloring paper; sticker books; soap bubbles; play dough; small dolls and furniture; animals; farm scenes; colorforms; cars and trucks; puzzles; picture books; tea sets; kitchen scenes.

Preparation of Transcripts

Written transcripts of the recording sessions were prepared in the following way. Within 3 to 5 days of a visit, an initial transcript was made by one researcher from the audiotape of the conversation between the mother and child, using a Sony BM-46 transcribing machine. The handwritten notes taken during the visit were used to facilitate the transcription. A verbatim written record of the conversation, at the morphemic level, was prepared at this stage. In addition, utterances were divided on the basis of pause length and prosodic marking (i.e., rise or fall in intonation) and marked by punctuation. Only the speech of the mother and child went into the conversational record; other speech was included in context notes. After going through the audiotape to prepare the transcript, the videotape was used to incorporate additional context notes that served to provide a detailed account of the ongoing nonverbal activity. This first draft of the transcript, including context notes, was then typed into an ASCII computer file using the SALT (Systematic Analysis of Language Transcripts) format for transcripts (Miller & Chapman, 1985). The first two handwritten pages were omitted from the typed copy.

A second researcher used the typewritten file and the audiotape to prepare a second draft of the transcript, thus checking the reliability of the initial transcription. Changes and corrections were typed in, and then a final check was made using the videotaped recording. The final draft of the transcript was coded at the level of morphemes, using Brown's rules (Brown, 1973) and following the SALT guidelines. For example, regular plural nouns and tensed verbs were marked as two morphemes, e.g., toy/s, give/ing, walk/ed. All routine utterances or phrases (e.g., singing, counting, reading, recitation of the alphabet) used by either the mother or child were placed in parentheses to be excluded from later analysis. Once the morpheme coding had been checked through, the complete transcript was ready for analysis.

Because both the autistic and DS children used a significant amount of imitation, including self-repetition, a sample of 100 spontaneous child utterances (excluding imitations and routine utterances) was prepared, based on the complete trancript. All child utterances that were full or partial imitations of a previous utterance within 5 transcript lines were excluded from the 100 sample. In addition, incomplete or unintelligible utterances, or those consisting only of routines (e.g., thank you; please), or yes, no, and proper names as one-word utterances were eliminated. The resulting sample consisted, then, of 100 spontaneous complete and intelligible child utterances. For each transcript, a corresponding 100-utterance sample was prepared in this way and typed into an ASCII file, again using the SALT format.

RESULTS

The 100-utterance sample for each visit was used to analyze the children's language development using the following measures: MLU; the Index of Productive Syntax (IPSyn), an alternative measure of the emergence of basic syntactic and morphological structures; lexical diversity; and distributions of lexical items among various form classes. Data from these analyses were analyzed for within-group and between-group patterns of developmental change.

Mean Length of Utterance

One of the most well-known measures of language change is the mean length of utterances, or MLU, measured in morphemes (Brown, 1973). This measure has been shown to be a remarkably useful index of grammatical development among normal children, at least up to a mean length of 4.0, primarily because increases in utterance length reflect the acquisition of new knowledge. Brown further subdivided the range of MLU between 1.0 and 4.0 among five roughly equal linguistic stages each of which has been associated with distinct linguistic achievements. By and large, children show increases in MLU over the course of acquiring language, nevertheless fluctuations within a certain range of MLU are also typical among normal children. These nonlinear fluctuations reflect differences and variability in the context, interest, and mood of the child (Brown, 1973). The first analysis we conducted was to chart the individual subjects' MLU over the course of time each was followed. MLUs were computed for each sample using the SALT program (Miller & Chapman, 1985). MLU curves are presented in

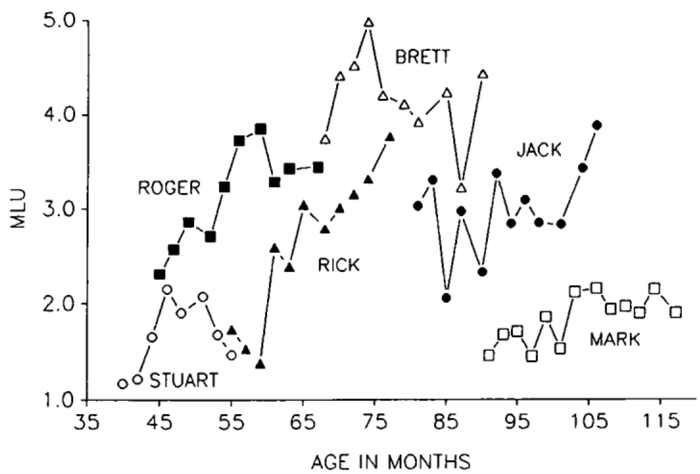

Fig. 1. Individual MLU curves for autistic subjects.

