5 The Course of Language Learning in Children with Down Syndrome

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A large body of research on first language acquisition has led to the general consensus that young children bring to the language-learning task certain predispositions for how to organize a grammar:

1. Numerous studies have demonstrated that young children typically progress through an early language stage, with common thematic relations, consistent word order, and an absence of closed class functors (e.g., Bloom, 1970; Brown, 1973; Gleitman & Wanner, 1982).
2. Well-studied cases of overgeneralizations within derivational and inflectional morphology suggest that children are driven to extract regularities from the input provided (e.g., Bowerman, 1982; Brown, 1973).
3. Examination of the syntactic structures that characterize the speech of young children suggests a well-ordered and rapidly completed sequence of development without obvious violations of general syntactic constraints (e.g., Bellugi, 1967; Hamburger & Crain, 1982).

As exemplified by the chapters in this volume, compelling evidence for internally driven linguistic constraints derives further support from the study of language acquisition under the most adverse learning conditions. Children who are blind from birth, deaf-isolate children who are born deaf and denied access to signed language, and children exposed only to impoverished "pidgin" languages all construct grammars similar in crucial respects to those developed under normal learning conditions (Feldman, Goldin-Meadow, & Gleitman, 1978; Landau & Gleitman, 1985; Newport, 1981; Sankoff & Laberge, 1973; see Gleitman, 1984, for a review and

discussion). Because the children in each of these cases produce grammars that go well beyond the input provided, it can be argued that the "learning process itself may contribute certain types of organizational characteristics to languages" (Newport, 1981, p. 120). The linguistic commonalities observed derive not so much from a carefully arranged highly structured input, but should be crucially dependent on the child's intact cognitive/linguistic system, which governs the learning process.

But what if the cognitive/linguistic system is itself disrupted in some way? Will these same constraints and organizational characteristics continue to apply? In this chapter, we consider the applicability of general features of language learning to individual cases where general cognitive impairment is associated with limited syntactic function. Specifically, we focus on the language of several mentally retarded children with Down syndrome, trisomy 21, who apparently lack sufficient cognitive or linguistic function to formulate a fully specified grammar. The children under study, like most individuals with Down syndrome, have achieved only limited success in language learning; their general cognitive deficit is evident as well in such areas as conceptual development, number knowledge, memory, and visual spatial function. Given that language learning is not complete, we can ask several questions bearing on the role of general cognitive factors on the character of language:

1. How far does learning progress and what seems to prevent further development?
2. Are certain facets of the developing grammar relatively more disrupted than others by general cognitive impairment?
3. How do these children get as far as they do? Do they induce rules, impose word order, and follow the canonical developmental sequence observed when intelligence is fully intact? Is there evidence that the cognitively impaired child, like the normally intelligent child, actively constructs a coherent and internally consistent grammar that goes beyond the individual instances presented? Or, are different learning strategies present?

It is recognized, of course, that the search for the effects of cognitive impairment on language learning begs many questions. For instance, if a child with Down syndrome obtains an IQ score of 50 and also acquires very little syntactic function, this cannot necessarily be attributed to general intellectual function. After all, language may be disrupted even in cases of normal to superior intelligence, as can be readily attested to by the much studied case of specific language delay, where extremely delayed language proceeds alongside otherwise normal intellectual function (e.g., Bishop & Edmundson, 1987; Johnston, 1988; Rescorla, 1989; Rescorla & Schwartz,

1990). Similarly, if a child with an IQ of 50 develops full syntactic competence, this does not necessarily imply that no "general" cognitive processes were brought to bear. Rather, both findings may suggest only that not all cognitive abilities proceed in lock-step. One area (e.g., spatial organization) may be so disrupted as to yield an extremely low score on an omnibus IQ test; relatively normal language function in such a case tells only that syntax is represented independently of spatial cognition. Just this situation appears to be the case in the child with William syndrome (Thal, Bates, & Bellugi, 1989). For these reasons, it is important to avoid thinking of cognition as a unitary construct and to resist the temptation to generalize from one case of impaired language associated with "general" cognitive impairment to all others. The goals of this enterprise are considerably more modest. Here, I can only note that language learning can become disrupted and look closely to determine how the nature of such disruptions may bear revealingly on the normal learning process.

The study of retarded children with Down syndrome to explore the effects (or noneffects) of cognitive impairment on the language learning process is hardly new. Indeed, the endeavor, which began with the pioneering work of Lenneberg, Nichols, and Rosenberger (1964), has been studied so often and has yielded such consistent findings that it is often dismissed with a single phrase, as being a remarkably uninteresting case of "delay, without deviance." This characterization rests on several observations:

1. No study of children with Down syndrome, or of any other mentally retarded group to date, has provided conclusive evidence for outright deviancies that would contradict constraints on learning postulated by linguistic theorists; no linguistic structures have been observed that have not also been found in normally intelligent children.[1]
2. Language complexity increases in a similar fashion across both mentally retarded and normally intelligent populations, whether thematic relations, grammatical functors, or complex syntactic structures are under study (Graham & Gulliford, 1968; Lackner, 1968). Retarded children, like young normally intelligent children, appear to produce and comprehend speech in what appears to be a coherent rule-governed fashion.

These conclusions have led to a developmental account of language delay in which retarded children proceed through the same stages as the normally

[1]Although some researchers claimed to observe deviant imitation or comprehension patterns (Cromer; 1972, 1974; Haber & Maloney, 1979), it is not clear that the controls were appropriately selected. Similar responses would be observed if younger children, at a language level more akin to the retarded children, had been selected.

intelligent child, but at a slower rate of acquisition and with an ultimately lower level of attainment commensurate with the degree of retardation. To return to our initial concern with constraints on language learning, these data might be interpreted as suggesting that even children whose cognitive/linguistic system is clearly not intact, as evidenced by failure across cognitive domains, are nonetheless bound to construct the same grammar from the input; as far as they do progress, it seems they must follow the same path as the brightest of children. On the face of it, all constraints are met and linguistic theory is intact.

However, without challenging the general finding of delay without deviance, we maintain that a close examination of language impairment in individuals with Down syndrome provides an interesting perspective on language learning. In particular, there are two features of language learning in individuals with Down syndrome that bear specific attention and explanation:

1. Although not often remarked upon, the absolute levels of linguistic attainment in individuals with Down syndrome are strikingly low, even taking the general retardation into account. A celebrated few notwithstanding (e.g., Seagoe, 1965), children and adults with Down syndrome tend to cluster at quite limited syntactic levels, lagging far behind both chronological and mental age expectations (Fowler, 1990; Miller, 1988; Wisniewski, Miezejeski, & Hill, 1988). Both clinical observation and a careful reading of the literature suggest that few individuals with Down syndrome move beyond the simple phrase-structure grammars that characterize the normally intelligent 2-year-old; this is true even for those individuals studied by Lenneberg et al. (1964).[2] Given the severity of the limitation, it is of great interest to examine the linguistic features of the stopping point and consider what prevents further development.

[2]The fact that consistently limited language levels associated with Down syndrome have received little attention presumably stems from the uninterpretability of this fact—after all, a small number of children with Down syndrome in any sample (including our own) do acquire full competence. Furthermore, early demographic studies pointing to a specific deficit in language associated with Down syndrome failed to take into account factors such as institutionalization; more recent research, including our own, have not controlled for such potentially contributing factors as low parental and teacher expectations, and the high prevalence of hearing loss resulting from chronic otitis media. Whether children who have been raised in supportive and optimistic home environments, who have not suffered a hearing loss because of appropriate medical intervention, and who have participated in early childhood intervention programs yield a different language outcome remains to be determined. Although such a survey of ultimate language achievement informed by such variables is highly desirable to understand how Down syndrome affects language learning, our present goal is somewhat different. Here, to better understand the basic processes of and constraints on language learning, we are primarily interested in the form that slow language learning can take, irrespective of the factors contributing to the delay.

2. The limitations on structural language development are even greater than deficits in other areas of language, more broadly defined. Carefully designed studies indicate that children with Down syndrome are relatively more advanced in both receptive vocabulary (Miller, 1988) and communicative skills (Beeghly, Weiss-Perry, & Cicchetti, 1990) than they are in language structure. Suspending the assumption that language, or even syntax, is one bounded and homogeneous system, it becomes possible to investigate differential delays, with different structures developing at different rates. Further investigation of this developmental disparity may provide insight regarding both the coherence of syntax and its dependence on general cognitive versus specifically linguistic factors.

It might be noted that these two features of atypical language development are not exclusive to individuals with Down syndrome. For example, children with left hemispherectomies and autistic children also fail to acquire full language mastery (e.g., Dennis & Whitaker, 1977; Scarborough, Rescorla, Tager-Flusberg, Fowler, & Sudhalter, 1991). Still more common is a discrepancy between structural aspects of language (syntax and phonology) compared to growth in vocabulary and/or communication skill. Such a discrepancy is, for example, a hallmark of specific language delay (Gathercole & Baddeley, 1989; Rescorla, 1989). Nonetheless, as a window on partial language failure, Down syndrome offers many advantages:

1. Children with Down syndrome are easily and objectively identifiable. The syndrome is comparatively well studied and is uniformly associated with general cognitive deficits, which may vary from mild to severe (for overall reviews see Beeghly, Weiss-Perry, & Cicchetti, 1990; Gibson, 1978; Nadel, 1988; Pueschel, 1988).
2. Full trisomy 21 has consistently been associated with impairments in language structure (Fowler, 1990; Miller, 1987; Wisniewski et al., 1988).
3. Large numbers of children with Down syndrome are currently being raised at home in supportive and hopeful environments.