Figure 1 for the autistic subjects and in Figure 2 for the Down syndrome subjects.

Both figures illustrate large within-group variability on this measure of language development. Looking first at the data from the autistic children, it is clear that there is little relationship between MLU and age: Some of the younger subjects, particularly Roger and Rick, were significantly more advanced than Mark, the oldest child in the group. Indeed, Mark made very little progress in MLU over the course of the 26 months he was followed, advancing only about 0.5 in MLU which is equivalent to about 5 months in normal development (Miller & Chapman, 1981).

In contrast, both Roger and Rick developed at almost a normal rate. Roger went from an MLU of 2.31, or Stage II in Brown's (1973) terms, to an MLU of 3.84, which is early Stage V, in a period of 14 months, before he then dipped back slightly to 3.44, by the end of the study. Rick's developmental progress was even more remarkable. Over a period of 22 months, he advanced from an MLU of 1.73, which is late Stage I, to an MLU of 3.76, also early Stage V. This is well within the limits of a normal rate of development, though Rick was already 5 years old when he was acquiring language. Nevertheless, both Roger and Rick illustrate that some autistic children can acquire language at a normal rate, even after a significant delay in onset.

Stuart, the youngest child in the group showed an unusual pattern of development. During the first 6 months his MLU increased from 1.17 (early Stage I) to 2.15 (early Stage II); essentially a normal rate of progress. Thereafter, however, he plateaued over the next few months, and then declined quite sharply back to an MLU of 1.47. This type of decline in MLU is never seen in normally developing children, but in Stuart it paralleled declines in

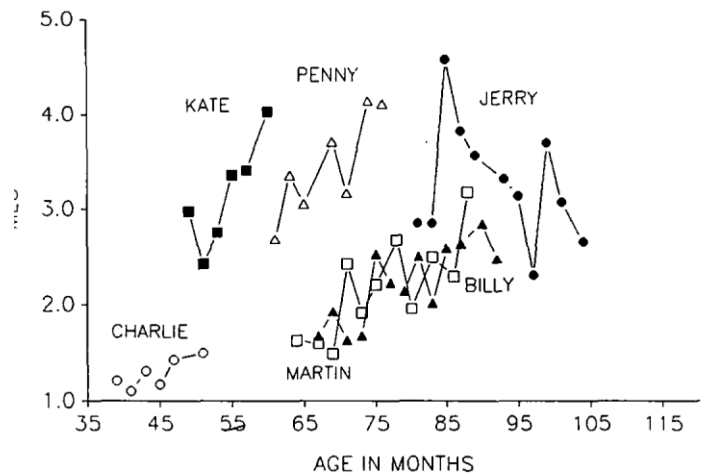

Fig. 2. Individual MLU Curves for Down syndrome subjects.

other areas of functioning. His parents withdrew from the study at this point, primarily because of the high levels of stress they were experiencing as a result of these changes in their autistic son.

Both Brett and Jack showed relatively little change in MLU over the course of the study. Brett's MLU was already 3.84 (Stage V) when he was first observed. As a measure, MLU is not very useful beyond about 4.0, and therefore one cannot expect to observe predictable increases beyond this point. Jack's MLU did not increase significantly from its initial level of 3.03 over the first 20 months that he was followed. Over the last 5 months his MLU increased to 3.87, though it is not clear, given some of the previous fluctuations in his MLU, whether this represented significant development. Although Jack's MLU was significantly higher than Mark's, his pattern of development looks most similar to Mark's.

In sum, the MLU data from the six autistic children showed widely different developmental patterns. Some of the children achieved a normal rate of development on this measure; one child showed a significant decline in MLU after a period of normal development; and two children, the oldest in the group, showed very slow development over the 2 years they were followed.

Interestingly, the two autistic children with the lowest IQ levels, Stuart and Mark, had the lowest levels of MLU and made the least overall progress across the course of study, suggesting that there may be a relationship between MLU increases and IQ level.