Given what is known about cognitive development in children with Down syndrome, we entertained several hypotheses about how language development might be affected. First of all, because it has often been noted that individuals with Down syndrome are characterized by severe limitations on both memory and articulation (e.g., Bleile & Schwartz, 1984; Crosley & Dowling, 1989; Marcell & Weeks, 1988; Varnhagen, Das, & Varnhagen, 1987), we hypothesized that we might find some disparity between syntactic competence and performance. That is, we expected that memory and production factors might impose an apparent ceiling on some indices of

language development, especially utterance length, while masking more advanced syntactic abilities. Thus, we hypothesized that children with Down syndrome, carefully studied, would show evidence of syntactic structures not yet mastered by a comparison group of normally developing children matched on mean utterance length.

As noted, the mean length of an utterance is a good indicator of the kind of morphological and syntactic structures a normal-IQ child has acquired and is apt to use. However, beyond the very earliest stages, length does not logically have to mirror complexity. Although *Whose book did you read*? is complex by virtue of wh-movement and subject–auxiliary inversion, it includes the same number of morphemes (five) as the more straightforward construction *They walk to the store*. If children with Down syndrome are held back in utterance length only by a memory and/or production limit, then one might plausibly find evidence for constructions that are short enough to fit within the production limit, but more complex than those ordinary found at that MLU stage in normally intelligent children.

The second hypothesis was that some aspects of language are more affected than others by general intellectual factors. Because it is well documented that language structure lags behind MA expectations (Fowler, 1990; Miller, 1987), one might expect that those facets of language most closely tied to general intelligence (as captured in the MA level) proceed in a different fashion from the more purely structural aspects. Of particular interest in this regard was the acquisition of closed-class vocabulary, that area of language which is at once least semantic and most vulnerable to environmental factors. The class of "little" words that glue sentences together includes grammatical inflections, articles, prepositions, and pronouns. These "functors" have been characterized as carrying no content, which distinguishes them from the content words that include nouns, verbs, adjectives, and adverbs. They also constitute a class in the historical development of languages by virtue of their finite nature: The language acquires new closed-class elements at an extremely protracted rate (over hundreds of years) as distinct from the open-class system which acquires hundreds of words per year. Furthermore, closed-class terms fall together as a phonological class in that they, as opposed to open-class words (nouns, verbs, adverbs, adjectives) lose stress within the total intonation of the sentence, resulting in *he's* for *he is*, *can't* for *cannot*, and the like (Kean, 1977; see Gleitman & Wanner, 1982, for an in-depth overview of the open-class/closed-class distinction). The closed-class system is fragile in many respects, hence, the expectation that it might be more impaired in retarded populations. It develops relatively late in child language (e.g., Bloom, 1970; Brown, 1973) and is missing in pidgin languages (Newport, 1982; Sankoff & Laberge, 1973) and in the invented language (homesign) of deaf isolates (Feldman et al., 1978). It is selectively impaired in Broca's

aphasia (Kean, 1977) and is more dependent on input characteristics than other language components (Gleitman, Newport, & Gleitman, 1984). Despite the well-attested fragility of closed-class grammar and its distinctive developmental course, it has not been adequately determined whether this specific aspect of language is differentially affected in individuals with Down syndrome.

A third hypothesis concerned the possibility of different language-learning strategies. Whereas prior research has provided little support for such a hypothesis by way of deviant language structures, we felt that longitudinal research might provide some revealing information regarding how it might be that the very same generalizations might be mastered at greatly protracted rates. Furthermore, because mental age measures have consistently proven to greatly overestimate language skill in individuals with Down syndrome (Fowler, 1990; Miller, 1987), it is possible that interesting differences may yet show up when a more sensitive matching procedure is employed. To this end, in both studies presented in this chapter, children with Down syndrome were matched to normally developing preschoolers, not on mental age, but on an anchor measure of language-development MLU (mean length of utterance in morphemes; Brown, 1973). As a measure of internal syntactic complexity, MLU surpasses any other single measure of linguistic competence in the early stages of language development, in both its predictive powers and its breadth of application across child language studies (Bloom, 1970, 1973; Brown, 1973; Nelson, 1973; Newport, Gleitman, & Gleitman, 1977; Shipley, Smith, & Gleitman, 1969). In particular, descriptive studies of early language development found MLU to be a useful independent variable against which to predict (a) the expression of semantic relations (Bloom, Lightbown, & Hood, 1975), (b) the productive use of certain grammatical inflections and functors (Brown, 1973; deVilliers & deVilliers, 1978; Klima & Bellugi, 1966), and (c) the emerging structure of negative and interrogative constructions.

In the first of the two studies, we (Fowler, Gelman, & Gleitman, 1980) focused on the linguistic stopping point of four adolescents with Down syndrome who naturally fell together as a group in terms of MLU. To place their achievement within a developmental context, their language was compared in detail to the language of normally developing preschoolers functioning at the same MLU level. By matching the two groups on a global language measure and juxtaposing performance on several internal measures of syntactic development, the intention was to identify differential delays to distinguish those areas of language most and least affected by Down syndrome retardation. Specifically, it was hypothesized (a) that length would be more compromised than syntactic complexity, and (b) that the closed-class system would be more affected than either open-class vocabulary or sentence length. We predicted that the grammar of adoles-

cents with Down syndrome would be relatively more advanced in terms of syntactic complexity (as in embedding) and vocabulary measures and less well developed on measures of morphological development. Although we were quite interested in observing evidence for linguistic strategies or generalizations that do not occur in the normal developmental sequence, we did not anticipate finding such evidence in this cross-sectional comparison.

STUDY I
LANGUAGE STRUCTURE OF ADOLESCENTS WITH DOWN SYNDROME COMPARED TO NORMALLY INTELLIGENT CHILDREN MATCHED ON MLU

Method

Subjects

The subjects included four moderately retarded adolescents with Down syndrome in a stimulating parochial day school. The four were selected for homogeneity of age (CA 10;9 to 13;0 years; mean = 12;7), intelligence level (Stanford-Binet IQ 46 to 56; mean = 51; MA 6 to 7 years; mean = 6;3), and language level (all were in Stage III, using the criteria of Brown, 1973). This language level (MLU 2.75 to 3.25; mean = 2.98) was representative of adolescent children with Down syndrome at that school and appears to be in keeping with other studies of adolescents with Down syndrome (Mein, 1961; Ryan, 1975; Semmel & Dolley, 1971). As a comparison group, non-MR youngsters were sought who had MLUs as close to 3.0 as possible. This was not easy; by 36 months of age, children have moved well beyond that language level and one has to "catch" younger children as they move through the level of interest. The controls in this study were 30 to 32 months of age, consistent with established norms (Bloom, 1970; Brown, 1973; Miller, 1980). The young age was surprising because the adolescents appeared, at least impressionistically, to be communicating well beyond a 3-year-old level. The resulting disparity in age (CA 12 vs. 2 $\frac{1}{2}$ years; MA 6 vs. 3 years) made dissociation all the more likely in the various analyses employed (refer to Table 5.1 for subject statistics).

Procedure

All analyses were based on spontaneous speech samples collected under naturalistic conditions. Children interacted with the experimenter at school in a half-hour of free play/conversation in a quiet room away from the classroom. The children had met and talked with the experimenter on

TABLE 5.1
Subject Characteristics

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Chronological age (years; months)			
Mean	12;3	2;7	18.25*
Range	10;9–13;0	2;6–2;8	
Mental age (years; months)			
Mean	6;3		
Range	6;0–6;9		
IQ			
Mean	51		
Range	48–50		
Utterance length statistics (based on spontaneous utterances)			
Number utterances produced	166.5	195.0	−0.86
MLU: mean length in morphemes	2.98	3.32	−1.32
Upper bound in morphemes	7.50	8.75	−1.56
Longest 10%: MLU in words	5.35	5.50	−0.29
Proportion one-word utterances	0.15	0.12	0.68
Word: morpheme ratio	0.95	0.92	1.63

Note. Groups were compared using independent sample two-tailed *t* tests.
*$p < .001$.

previous occasions. The conversation centered about a large three-dimensional house with miniature furniture and people. The children were encouraged to talk about the objects, to talk about own homes and families, and even to make up conversations using the objects as props (i.e., to play house). The sessions were videotaped and recorded on a hi-fidelity stereo tape recorder. The recordings were transcribed as soon as possible after the task by the experimenter. The utterance length measures were obtained as described below. In addition to these, internal analyses were performed to tap three different aspects of linguistic skill: (a) syntactic complexity, (b) grammatical morphology (closed-class knowledge), and (c) vocabulary (open-class knowledge).

Utterance Length Measures

MLU. The guidelines outlined in Brown (1973) served as the basis for the calculation of MLU, with some variations applied to both Down syndrome and control subjects. The primary deviation from his procedure was to incorporate in this analysis only those utterances initiated by the child; responses, imitations, and long lists without internal structure (e.g., counting or recitation of family names) were excluded. Additionally, only

five tokens of any exact phrasing were included in the MLU analysis in order to relieve any possible bias introduced by repeated use of stock phrases such as *What's that*? Finally, analyses in this study were based on all utterances produced rather than on only the first 100 utterances of a transcript (see Fowler, 1984, for justification of these variations).

Two additional utterance length measures served as an index of optimal, as opposed to mean, performance. These included the *upper bound* (the length of the single longest utterance produced in the session, measured in morphemes, after Brown, 1973) and *MLU for the longest 10% of the utterances*. The fourth and final utterance length measure concerned the *distribution of utterance lengths*. Given an average length of utterance, the goal was to determine whether, perhaps as a function of usage factors, children with Down syndrome rely to a greater extent on very short utterances than other children with comparable syntactic skill.

Syntactic Measures

Newport Measures of Internal Complexity. As a first look at the internal structure of the utterances produced, counts were made of the number of major constituents (noun phrases and verbs) per utterance, and, in turn, of the number of words and morphemes entering into each constituent category. Length may derive from a greater number of sentential constituents (e.g., *see you help boy*) and from the internal length of few constituents (e.g., *going to the store*). These measures were developed by Newport et al. (1977), who found them to correlate highly with MLU in very young normally developing children.

This analysis was based upon a sample of 50 consecutive utterances from each child. Candidate utterances required a main verb other than *be* (explicit or not). A new MLU based on this sample was also computed. For this analysis, nouns were defined as nouns or pronouns, whether in subject or object position; they could also occur as objects of prepositions. Morphemes per noun phrase also included articles and inflectional markers; words per noun phrase excluded inflections. Verbs were defined to include only immediate verbal constituents: semimodals, auxiliaries, *not*, and the verb. Sentential elements not included in this count include optional elements such as adverbs, as well as particles and prepositions.

Expression of Thematic Relations. As a context-dependent measure of syntactic development, productions were analyzed for presence or absence of arguments made obligatory by certain verbs (or implied verbs). Does a child with Down syndrome choose to encode and delete the same thematic arguments as the non-MR child, when both are equally limited in

productive language skill? Attention was focused on locative expressions for two reasons:

1. First, they were elicited in quantity by the task at hand—placing objects in a model house.
2. Normative developmental data on locatives are available (Bloom, Miller, & Hood, 1975); their analysis was the basis of the coding and scoring scheme relied upon here. Bloom et al. investigated three locative sentence frames: *Agent-Locative Action* utterances were defined as expressing the movement of an object (Patient) by an independent Agent, as in *I'm trying to put this back in here.* This sentence type requires an Agent (syntactic subject), Patient (object), Place and Verb. The *Mover-Locative Action* sentence type (e.g., *You can come my house*), includes those utterances specifying a movement in which the Agent was also the Patient moved, hence the Mover. This argument structure requires a Mover (subject), Verb, and Place. Bloom et al.'s third locative category, *Locative State*, specifies a state rather than a movement (e.g., *sleep*, *sit*, *be*, *belong*, and *go*, as in *This goes here*). This category also requires a Patient (subject), Verb, and Place.

Indices of Complex Syntax. The two previous syntactic measures are useful in analyzing early language production, from the onset of two-word combinations in Stage I through Stage III. However, at the level of interest here, children are also on the verge of mastering aspects of complex syntax. Most notably, they must acquire the intricacies of the verbal auxiliary system (both movement rules and grammatical terminology) in order to produce correct negative and interrogative structures. Children just beyond this stage acquire many means of coordinating and embedding sentence clauses, such as conjunctions, relative clause structure, or preposing; here, too, they must master movement rules and grammatical markers. To measure progress made in this direction, in this study, a count was made of some of the earliest appearing aspects of complex syntax, such as those noted by researchers like Menyuk (1969) or Bellugi (1967). Constructions of interest included subordination and coordination, subject/auxiliary version in yes/no and wh-questions, passive voice constructions with *got* or *be*, and choice of negative markers.

Confirmation of syntactic development was sought via a quantitative measure of syntactic complexity devised by Scarborough (1990). The Index of Productive Syntax (IPSyn), based upon a 100-utterance sample, awards points for the occurrence of 56 kinds of morphological and syntactic forms. Baseline data for normal children are available, based on 48 transcripts from children aged 24 to 48 months; the scale is of potential value for

children below and beyond this age range. Because full credit is awarded if a construction occurs twice in a 100-utterance transcript, this analysis serves as a measure of optimal rather than mean performance.

The Closed-Class System

It was suggested earlier that the acquisition of closed-class vocabulary might be more affected in individuals with Down syndrome than would the acquisition of open-class vocabulary. In particular, it was hypothesized that grammatical morphology might lag behind other aspects of syntactic development. This question was addressed first by the *word/morpheme ratio* calculated among the utterance length measures. This measure of use of bound inflections is calculated as the ratio of the number of "words" (defined phonologically) to the number of morphemes. The difference is made up by nominal and verbal markers, such as the plural or past tense markers.

Closed-Class Vocabulary. To assess the development of closed-class vocabulary, a count was made of all tokens of the five major closed-class categories: (a) pronouns, (b) prepositions, (c) modals, (d) wh-forms, and (e) demonstratives. This figure was compared to the total number of words in each speech sample. To supplement this measure of dependence on closed-class vocabulary, we also made a measure of lexical sophistication within these categories by looking at the diversity of vocabulary types falling into these and other categories of closed-class markers.

Use of Grammatical Morphemes in Obligatory Context. For a more fine-tuned measure of morphological development, an assessment was made of use in obligatory context of the first 14 grammatical morphemes to occur regularly in early child language. These include prepositions, verbal auxiliaries, and nominal and verbal inflections. Brown (1973) identified the contexts where these morphemes should appear, calculated the proportion of cases where they did appear, and tracked the development of each over the language-learning period. His methods were adapted for cross-sectional study by deVilliers and deVilliers (1978); their procedures were adopted here.

Open-Class Vocabulary

At the language level under study, it is difficult to make a fair assessment of productive vocabulary, especially in a single spontaneous speech sample. Nonetheless, a gross measure of vocabulary usage, the *type/token ratio*, was derived by calculating the ratio of different vocabulary types produced to the total number of words in the corpus (following Nelson, 1973).

Although this measure clearly does not explore the depth of the child's lexical knowledge for open-class items, it probably does provide a fair index of the closed-class lexicon, which is, after all, both finite and frequently used. The ratio also serves as a measure of information value independent of the syntactic structure employed.

Results

Utterance-Length Measures

By design, all subjects had MLUs falling within Brown's Stage III or IV. As seen in Table 5.1, MLU measures did not differ significantly across the groups. The average MLU of the group with Down syndrome was 3.0 (range 2.6 to 3.3); in the preschoolers, mean MLU was 3.3 (2.8 to 3.8). There was a generally low usage of inflectional morphology; in both groups, MLU in words was slightly, though comparably, lower than MLU in morphemes (2.8 and 3.0 for the children with Down syndrome and the comparison preschoolers, respectively). Similarly, word:morpheme ratios were high and not significantly different across the groups. The children with Down syndrome also did not stand out on optimal measures of utterance length. Their upper bound ranged from 7 to 9 morphemes; this was not significantly different from the upper bound found for the normally developing children (7 to 10). Both scores were in keeping with Brown's (1973) report of an upper bound of 9 at Stage III. Similarly, when only the longest 10% of the utterances were taken into account, the MLUs (in words) of the two groups were nearly identical (children with Down syndrome: 5.35; non-MR children: 5.50).

Although it might have been expected that the children with Down syndrome would be more variable in sentence length, alternating perhaps between long and very short utterances, this was not the case. The shape of the distribution of utterance lengths was similar across both groups. In each group, two-and three-word utterances made up more than 50% of the total and there was no utterance longer than 9 words. One-word utterances made up 15% of the utterances produced by the children with Down syndrome and 12% of the utterances produced by the non-MR children; this difference was nonsignificant.

Syntactic Measures

Newport Measures of Internal Complexity. Measures of internal complexity are presented in Table 5.2. As can be seen, the mean length of the utterances fitting these criteria was identical across populations and there was virtually the same number of major constituents (noun phrases and

TABLE 5.2
Measures of Internal Complexity (Following Newport, Gleitman, & Gleitman, 1977) (Based on 50 Consecutive Nonequational Utterances)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Mean words per utterance	3.68	3.73	−0.18
Major constituents per utterance			
Noun phrases/utterance	1.37	1.37	0.10
Verbs/utterance	1.07	1.01	1.81
Other (particles, adverbs)	0.36	0.55	−1.43
Internal structure of major constitutents			
Words/nounphrase	1.62	1.72	−1.63
Morphemes/nounphrase	1.71	1.85	−2.44*
Morphemes/verbphrase	1.45	1.50	−0.40

Note. Groups were compared using independent sample two-tailed *t* tests.
*$p < .05$.

verbs) per utterance. There was, however, one internal difference: The group with Down syndrome relied upon significantly fewer morphemes per noun phrase. As will be supported by other measures, this is due, in part, to the fact the children with Down syndrome relied heavily on pronouns rather than on expanded noun phrases.

Expression of Thematic Relations. At the language level under study, children in both groups were explicit in expressing most of the obligatory thematic relations studied by Bloom, Miller, and Hood (1975). As shown in Table 5.3, of the 10 relations under study, 85.1% were expressed by the group with Down syndrome and 83.7% by the non-MR group. When scores were compared across individual and averaged categories, there were no significant differences across the two groups.

Although small numbers and potential differences in scoring procedures preclude statistical comparison with Bloom, Miller, and Hood's findings, the subjects in this study seemed to be performing as well as, if not better than, the children at the close of the normative study (MLU = 3.0). In both studies, nonstative verbs were expressed virtually 100% of the time. In addition, the children in this study consistently included the place term across the three locative sentence types (Down syndrome: 95%; non-MR: 92% expressed); this was well beyond the 55% average quoted by Bloom, Miller, and Hood. In that normative study, stative locative verbs (*sits*, *belongs*, etc.) were consistently expressed (near 100%), just as were the nonstative verbs. In this study, however, nonstative verbs were often only implicit in both groups; subjects frequently produced utterances such as *the doll ____ upstairs* while placing a doll in a dollhouse, implying a verb such

TABLE 5.3
Obligatory Thematic Relations Expressed in Locative Utterances
(Proportion of Times an Argument or Verb is Expressed Where Obligatory)
(Following Bloom, Miller, & Hood, 1975)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Locative Utterance Category			
Agent Locative (e.g., *I'm trying to put this in here*)			
Mean # in category	6.75	11.75	−1.27
Agent	0.39	0.51	−1.67
Verb	1.00	0.99	0.67
Patient	0.76	0.96	−1.07
Place	0.87	0.99	−1.25
Mover Locative (e.g., *Daddy going trolley*)			
Mean # in category	12.25	12.25	0.00
Mover (Agent *and* Patient)	0.65	0.69	−0.23
Verb	0.65	1.00	0.00
Place	0.97	0.83	1.31
Locative State (e.g, *She sleep in bed*)			
Mean # in category	12.25	23.75	−1.01
Patient	0.93	0.84	0.80
Verb/copula	0.79	0.62	0.80
Place	0.94	0.96	−0.31
Average score for 10 thematic categories	0.85	0.84	0.38
Proportion Syntactic Categories Expressed[a]			
Nouns	0.72	0.75	−0.45
Subject	0.70	0.68	0.30
Object	0.76	0.96	−1.07
Verbs	0.93	0.92	0.22
Stative	0.79	0.62	0.93
Nonstative	1.00	0.99	0.00
Place terms	0.95	0.92	0.47

Note. Groups were compared using independent sample two-tailed *t* tests.
[a]Syntactic scores were obtained by averaging across thematic categories, according each sentence type equal weight.

as *goes* or *belongs*. In this regard, the difference between groups was not significant (children with Down syndrome: 79% expressed; nonMR children: 62%). In part, of course, this may arise from a failure to produce the contractible copula (*the doll's upstairs*).