The MLU curves from the DS subjects also illustrate a number of distinct developmental patterns. Martin and Billy both developed quite slowly over the 2 years they were followed. Martin's MLU went from 1.63 (late Stage I) to 3.18 (early Stage IV), while Billy's MLU went from 1.68 to 2.85 (Stage III). Normally developing children generally take only 1 year to achieve equivalent levels of change (Miller & Chapman, 1981). Charlie, the youngest child in this group, appears to be on a similar developmental path, though at a less advanced stage.

The two girls with DS, Kate and Penny, showed more rapid developmental progress than any of the other children; they also had the highest IQ levels in the group (see Table I), again suggesting some relationship between IQ and rate of language development. Kate's MLU rose from 2.98 to 4.03 over the course of 12 months, while Penny's MLU went from 2.68 to 4.11. These changes are not much different than developmental rates found in younger normally developing children. And, given the shape of their MLU curves, there is no reason to believe that either of them had reached the end point in their linguistic dvelopment when we stopped observing them.

The oldest DS subject, Jerry, showed the most anomalous MLU pattern, with large fluctuations over the 2-year period he was followed. His MLU went from a high of 4.57 at 7 years of age to a low of 2.31 just 1 year later. By the end of study, Jerry's MLU returned to 2.66, the stage it was at the beginning. Because MLU is, to a certain extent, sensitive to the conversational context especially at the later stages, it is quite likely that much of the fluctuation evidenced in his MLU curve was due to differences in contexts rather than real developmental changes. Jerry may thus have already reached a plateau by the time we began our observations of his language. It is interesting to note that his MLU curve closely resembles Jack's to whom he was matched at the start of the study on age and MLU.

The various developmental patterns match those described for the autistic subjects, with one exception: None of the DS children showed the kind of decline in MLU, without recovery, that Stuart did. A number of autistic and DS children showed almost normal rates of development in MLU though at much later ages, while others in both groups were significantly slower in their rate of development. Whereas in normally developing children, there is a very strong correlation between age and MLU ($r = .88$; Miller & Chapman, 1981), in these groups the correlation is much lower. For the DS group $r = .42$, $p < .001$; for the autistic group $r = .04$, ns.

Index of Productive Syntax

Despite the fact that both groups of subjects showed similar patterns in their MLU growth curves, it may be the case that in autistic children MLU, as a simple measure of length, reflects the development of quite different grammatical structures than in normally developing children or children with DS. In order to investigate this possibility, we used a second measure of grammatical development, Index of Productive Syntax (IPSyn), developed by Scarborough (1985).

The IPSyn consists of 56 items that are divided between four subscales: noun phrase (NP), verb phrase (VP), question and negation (QN), and sentence structure (SS). Within each subscale the items are ordered developmentally, based on current knowledge of normal language acquisition patterns. The Appendix presents the items and their developmental order within each of the IPSyn subscales. The occurrence of zero, one, or two different examples of each item are noted and awarded corresponding points. Scores can be summed both within and across the subscales to yield a total IPSyn score, which has a maximum of 120. Scarborough found that IPSyn correlated very highly with MLU, but it provides more detailed information about the grammatical content of a child's speech, and it can be useful beyond an MLU of 4.0.

For each of the 100-utterance samples, IPSyn scores were computed, following Scarborough's guidelines. Figures 3 and 4 present the IPSyn curves for the individual autistic and DS children, respectively.

The shapes of the IPSyn curves are remarkably similar to the MLU curves presented in Figures 1 and 2. Among the autistic children, Roger and Rick again showed significant development at a fairly rapid rate; Mark's IPSyn growth was very gradual; and Stuart declined sharply after an early period of progress. The IPSyn curve for Jack indicates that there was little change in his grammatical abilities over the course of time that he was followed. Brett's IPSyn curve does indicate significant development that was not apparent from his MLU curve. Recall that from the start, his MLU was almost at 4.0, the point at which it is no longer a useful measure of language development.

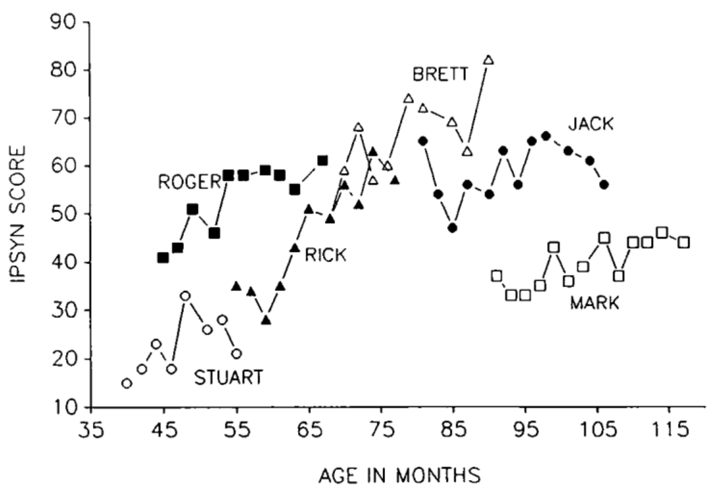

Fig. 3. Individual IPSyn curves for autistic subjects.

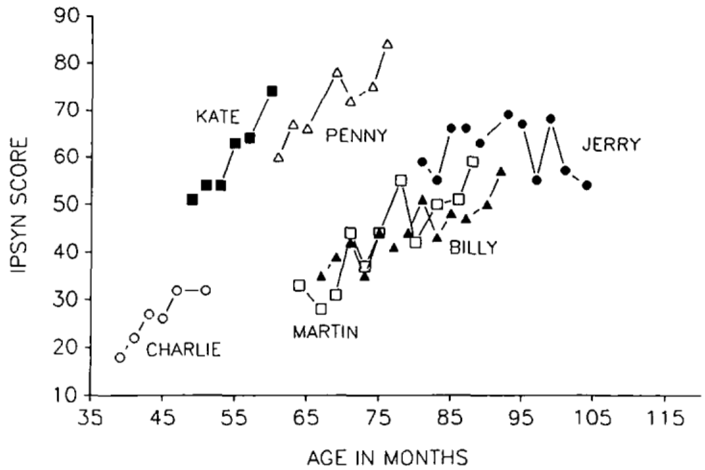

Fig. 4. Individual IPSyn curves for Down syndrome subjects.

Similarly, the IPSyn curves for the DS children closely matched their MLU curves. Charlie, Martin, and Billy showed slower IPSyn development than did Kate and Penny, while Jerry exhibited little change over the course of the study. Compared to Figure 2, his IPSyn curve shows less dramatic fluctuations across samples, indicating that this measure is less sensitive to contextual influences than is MLU.

Scarborough found that for normal children IPSyn correlated very highly with MLU (r = .93). We computed Spearman product-moment correlations between MLU and IPSyn scores for each group of subjects. For the DS children, r = .94, while for the autistic children, r = .85, a somewhat lower, though still highly significant correlation. To see how closely matched MLU and IPSyn were for the two groups, we computed t tests on the total IPSyn score at each MLU stage. Although there were no significant differences at Stages I (autistic M = 32.7; DS M = 31.7), II (autistic M = 39.9; DS M = 47.l), and III (autistic M = 51.7; DS M = 52.3), significant differences between the groups did emerge by Stages IV and V. At Stage IV the IPSyn scores for the autistic children (M = 58.9) were significantly lower than for the DS children (M = 64.9), $t(21) = 2.94$, $p < .01$. The same pattern was found at Stage V: the means for the autistic and DS children were 63.l and 71.8, respectively, $t(19) = 2.27$, $p < .05$.

Although for both groups of children MLU growth was also reflected in growth in IPSyn, the curves themselves do not reveal whether the children in each group followed a normal developmental path in acquiring new grammatical constructions. In order to examine this, we identified for each sample the highest, or *maximum,* item within each subscale that was scored.

Table II. Mean Maximum Scores on IPSyn Subscales for Autistic and Down Syndrome Children[a]

MLU stage	Autistic				Down syndrome			
	NP	VP	QN	SS	NP	VP	QN	SS
I (1.0–2.0)	7.9	7.4	3.8	5.5	7.6	6.8	2.8	4.7
II (2.0–2.5)	8.1	10.4	4.4	6.8	7.7	10.6	5.7	9.0
III (2.5–3.0)	9.3	10.7	6.1	11.2	8.7	11.7	6.2	10.0
IV (3.0–3.5)	9.3	12.2	7.6	11.5	10.1	13.1	8.1	11.9
V (3.5 +)	9.5	12.5	7.7[b]	13.3	10.4	14.4	9.1[b]	15.3

[a]NP = noun phrase, VP = verb phrase, QN = question/negation, SS = sentence structure.
[b]$p < .01$.