When attention is restricted to obligatory nominal arguments, more variability is apparent. Overall, nominal arguments entering into locative relations were supplied 72% of the time by children with Down syndrome

and 75% of the time by the non-MR group. The largest tendency to omit an obligatory nominal involved the Agent (subject) of Agent locative utterances, as in *put this right here*. Although the tendency not to express this form was somewhat greater among the Down syndrome group (39% supplied) than among the non-MR group (51% supplied), not one of the eight subjects supplied it more than 75% of the time. (Bloom, Miller, and Hood report an average score of 54%.)

The children were more apt to express the Mover in the Mover locative category. Although this category is similar to the Agent category in serving as sentence subject, thematically it also serves as Patient. The two groups performed comparably (64.8% Down syndrome; 68.8% non-MR), with two children in each group supplying this argument less than 75% of the time, and only one child (non-MR) supplying it more than 90% of the time.

Sentence subjects were most consistently supplied when functioning as the Patient in the locative state utterances (e.g., ___ *belongs in the kitchen*). Each child supplied this argument a minimum of 75% of the time, which was the mean performance reported by Bloom, Miller, and Hood. The high scores observed (92.8% Down syndrome; 83.5% non-MR) may be artificially inflated by coding procedures requiring that a minimum of two arguments be supplied in order to be included in the analysis. Thus *here*, meaning *this goes here*, would not be included in the analysis because it lacks both the noun and the verb.

Young children consistently supply the Patient in object position, as in Agent locative utterances (e.g., *I'll put* ___ *right here*), with 70% supplied from MLU 1.2 on (Bloom, Miller, & Hood, 1975). Consistent with these results, in the present study, each child in the non-MR group provided the locative Patient at least 90% of the time (group average 96%). Although the average score obtained by the group with Down syndrome (75.5%) did not differ significantly from the non-MR score, there was variability in the group with Down syndrome. Two of the children with Down syndrome, like the non-MR children, provided the Patient consistently; a third supplied it only 80% of the time and the fourth consistently failed to express it (22% supplied).

The focus in Bloom, Miller, and Hood (1975) was on the earliest stages of language; their observations were concluded at just the level of interest here. Although the children in the present study, like those at the close of Bloom, Miller, and Hood were more apt to express a nominal argument that incorporates both Agent and Patient than one which is Agent alone, the more obvious facts seem to concern grammatical categories. In the present study, although both groups tended to express sentence subject (children with Down syndrome 70%; non-MR children 68%) and grammatical object (children with Down syndrome 76%; non-MR children 96%), with differences failing to reach significance, there was a significant group

by grammatical category interaction, indicating a greater split between these two categories in the non-MR group than in the group with Down syndrome.

Indices of Complex Syntax. There was very little evidence for use of complex constructions in either group; what small differences existed between groups failed to reach significance (see Table 5.4a). Little use was noted in either group of the passive construction, subject/auxiliary inversions, the possessive form, or conjoined clauses. In both groups, the primary means of expressing negation was through negative modals, fitting with descriptions in the literature of negation at this stage (e.g., Klima & Bellugi, 1966). Primitive forms like *He have no chin* or *This not fit* were observed primarily in the non-MR group, whereas the children with Down syndrome tended to produce very few negatives overall.

Multiverb utterances were also rare, comprising less than 5% of the utterances in either group and consisting primarily of conjunctions and concatenations. Similar multiverb utterances were produced in both samples: A Down syndrome subject produced *put it on get more*, but *do that fix this* came from a non-MR child; *I want it shut* was produced by a child with

TABLE 5.4a
Indices of Grammatical Complexity
(Presented as Average Number of Occurrences per 100 Utterances)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Utterances with 2 or more sentence nodes	3.83	2.38	1.39
Conjunction:			
Noun + noun	1.15	0.17	1.42
Verb + verb	0.40	0.00	1.00
Sentence + sentence	0.42	0.60	0.27
Prenominal adjectives	1.13	2.13	−1.62
Negative forms:			
No + verb	0.00	0.98	−1.31
Not + verb	0.20	1.18	−1.70
Negative modals	3.40	2.58	0.44
Passive forms:			
Got + verb	0.50	0.00	0.73
Be + verb	0.00	0.00	0.00
Use of possessive form:			
Noun's noun	0.85	0.60	0.37
Auxiliary inversion in yes/no questions	0.25	0.20	0.18

Note. Groups were compared using independent sample two-tailed *t* tests. There were no significant differences between groups.

Down syndrome and *and keep a door closed* by a non-MR child. Preverbal adjectives occurred rarely and in both samples consisted of such common constructions as *big truck* or *little boy*.

Index of Productive Syntax (IPSyn). The two groups also performed comparably in overall performance on Scarborough's (1990) IPSyn measure (children with Down syndrome 60.5; non-MR children 54.25). The scores of the group with Down syndrome were consistent with those reported by Scarborough for her 30-month-old group of nonhandicapped children; the non-MR group here was somewhat behind this average. Although the two groups in this study were highly comparable on the three subscales of this test tapping complexity of noun phrases, verbal auxiliary development, and devices for constructing negative and interrogative sentences, there was a notable difference regarding sentence complexity. This last subscale looks at means of embedding and coordinating sentence clauses; however, following Miller (1980), it is more concerned with movement rules and word order than it is with whether the particular grammatical markers are expressed. Thus, the child who produces *want my mommy come here* is credited with being able to produce infinitival sentences with a subject distinct form the matrix subject, despite the fact that the infinitival marker *to* was unexpressed. Although both groups, and Scarborough's as well, had this advantage (as shown in Table 5.4b), the group with Down syndrome were relatively more advanced on such constructions than were the non-MR children (though, see Scarborough, Rescorla, Tager-Flusberg, Fowler, & Sudhalter, 1991).

The Closed-Class System and Open-Class Vocabulary

The *word/morpheme ratio*, presented in Table 5.1, indicates that neither group made much use of inflectional morphology (Down syndrome .95;

TABLE 5.4b
Performance on Index of Productive Syntax (Based on Scarborough, 1990)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Subscale:			
Noun phrase	16.25	15.75	0.29
Verb phrase	17.50	16.75	0.70
Questions and negatives	11.50	9.75	0.63
Sentences	15.50	12.00	2.18*
Total	60.50	54.25	1.89

Note. Groups were compared using independent sample two-tailed *t* tests.
*$p < .10$.

non-MR .92). The nonsignificant advantage that does occur for the non-MR group is a function of one child with Down syndrome who used very few inflections at all and one non-MR child who was more advanced on this measure.

Closed-Class Vocabulary. Pronouns, prepositions, modals, wh-forms and demonstratives made up a similar proportion, overall, of the lexical items produced by children with Down syndrome (31%) and by non-MR children (30%). Differences between groups within individual categories were not remarkable, although there was a marginally significant tendency for the non-MR children to use more demonstrative terms (*this*, *that*); this was complemented by a nonsignificant tendency on the part of the children with Down syndrome to use a greater number of pronouns (see Table 5.5). In terms of diversity of the closed-class items employed, children with Down syndrome had a slight, but nonsignificant, advantage over the non-MR children. This difference was particularly evident with modals and wh-forms, where it neared or attained significance (see Table 5.6).

Use of Grammatical Morphemes in Obligatory Context. Sufficient information was available for comparison across groups for 8 of the 14 morphemes (i.e., there were at least four identifiable obligatory contexts per subject); averaging across these morphemes the overall percentage supplied for each group was virtually identical: 68% for the group with Down syndrome, 66% for the non-MR group (Table 5.6). There appear, however, to be some differences regarding the pattern of acquisition for individual morphemes. This is evident in the scores for the progressive form (*-ing*), the first morpheme usually acquired. Although the non-MR children provided

TABLE 5.5
Usage of Closed-Class Vocabulary Tokens
(Mean Proportion of Words Falling into Each of Five Closed-Class Categories)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Mean # words per corpus	468.25	474.75	−1.18
Closed-class categories			
Pronouns	16.56	13.81	1.57
Prepositions	3.66	4.52	−0.59
Modals/semimodals	3.23	1.97	1.21
Wh-terms	3.54	2.78	1.17
Demonstratives	4.01	6.68	−2.02*
Total	31.00	29.75	0.51

Note. Groups were compared using independent sample two-tailed *t* tests.
*$p < .10$.

TABLE 5.6
Proportion Usage of 14 Grammatical Morphemes in Obligatory Contexts (following Brown, 1973, and deVilliers & deVilliers, 1978) (# Subjects Reaching 90% Criterion Presented in Parentheses)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	T
Grammatical morphemes:			
Progressive marker - *ing*	0.61(0)	0.86(2)	−2.16*
Preposition *on*	0.84(1)	−(1)[a]	—
Plural *-s*	0.84(2)	0.92(2)	−0.59
Preposition *in*	0.73(1)	0.75(3)	−0.07
Past tense irregular	0.82(0)	0.63(0)	1.20
Articles *a* & *the*	0.43(0)	0.49(0)	−0.46
Possessive *'s*	−(0)	−(0)	—
3rd person irregular	−(0)	−(0)	—
Contractible copula	0.82(2)	0.62(0)	1.31
3rd person regular *-s*	0.25(0)	0.36(0)	−0.71
Past tense regular	—	—	—
Contractible auxiliary *be*	−(1)	0.39(0)	—
Uncontractible auxiliary *be*	(0)	−(0)	—
Overall proportion supplied[b]	0.68	0.66	0.16
Mean number morphemes acquired per child	2.25	2.25	0.00

Note. Groups were compared using independent sample two-tailed tests t tests.

[a]Averages were only calculated when there were more than four obligatory contexts for three out of four subjects.

[b]Overall proportion based upon just those 8 morphemes for which there was sufficient data for both groups.

*$p < .10$.

this form quite consistently (86% supplied), the children with Down syndrome were much more variable (61% supplied, $p < .10$). When performance is looked at case by case, there are eight cases of full mastery (90% usage in obligatory context) of the first 4 morphemes among the four non-MR children in this study. In contrast, there are only four such cases among the non-MR group. Interestingly, when a count is made of the number of cases of full mastery across the whole range of the 14 morphemes, the overall score is nine in each group. In some sense, the comparison preschoolers are "more normal," mastering the earlier morphemes first and only later going on to acquire the more difficult morphemes. Although one cannot infer the developmental sequence from this single point data, it appears that the Down syndrome group may have moved on to more difficult morphemes (notably, the copula) without having full mastered the simplest ones. It may well be that what the non-MR child learns he learns fully, hence rapidly reaching near 100% on the earliest morphemes. The child with Down syndrome, in contrast, may work on

more constructions simultaneously but never acquire fully—or use consistently—even the earliest rules acquired.

Open-Class Vocabulary. On the open-class type-token ratio, the comparison preschoolers, with an average of 19.13 different open-class vocabulary types per 100 words produced, appeared to rely on a wider range of open-class vocabulary than did the children with Down syndrome, with a mean of 15.41 ($t = -2.10$; $p < .10$). This nearly significant difference derives almost entirely from the significantly greater tendency of the non-MR group to use different noun types (see Table 5.7). Thus, although PPVT scores indicate the children with Down syndrome should have access to a higher vocabulary, they tended not to rely upon a large (especially nominal) vocabulary in this spontaneous speech sample. As was observed in the analysis of closed-class vocabulary, the children with Down syndrome tended to rely on pronouns where possible.

Discussion

In summary, the adolescents with Down syndrome in this study appear to be at a linguistically stable, if extremely restricted, point of development,

TABLE 5.7
Measure of Lexical Diversity
(Presented as Number of Different Vocabulary Types per 100 Words)

	Children with Down Syndrome ($n=4$)	*MLU-Matched Controls* ($n=4$)	*T*
Number of words in corpus	468.25	474.75	-0.18
Open-class categories:			
Nouns	5.94	9.48	−3.69*
Verbs	5.52	5.79	−0.27
Adjectives	0.90	1.33	−0.70
Adverbs	3.05	2.54	1.08
Total	15.41	19.13	−2.10**
Closed-class categories:			
Pronouns	3.09	2.56	1.20
Prepositions	1.33	1.48	−0.66
Modals & semimodals	1.36	0.69	2.46*
Wh-forms	1.08	0.68	2.31**
Demonstratives	0.48	0.48	0.00
Quantifiers	0.93	0.87	0.22
Logical forms	0.25	0.42	−1.47
Total	8.50	7.18	1.82
Overall Total	23.90	26.47	−1.03

Note. Groups were compared using independent sample two-tailed *t* tests.
*$p < .05$. **p < .10.

with no syntactic or grammatical measure deviating from that stage. Overall, the combination of the syntactic measures employed reveal Down syndrome subjects to be at a level of simple phrase structure grammar—one that cannot be reduced, perhaps, to semantic generalizations (see Slobin, 1980, for a discussion of the normal course), but one that precedes, across the board, the dramatic changes required to build the complex syntax with its associated verbal auxiliary system, sentential embedding, and movement rules. Furthermore, despite the fact that this set of measures was chosen specifically with the aim of uncovering plausible differences between retarded adolescents and normally intelligent preschoolers, similarities across groups of children at the same language stage were more striking than were any small differences. Performance on each measure was within the expectations derived from the normal literature relevant to that stage and was confirmed on the basis of measures made on our own comparison group.

In contrast to our initial expectations, where differences did occur, it was usually the adolescent with Down syndrome who lagged behind the normally developing preschooler despite attested higher verbal MA. The adolescents supplied early grammatical morphemes and grammatical objects less consistently and produced less complex noun phrases. Despite relatively advanced receptive vocabulary scores, they relied more heavily on pronouns and produced only a limited set of nouns.

Even where the adolescents with Down syndrome maintained an advantage, there are important disclaimers. For instance, although they were somewhat more advanced in the acquisition of different closed-class terminology than non-MR children at this language level, other analyses make it apparent that they failed to use these forms appropriately and consistently to serve syntactic/grammatical functions. Similarly, although they produced complex sentences of appropriate length and word order, our results suggest that this level of syntactic complexity is not at all supported by appropriate grammatical markers. It is interesting that even within the closed-class system, then, one sees a relative advantage for vocabulary and relative deficit in structure (see Fowler, 1990, for further discussion).

There are, by now, many studies replicating the main finding of this study: When appropriate matching procedures are employed, internal analyses fail to distinguish the language structures employed by children with Down syndrome from those produced by normally developing children at the same language stage. This is true not only at the language level under study here, but at earlier levels of language as well (for reviews, see Fowler, 1990; Miller, 1988). Other studies are also in agreement with our findings concerning absolute level of language skill, consistently finding that individuals with Down syndrome tend to cluster at quite limited syntactic levels,

lagging far behind both chronological age and mental age expectations (Fowler, 1990; Miller, 1988; Wisniewski et al., 1988).

From one perspective, then, the findings from this study and several related studies serve to strengthen the notion of retarded language as a monolithic indissociable "normal" system proceeding at a slower pace. On the other hand, this entire body of research, so consistent in its findings, fails to shed light on how they manage to acquire exactly the same system at dramatically slower rates, or why children with Down syndrome progress only as far as they do. Rather, this research serves only to highlight the dilemma with which we introduced the chapter: How is it that the child can be learning "normally" over a period of 12 years what is otherwise acquired in 30 months; what accounts for the failure to ever achieve the complex syntax that normal preschoolers appear to acquire rapidly and effortlessly? Where do individual differences in language learning show themselves, and what facets of language learning remain constant despite differences in cognitive skill? In an effort to understand how language learning can be slowed, without violating apparent constraints on the system, the next obvious step was to look at language learning over time. In terms of both overall language growth and the mastery of individual language structures, will longitudinal investigation reveal specific properties of the course and process of language acquisition that bear back revealingly on the normal case?

STUDY II

A LONGITUDINAL INVESTIGATION OF LANGUAGE ACQUISITION IN A YOUNG CHILD WITH DOWN SYNDROME

To account for extreme delays in language learning with no apparent deviancies, we undertook a detailed longitudinal study, examining the effects of Down syndrome retardation on the rate and character of language learning. By closely monitoring language growth in a young child with Down syndrome from the onset of two-word combinations (Brown's Stage I) to the achievement of the language levels examined previously (Brown's Stage III), we sought to develop a body of data directly comparable to the data available on normally developing children (e.g., Bellugi, 1967; Brown, 1973). We used this method to explore three different ways in which markedly delayed learning might differ interestingly from the normal case,

with an eye toward understanding why language learning ceases where it does:

1. We first considered the rate and character of the overall learning curve for MLU. We considered two different possibilities. On the one hand, it is possible that language learning proceeds as a single accretion of information over time and practice conditions. If so, this accretion should be commensurately and uniformly slower in the retarded child, leading to an altogether flatter, stretched-out, language-learning curve. We contrasted this with the possibility that periods of learning at an apparently normal rate might be interspersed with periods of no learning at all. On this conceptualization, language acquisition is better characterized as a series of stages in which available information is reorganized and resystematized by learners (e.g., Bowerman, 1982; Karmiloff-Smith, 1979). Once having reached a stage, the retarded child should form generalizations in much the same way and at much the same rate as a normal child at the same language stage. The retarded child should, however, arrive at such stages late and show extreme difficulties in moving from one stage to another, ceasing altogether at a linguistically coherent ceiling.
2. The second area of investigation concerned the scope of linguistic generalizations, again looking at the character of language-learning curves, but in this case with respect to well-studied individual linguistic regularities, such as the plural morpheme or auxiliary inversion in questions. Here again, learning curves which are simply flatter in slow language learning suggest an inability to make generalizations of the same scope as normally observed. Again, it is possible that children with Down syndrome acquire rules of the normal scope but take longer between acquisition of these regularities, leading to a series of growth spurts and plateaus compared to the normal case.
3. Longitudinal investigation provides another window on the issue of differential delay addressed in Study I. Although, in that study, dissociation among language-production measures was not evident among adolescents with Down syndrome, it is possible that different facets of the developing systems follow distinct courses, with all reaching maximum potential at adolescence. In particular, we were interested in whether acquisition of different language structures varied, depending on how "semantic" or "syntactic" they were.