For example, if the most advanced NP item scored was a plural -s, the NP maximum score awarded was 7 (see Appendix). Given that the subscales are arranged in developmental order of emergence, as MLU or IPSyn total scores increase, the subscale maximum scores should increase too. If, on the other hand, the developmental order of grammatical constructions for either autistic or DS children does not follow the normal pattern there should be no relationship between these scores.

Table II shows the average maximum score data for each IPSyn sub- scale for both groups, dividing the samples by MLU stage. The data presented show that as MLU increases, the maximum scores increase within each sub- scale, indicating that subjects in both groups are using more advanced grammatical constructions at higher MLU stages. This suggests similar developmental patterns in the emergence of syntactic and morphological structures in normal, DS, and autistic children. T tests were conducted to test for group differences on each subscale at each MLU stage. The only significant difference was found on the question/negation subscale at the highest MLU stage.

Lexical Diversity

Thus far we have looked at the subjects' language acquisition only from the perspective of grammatical development. Research on normal patterns of language acquisition has also demonstrated that as children's language develops, their lexicons gradually increase in size (Nelson, 1975). We analyzed the number of different word roots used in each 100-utterance sample for all the subjects in the study, using the SALT program, and called this measure lexical diversity, following Scarborough and Dobrich (1985). Figures 5 and 6 show the developmental patterns on this measure for the individual autistic and DS children, respectively.

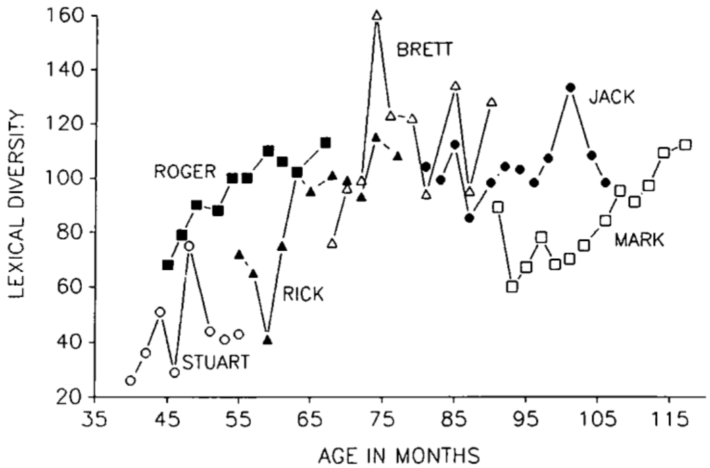

Fig. 5. Individual lexical diversity curves for autistic subjects.

By and large, the lexical diversity curves for both groups looked similar to the MLU and IPSyn curves presented above. Among the autistic children, Mark's lexical diversity curve illustrated a much sharper rate of linguistic development than was revealed in either his MLU or IPSyn curves. This suggests that while his grammatical development was extremely limited over the 2 years he was followed, his lexicon grew at a more significant rate. For all the other children, the same developmental patterns that were evident on the grammatical measures were also found on the lexical diversity measure.

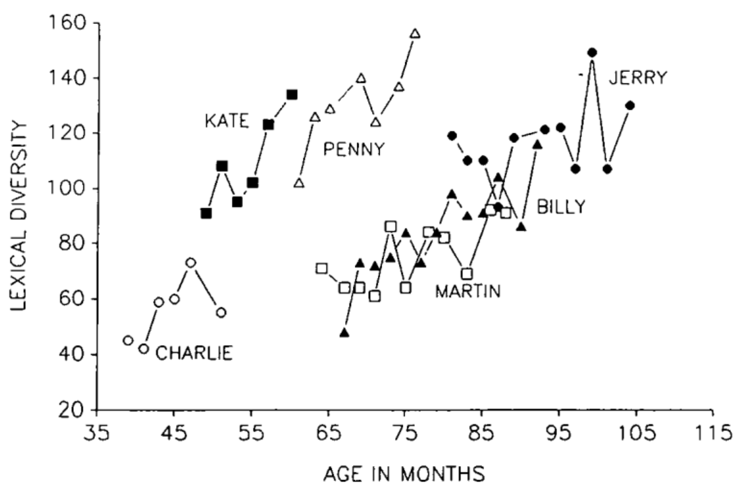

Fig. 6. Individual lexical diversity curves for Down syndrome subjects.

We also computed the correlations between lexical diversity and each of the grammatical measures. For the autistic children the correlations were $r = .73$ and $r = .85$ ($p < .001$) for MLU and IPSyn, respectively. The correlations were somewhat higher for the DS children: $r = .84$ and $r = .91$, $p < .001$.