Because language learning in individuals with Down syndrome is widely assumed to occupy the first two decades of life, it is not surprising that longitudinal studies have rarely been undertaken. Longitudinal studies that do exist have not focused on language structure independently of vocabulary growth (Carr, 1988; Share, Koch, Webb, & Graliker, 1964). Even the

most relevant and best known study of language delay in the retarded (Lenneberg et al., 1964) preceded the in-depth longitudinal research of normal children that so fundamentally shaped our ideas about language acquisition (e.g., Bloom, 1970; Brown, 1973). The measures taken by Lenneberg et al. (1964) were cursory and taken only at 6-month intervals. In the assessment of syntax, for example, subjects' speech was described as fitting into one of four categories: (a) one-word, (b) phrases, (c) sentences with errors, or (d) complete sentences. (Note, with regard to our earlier point about absolute levels of achievement, that only 2 out of 35 subjects ever moved beyond the phrase level during the entire period of study). The study is valuable in that it covers the entire period from 3 to 22 years of age; unfortunately, the learning curve presented was averaged over individual curves, each covering a 3-year period of observation.

What does seem apparent from Lenneberg et al. (1964) and other cross-sectional studies did not bode well for longitudinal research, leading one to expect that the language learning associated with Down syndrome is a painstakingly slow process, lasting from when the children were 3 or 4 years of age until puberty. However, pilot research and simple observations encouraged us to pursue a longitudinal investigation nonetheless. Consistent with Lenneberg et al. (1964), follow-up of the four adolescents studied in Experiment I revealed no further linguistic progress for the $2\frac{1}{2}$ to 4 years following the initial investigation; MLU remained within the range of 3.0 to 3.5, suggesting they had reached their final linguistic attainment. Cursory observation of younger children with Down syndrome (aged 8 or 9 years) attending the same school as our adolescents revealed that they too were functioning at a similar language level. In the one longitudinal study of children with Down syndrome that had mimicked the procedures of normal language acquisition, there seemed to be evidence for an extended period of "no growth," speaking to our "stage" hypothesis. In that study, Dooley (1977) conducted a year-long observational study of two moderately retarded children with Down syndrome (IQ 51 and 44; starting CA 3;10 and 5;2), examining individual growth curves using the language analysis procedures of Brown (1973). Throughout the study, both children remained in Brown's Stage I. Over the year, one child made approximately one month's progress (MLU 1.48 to 1.75) relative to non-MR children studied in Brown (1973); the other child actually declined somewhat in MLU (1.84 to 1.73). With the exception of the fact that they failed to change significantly over the period, the children were similar to Stage I non-MR children on internal measures (semantic relations, grammatical morphemes, utterance diversity, and size of lexicon). The only difference of note was a greater tendency on the part of the children with Down syndrome to rely heavily on routinized expressions and pro-forms (*it*, *they*, *here*, *there*, *do*), in keeping with our findings above. Dooley (1977), however, noted that this tendency

also varies within the normal population. On the basis of these three observations, we hypothesized that perhaps most language learning takes place in a restricted age range, between 4 and 9 years of age, making a longitudinal project more feasible.

Method

Subject

The subject of our longitudinal study was Rebecca, a mild-to-moderately retarded child diagnosed at birth as having Down syndrome, trisomy 21. Her tested IQ on the Stanford-Binet was 57 at age 61 months. She and her nonretarded twin brother were the last-born of a large, supportive, middle-class family. Her family received public assistance in "infant stimulation" programs from a few months of age, and she was first enrolled in preschool at 2 years of age. She first came to our attention when she was 46 months old; at that time she had begun to speak in one-word utterances. Intensive longitudinal investigation began 5 months later, when she was 51 months old and attending a local parochial day school for handicapped youngsters; she remained at this school throughout the study. At that time, as noted by both the school speech therapist and ourselves, Rebecca was beginning to produce two-word combinations, making her comparable to the children at the outset of the Brown and Bloom studies.

Rebecca was an ideal subject for our observations for several reasons:

1. We caught her at the onset of syntax and were able to observe her in the very act of making progress.
2. From the beginning, her speech was relatively articulate for a child with Down syndrome, making transcription and interpretation straightforward for numerous undergraduate assistants.
3. She clearly enjoyed the attention and the interactions during which we collected language data, and was happy to play anything from "store" to "McDonalds" to "tea" for extended periods, providing us with volumes of data.

Procedure

Because we wished to compare her development to that of normally developing children, we tried to mimic as closely as possible both the methods and descriptive categories of Brown's (1973) and Bloom's (1970, 1973) classic investigations of speech development in the normal child. Thus, we visited Rebecca in her home once a month for an hour-long session from the age of 51 months to 89 months. At each visit, two experimenters would arrive with a bag of toys (toy town, dolls, drawing

materials) and a high-fidelity tape recorder. Rebecca would play and chat with one of the experimenters; the other would take detailed notes on both speech and context. The audiotaped sessions were transcribed, either in full or until 250 useable utterances (i.e., intelligible, nonimitative, nonrepetitive, and nonelicited) from the subject had been recorded. Each transcript was fully checked by at least two listeners and discrepancies in the transcription were either resolved or removed from the analysis, leading to virtually complete interrater agreement. All further internal analyses were also submitted to double coding and scoring until full agreement was achieved among the experimenters. These analyses, much the same as those employed in the earlier experiment, are reviewed briefly.

Utterance-Length Measures

Following the classic language development studies, growth in utterance length served as our overall measure of language development and allowed for comparison with normally developing children on internal analyses. Three utterance-length measures were calculated. First, procedures outlined by Brown (1973) were duplicated exactly to yield the *Brown MLU*, allowing for direct comparison to his subjects. As a more optimal measure of language competence, we also calculated a spontaneous mean utterance length, *SMU*, following the procedures presented in Study I, in which responses, etc., were omitted. Our third index of utterance length was the *upper bound*, the length of the single longest utterance produced in the session, measured in morphemes (Brown, 1973).

On the basis of these three measures, transcripts were assigned to one of Brown's (1973) five language stages. This assignment allowed us to compare Rebecca's development on internal measures to growth in normally developing children. Although originally defined by Brown in quantitative terms (the upper bound for each midpoint increasing by 2 from 5 to 13), the stages have come to represent qualitatively distinct periods in development, each with a somewhat different focus of interest.

Internal Measures of Linguistic Complexity

Thematic Relations. Bloom's coding system for semantic/syntactic relations encoded in the earliest multiword utterances of young children serves as a measure of content and thematic complexity in Rebecca's language from Stages I to III (Bloom, Lightbown, & Hood, 1975). Our coding system followed hers closely. For purposes of comparison, we calculated a standard deviation for Bloom's subjects, and then determined by how many standard deviations Rebecca's performance deviated from that norm.

Grammatical Morphology. To assess Rebecca's development of closed class morphology, we relied upon Brown's (1973) measure of use in obligatory context of the first 14 grammatical morphemes to appear reliably in child language. Individual learning curves and point of full acquisition (90% use in obligatory context across three sessions) were plotted for each of these morphemes.

Syntactic Measures. As one measure of syntactic knowledge, we traced the development across stages of constructions with negative or interrogative intent. Here, we relied upon Bellugi (1967) for normative longitudinal data. As a clue to understanding the learning and generalizing procedures which characterize Rebecca's development, we were particularly interested in observing overgeneralizations in her attempts to acquire question and negative-formation.

Results

Stages of Language Development

Because the language stages laid out by Brown (1973) serve as major guideposts for the purpose of discussion and comparison, they are described briefly here, complete with MLU criteria from Brown (1973), normative chronological age data from Miller and Chapman (Miller, 1980), and discussion of how Rebecca's growth in MLU fits in (refer to Table 5.8).

Brown's (1973) Stage I covers MLU 1.0 to 2.0, with an upper bound of 5 words at the mean MLU of 1.75. This is the period in which children, typically between 18 and 24 months of age, begin to combine words into utterances; the focus in most studies at this stage has been on what meaning relations the child encodes with the minimal combinatorial power available; such analyses are available in Nelson (1973), Brown (1973), Bowerman (1973), and Bloom, Lightbown, and Hood (1975). For comparison with studies of normally developing children in Stage I, we have analyzed Rebecca's samples from 50 to 58 months of age. During this period, her MLU ranged from 1.2 to 1.8, her SMU from 1.3 to 2.0, and her upper bound was 5 morphemes.

Stage II covers MLU 2.0 to 2.5, with an upper bound of 7 morphemes at the mean MLU of 2.25 (Brown, 1973). Children, on average, traverse this stage between 24 and 30 months of age. Studies of normally developing children at this stage continue to focus on meaning relations. In addition, note is taken of the emergence of a few early functors and inflections; that endeavor continues up to and beyond Stage V. For comparison with Stage II children, we relied upon Rebecca's samples from 61 to 63 months. Her

TABLE 5.8
Utterance Length Statistics as a Function of Age in a Young Child with Down Syndrome

Stage	*Age in Months; Weeks*	*Brown MLU*	*UpperBound*[a]	*Spontaneous Mean Number of Morphemes per Utterance*	*Number of Spontaneous Utterances*
I	50;1		3	1.57	35
	51;1	1.22	4	1.33	40
	53;0	1.21	4	1.43	102
	54;0	1.30	3	1.42	43
	55;0	1.36	4	1.49	286
	55;1	1.40	4	1.60	208
	56;2		5	1.88	123
	57;0	1.77	5	2.11	126
	57;2	1.60	5	1.93	194
	58;0	1.79	4	2.06	177
II	59;2	1.82	7	2.21	138
	61;0	2.03	8	2.31	192
	62;0	2.03	7	2.22	119
	63;0			2.61	
	64;0	2.30	8	2.85	222
III	65;0	2.42	9	3.04	128
	66;1	2.70	7	3.39	171
	67;0	2.70	9	3.37	350
	68;0	2.85	8	3.10	338
	69;0	2.39	8	3.16	585
	70;0	2.88	9	3.43	314
III/IV	71;0	2.52	13	3.51	304
	72;0	2.97	11	3.39	365
	73;0	2.64	10	3.48	151
	74;1	2.89	10	3.51	234
	75;1	2.73	13	3.52	293
IV	77;0	3.19	11	3.73	190
IV/V	78;0	3.55	14	4.34	166
	79;0	3.66	11	4.25	328
	80;0	3.02	18	3.98	369
	81;2			3.50	381
	82;2	2.86	10	3.52	525
	84;0	3.28	11	3.77	504
	86;1	4.45	16	4.45	502
	87;0	3.49	13	4.30	466
	89;0	3.21	16	4.19	479

[a]presented in morphemes; excludes lists.

MLU at this time was 2.0, her SMU ranged from 2.2 to 2.8, and her upper bound was 7 or 8 morphemes.

Stage III includes MLU 2.5 to 3.25, with an upper bound of 9 words at the mean MLU of 2.75. At this stage, most basic meaning relations have

appeared and are used in conjunction with one another. Half a dozen grammatical morphemes are being used with 90% regularity; several others are being used erratically. It is at this point, when the child is between 30 and 36 months of age, that one can begin to track the development of such complex syntactic structures as negatives, wh-questions, and yes/no questions. The lack of verbal auxiliaries is a notable feature in these sentence types at this stage. This period is also notable for overgeneralizations such as *feets* or *goes*; it is a time when the child seems to be able to express whatever he or she wants, but in a "cute" childish fashion. For Stage III comparisons, we relied upon Rebecca's samples from 65 to 70 months, with an MLU ranging from 2.4 to 2.9, an SMU of 3.0 to 3.5, and an upper bound from 7 to 9 morphemes.

Stage IV covers MLU 3.25 to 3.75, with an upper bound of 11 words at the target value of 3.50. The 3-year-old child is typically at this stage and can form most negative and yes/no questions accurately, but has a way to go before full mastery of the intricacies of wh-questions. By the end of this stage, he or she has mastered 8 or 9 grammatical morphemes; most grammatical morphemes are supplied where required. The new feature at Stage IV is the embedding of one simple sentence within another, as in *I said you draw it.*

At this point, it becomes difficult to make direct comparisons between Rebecca and other children on the basis of utterance length alone. Between 71 and 75 months of age, Rebecca's MLU fluctuated between 2.5 and 2.9 (Stage III), her SMU varied between 3.5 and 3.7 (more like Stage IV), and her upper bound varied between 10 and 13 morphemes (also Stage IV). We refer to this period as Stage III/IV to indicate its intermediary status. In a later sample (77 months), all three measures converge on Stage IV assignment (SMU 3.7; MLU 3.2; upper bound 11); we use that sample for Stage IV comparisons.

Stage V covers MLU 3.75 to 4.25, with an upper bound of 13 at MLU 4.0. Once into this stage, the child (typically $3\frac{1}{2}$ years of age) can generally express what he or she needs to. MLU becomes more a measure of situational factors than of grammatical ability. Although the mastery of English grammar is not complete at this point, children at this level have strong mastery of most grammatical morphemes, supplying the first 14 90% of the time and producing auxiliaries appropriately in negative and interrogative constructions. There has been little longitudinal work beyond this level; at Stage V and beyond the child is considered to have mastered the basics of language (e.g., Crain & Fodor, in press). It is highly questionable whether Rebecca truly attained Stage V competence in the course of this study. Beyond the 77 month session, her utterance-length measures fluctuated erratically from MLU 2.9 to 5.6, SMU 3.5 to 4.5, and upper bound 10 to 16. For comparison purposes with studies in Stages IV and V, we have

selected the last three sessions of the study: 86 to 89 months. In these samples MLU varied between 3.2 and 4.5, but SMU was consistently above 4.0 and upper bound was at least 13. These sessions are referred to as Stage IV/V.

Discussion of internal analyses divide naturally into two periods of development: (a) Stage I–III, and (b) Stages III and beyond.

Internal Analyses: Stages I–III

MLU. After a slow start in early Stage I, Rebecca proceeded from Stage I to Stage III (55 to 66 months) in a strikingly normal fashion. On all measures taken, her growth was unremarkable both in rate and character. MLU progressed rapidly and consistently upward until attaining Stage III (refer to Fig. 5.1 for a comparison of Rebecca's MLU growth curves with those of normally developing children).

Thematic Relations. Encoding of thematic relations progressed in an orderly fashion, although slightly in advance of other measures, including MLU. Usage of categories was consistent with that seen in Bloom's subjects; the only difference was a consistently greater reliance on Rebecca's part on nondevelopmental categories including stereotyped phrases, adverbs, and vocatives (see Fig. 5.2).

Rebecca's relative advantage in this area is particularly evident when one looks at the proportion of her multiword utterances expressing more than one thematic relation. By Stage II, Rebecca had attained or surpassed the level achieved by normally developing youngsters at the close of the study by Bloom, Lightbown, and Hood (1975). Rebecca continued to progress in this area, and by Stage III, had twice as many thematically complex utterances as her younger stage-matched peers (see Fig. 5.3).

Grammatical Morphology. During Stages I–III, the first 4 of Brown's 14 grammatical morphemes were mastered to 90% criterion usage. These same 4 were the first acquired by each of Brown's three subjects, within comparable stages (refer to Fig. 5.4 to see growth on 14 grammatical morphemes). Growth curves for these same 4 individual morphemes were also calculated and are presented here. As can be seen in Fig. 5.5, Rebecca showed rapid mastery and consistent usage of *in* and *on* much like Eve, studied by Brown (1973). Her acquisition of the progressive *-ing* was more variable; again, this was also consistent with Brown's observations (see Fig. 5.6 for a comparison).

Syntactic Measures. Rebecca's early negative and interrogative constructions paralleled normal acquisition, with a heavy reliance on intonation

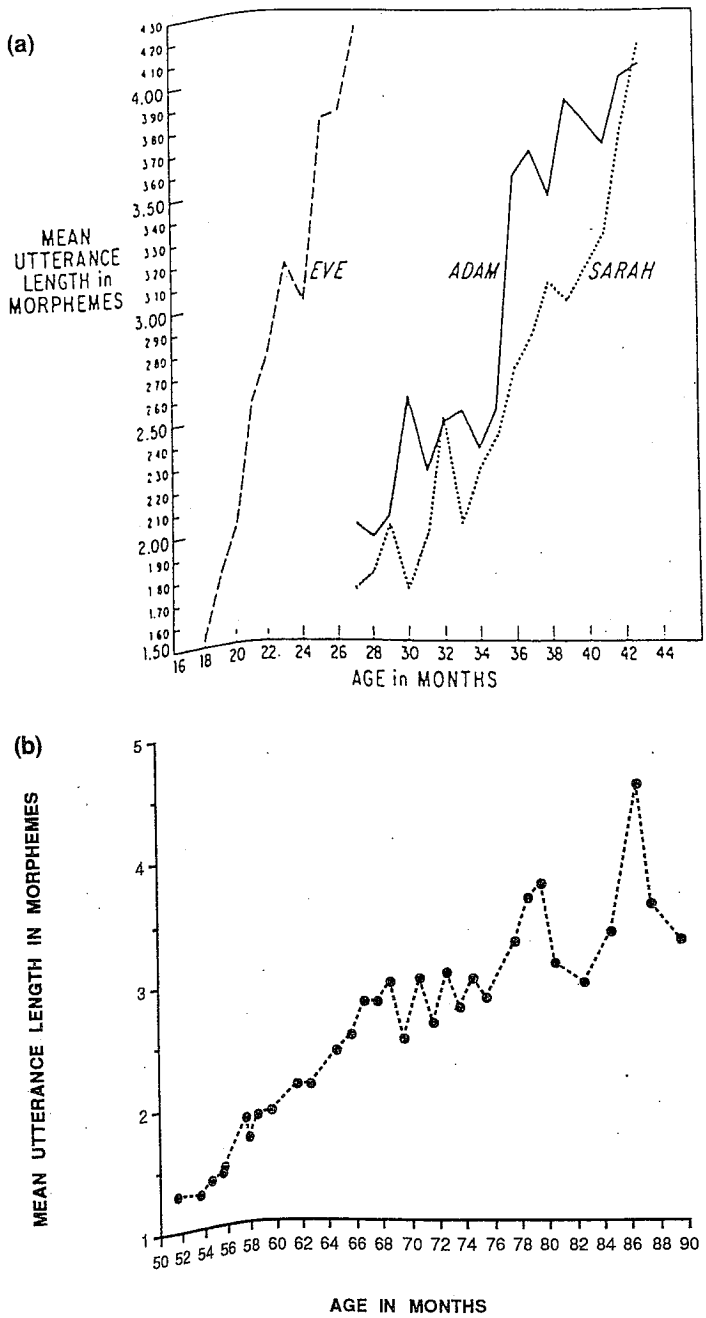

FIG. 5.1. Growth in mean utterance length in (a) three normally developing children studied by Brown, 1973, and in (b) Rebecca, a young child with Down syndrome. (Fig. 5.1a copied from *A First Language* by Roger Brown, 1973, Cambridge, MA: Harvard University Press. Copyright © 1973 by the President and Fellows of Harvard College. Reprinted by permission).