Form Class Distribution

The final analysis that we conducted focused on the distribution of vocabulary among the main form classes — nouns, verbs, modifiers (including adjectives and adverbs), and miscellaneous closed class or function words (e.g., pronouns, articles, conjunctions, prepositions, auxiliaries). The purpose of this analysis was to see how the content of the autistic and DS children's lexicon compared at various stages of language development. Within each 100-utterance sample every word was categorized in one of the four form class categories, using both lingusitic and nonlinguistic context to identify the appropriate category for each word. Table III presents the results of this analysis, showing the mean percentage of words within each category at different MLU stages. *T* tests were conducted to investigate group differences and those that reached significance are marked on the table.

In general, the data for both groups indicated that the proportion of nouns decreased as children's MLU increased. At the same time, the proportion of verbs and closed class words increased with more advanced language, confirming the broad developmental patterns that have been found among normally developing children (Bates, Bretherton, & Snyder, 1988). There were, however, significant group differences in the proportions of nouns and closed class words between Stages I and III. The autistic children tended to use relatively more nouns, while the DS children tended to use more closed class forms, especially pronouns and demonstratives.

Table III. Distribution of Words Among Major Form Classes for Autistic and Down Syndrome Children

MLU stage	Autistic				Down syndrome			
	Noun	Verb	Mod	Closed class	Noun	Verb	Mod	Closed class
I (1.0–2.0)	52.7	15.3	10.6	20.4[a]	47.6	15.4	9.9	25.2[a]
II (2.0–2.5)	46.3[b]	21.6	10.4	19.1[c]	34.1[b]	22.9	9.5	31.6[c]
III (2.5–3.0)	40.6[a]	23.1	8.7	25.7[b]	33.2[a]	22.0	10.3	32.8[b]
IV (3.0–3.5)	36.4	22.8	8.1	31.4	33.6	21.9	10.7	32.9
V (3.5 +)	34.5	22.8	8.8	32.8	37.0	20.8	8.3	32.9

[a] $p < .05$.
[b] $p < .01$.
[c] $p < .001$.

DISCUSSION

In this paper we present data from a comprehensive longitudinal study of language acquisition in a group of six autistic children, across a broad range of developmental levels. The findings from this study address a number of important issues that include whether autistic children follow the same developmental path as do other language-impaired children, individual differences among different groups of children, and the nature of the language impairment in autism. We take up each of these issues in turn.

First consider the theoretical question that was the primary focus of this study. Do autistic children develop functional language in the same way or in quite different ways compared to normally developing or other language- delayed children? Simon (1975) argued that autistic children had anomalous language acquisition patterns in that they did not show normal growth in MLU or the same order of emergence for grammatical constructions. The data presented here contradict Simon's claims. The majority of our autistic subjects did show uniform increases in MLU, though they represented varying rates of development. Only two of our autistic subjects did not exhibit growth in MLU: Brett, whose MLU was already close to the upper limit of MLU at the time that we began taping him, and Jack, an older child, whose language changed very little over a 2-year period. Note that Jerry, a boy with DS who was closely matched to Jack on age and MLU at the start of study, also showed little change in MLU over the course of time he was observed. Thus we found that MLU was indeed a useful indicator of language development for autistic children, and it correlated highly with our other language measures, IPSyn and lexical diversity. In this respect our autistic children were very similar to our DS subjects, thus confirming other research on the usefulness of MLU as a language measure for language-impaired populations (e.g., Rondal, Ghiotto, Bredart, & Bachelet, 1987).

The data from the IPSyn measure also indicate that autistic children acquire specific grammatical structures in the same general order as has been found in normal and DS children. Similarly the results of the form class analysis of the children's vocabulary suggest that autistic children are no different from other populations in this lexically based aspect of language development. Altogether, the various measures employed in this study suggest that many autistic children who develop some functional language look similar to normal or other language-impaired children.

We did, however, find some exceptions to this normative pattern of language development. The youngest autistic child, Stuart, showed a fairly steep decline in MLU and the other language measures after a 10-month period of almost normal development. This kind of decline is not typical even among DS children (c.f. Fowler, 1986) who otherwise match the variety of developmental patterns we found among our autistic subjects. In Stuart's case this decline in language was closely related to increased disturbances in other aspects of his behavior. We do not know whether is was simply temporary since we did not continue to follow his progress. Nevertheless, his more deviant language development supports the view that in young autistic children language is an important prognostic factor and parallels psychological functioning in other domains (cf. Rutter, Greenfield, & Lockyer, 1967). We note here that our findings relate only to higher functioning *verbal* autistic children. The majority of autistic children, who generally do not acquire much functional language beyond the single-word stage, clearly do not fit the pattern of development found in this study.

We also found differences at more advanced MLU stages between the autistic and DS children's overall IPSyn scores. Beyond an MLU of about 3.0 the autistic children have significantly lower total IPSyn scores, suggesting that although their utterances continue to grow in length, they tend to rely on a narrower range of grammatical structures in their spontaneous speech. Autistic children tend to rigidly depend on a particular sentence structure even though they have the knowledge to employ greater variety in their speech. Despite their lower total IPSyn scores, the data on the maximum item reached on each subscale produced only one significant difference on the question/negation subscale at MLU Stage V. It is interesting to note that in comparison to the other subscales, this one has a strong pragmatic component, so this one significant result may reflect more of a difference in the number of questions asked by autistic children than a real grammatical deficit (Tager-Flusberg, 1989b).

Although the overall patterns of development were highly similar among the majority of autistic and DS subjects, our data reveal some interesting differences between the groups. Specifically, at the early stages of language development DS children tended to rely more heavily on closed class forms than on specific nouns, whereas the reverse pattern was found for the autistic children. These distinct patterns have also been found among normally developing children

(Bates *et al.*, 1988), and resemble the individual difference styles than Bloom, Lightbown, and Hood (1975) have referred to as the nominal/pronominal contrast. The autistic children in this study are more like the "nominal" children that Bloom *et al.* studied, whereas the DS children are closer to the "pronominal" end of this individual difference continuum. Other studies, for example, Dooley (1976), have also found a predominance of pronominal forms in the speech of young DS children. In general, these differences have been categorized as differences in acquisition *style,* though some researchers have argued that they may reflect deeper differences in the ways in which language is acquired (Bates *et al.*, 1988; Peters, 1983).

The overall findings from this study confirm the results of previous research, which suggests that autism does not involve a fundamental impairment in grammatical ability. Not only did our autistic subjects use the same general syntactic and morphological forms as the DS subjects, confirming the work of others in this field (e.g., Pierce & Bartolucci, 1977), we also showed that these forms were acquired in the same general order. Although it has been proposed that autistic children may have particular difficulty acquiring words with relational meaning such as verbs and modifiers (cf. Hobson, 1989; Menyuk & Quill, 1985), our results do not support this hypothesis. The distribution of words among form classes did not reveal a paucity of either verbs or modifiers in the speech of autistic children, though we did not analyze the underlying meanings of these words or how they were used by our autistic subjects.

Some important questions about language acquisition that cannot be addressed by the types of analyses presented in this paper remain. One key issue is whether autistic children acquire linguistic forms in exactly the same way, using the same *developmental processes,* as other children do. A second is whether there are significant differences in the form and function of particular grammatical constructions for children with autism. Future papers reporting on the data from this program of research will focus on these fundamental theoretical questions regarding the nature of language development in autism.

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APPENDIX

Items in IPSyn

	Noun Phrase	*Verb Phrase*	*Question/Negation*	*Sentence Structure*
1.	Noun	Verb	Intonation Q	≥ 2 words
2.	Pronoun	Part/Prep	Routine Q	Subject-Verb
3.	Modifier	Prep phrase	No(t) x	Verb-Direct O
4.	2 wd NP	Copula	Wh-(N) Verb	Sub-Verb-Object
5.	Article	Catenative	Noun not Verb	Conjunction
6.	Verb + NP	Present aux	Wh-aux	Two verbs
7.	Plural	-ing	Neg aux	Phrasal conjunction
8.	NP + Verb	Adverb	yes/no aux	infinitive
9.	3 wd NP	Present modal	Why, when, which	Let's ...
10.	NP adverb	-s (3rd pers)	Tag question	Advb. conjunction
11.	bound morph.	Past modal	other	Prop. complement
12.	other	-ed (reg past)		Sent conjunction
13.		Past aux		Wh-clause
14.		Medial adverb		Bitransitive
15.		Uncontr. aux/cop		3 verbs
16.		Past copula		Relative clause
17.		Other		Infinitive −2 subj
18.				Gerund
19.				Fronted clause
20.				Other