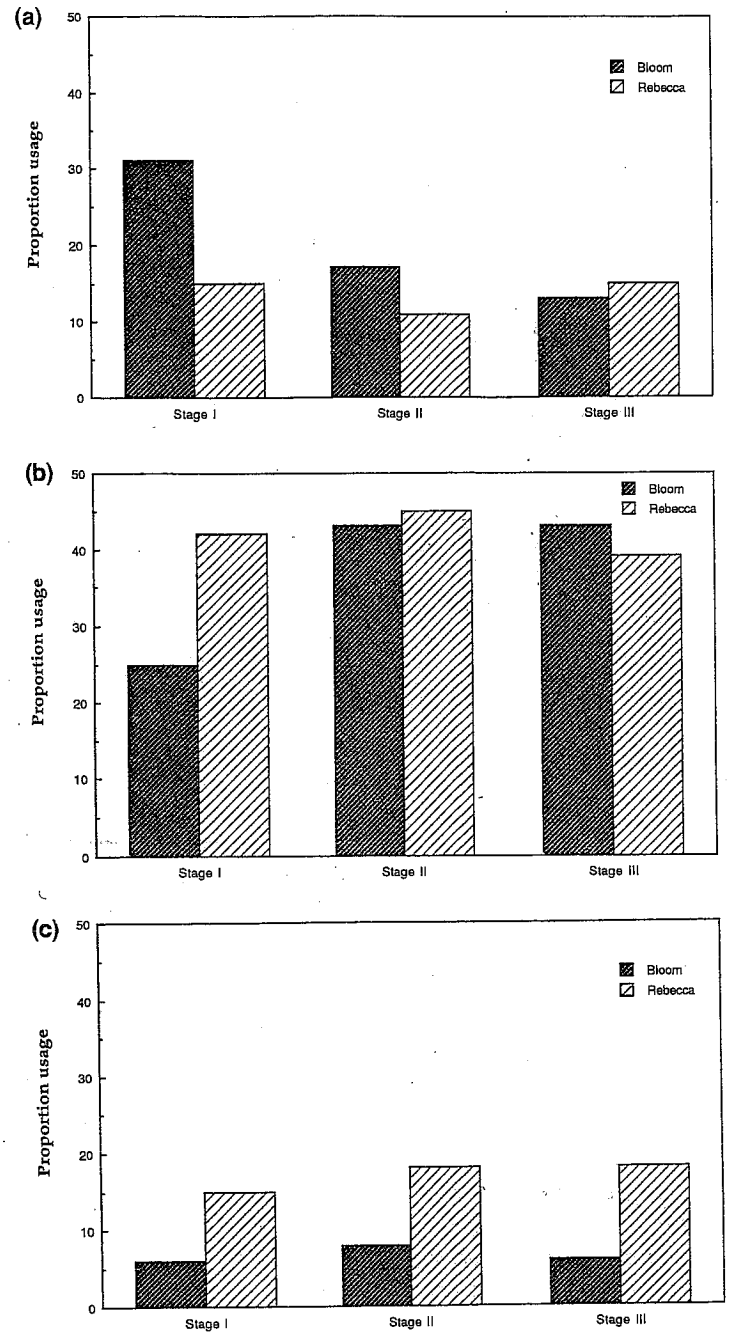

FIG. 5.2. Encoding of Thematic Relations in Normally Developing Children (Bloom, Lightbown, & Hood, 1975) and in Rebecca, a child with Down syndrome. (a) Functional categories (e.g., existence, recurrence, negation). (b) Verbal categories (e.g., actions, states). (c) Nondevelopmental categories (e.g., sterotype, routine, vocative).

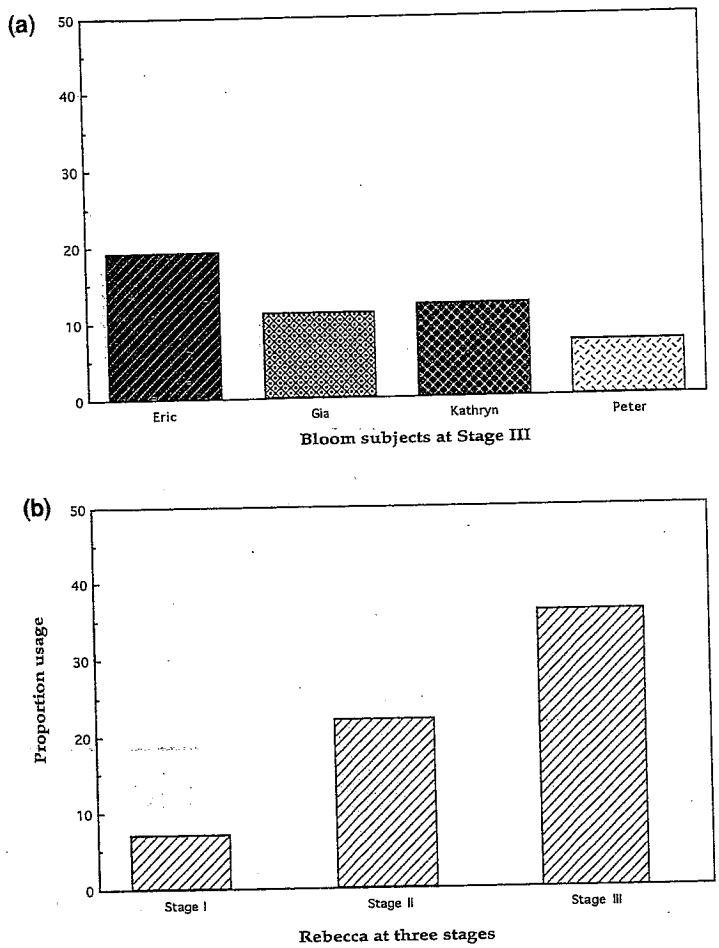

FIG. 5.3. Proportion of mulltiword utterances expressing more than one thematic relation in (a) four normally developing children studied by Bloom, Lightbown, and Hood (1975) and in (b) Rebecca, a young child with Down Syndrome.

(e.g., *I play this? This is yours*?), negative modals and the unadorned NOT (e.g., *I can't shut it, Her not go*), and a repertoire of unanalyzed wh-questions (e.g., *Where's NP*? *What's this*?). Examples of constructions at each stage are provided in Tables 5.9 through 5.11, together with comparison constructions collected by Bellugi (1967). During this period, there were no unusual or persistent overgeneralizations.

Internal Analyses: Stage III and Beyond

MLU. Having achieved Stage III (MLU 3.5; 67 months), Rebecca's progress slowed sharply and began to differ in interesting respects. Growth

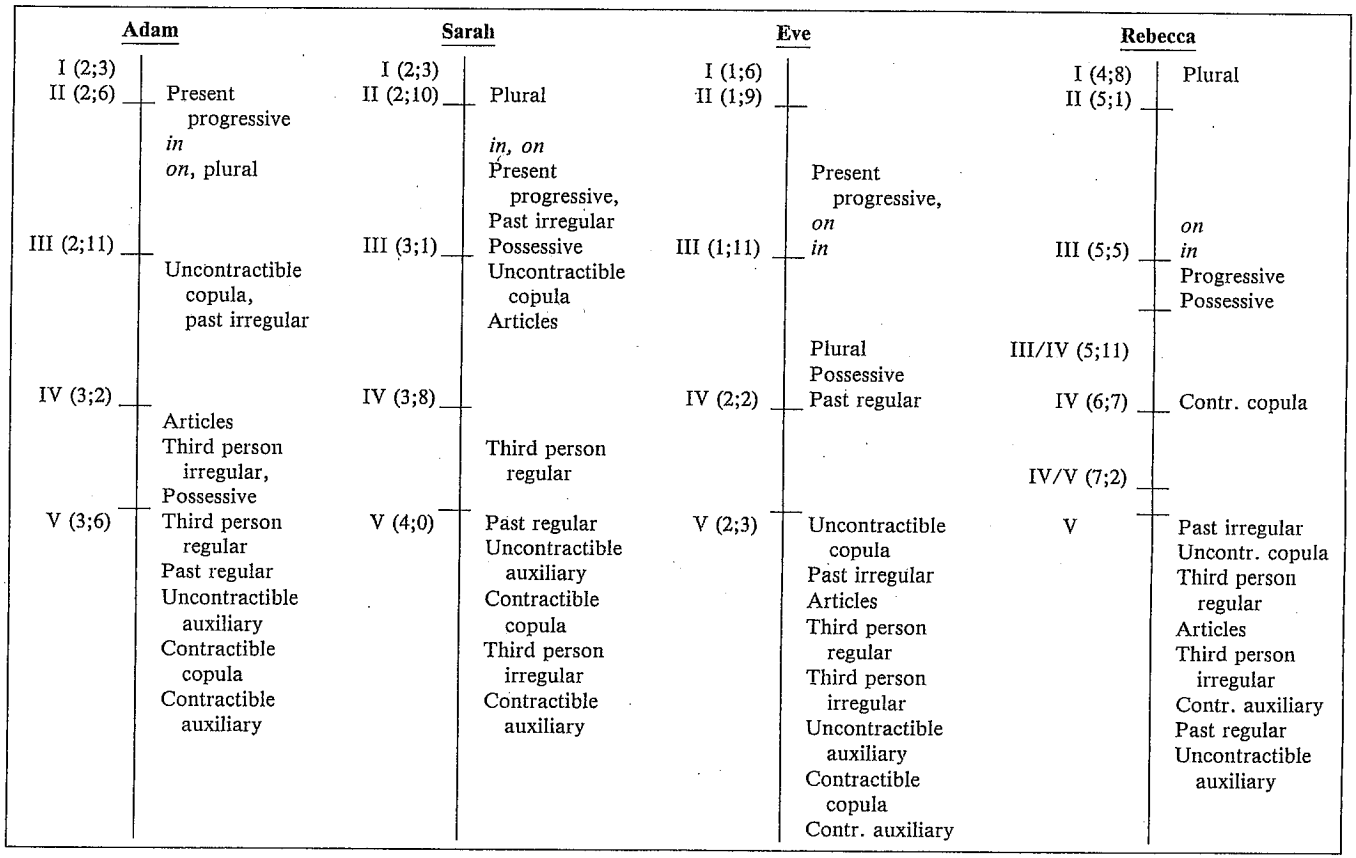

FIG. 5.4. The order of acquisition of 14 grammatical morphemes in three normally developing children studied by Brown, 1973, and in Rebecca, a young child with Down syndrome. Note: For all children, morphemes included below Stage V had not attained the 90% criterion at that point. (Adapted from *A First Language* by Roger Brown, 1973, Cambridge, MA: Harvard University Press. Copyright © 1973 by the President and Fellows of Harvard College. Reprinted by permission.)

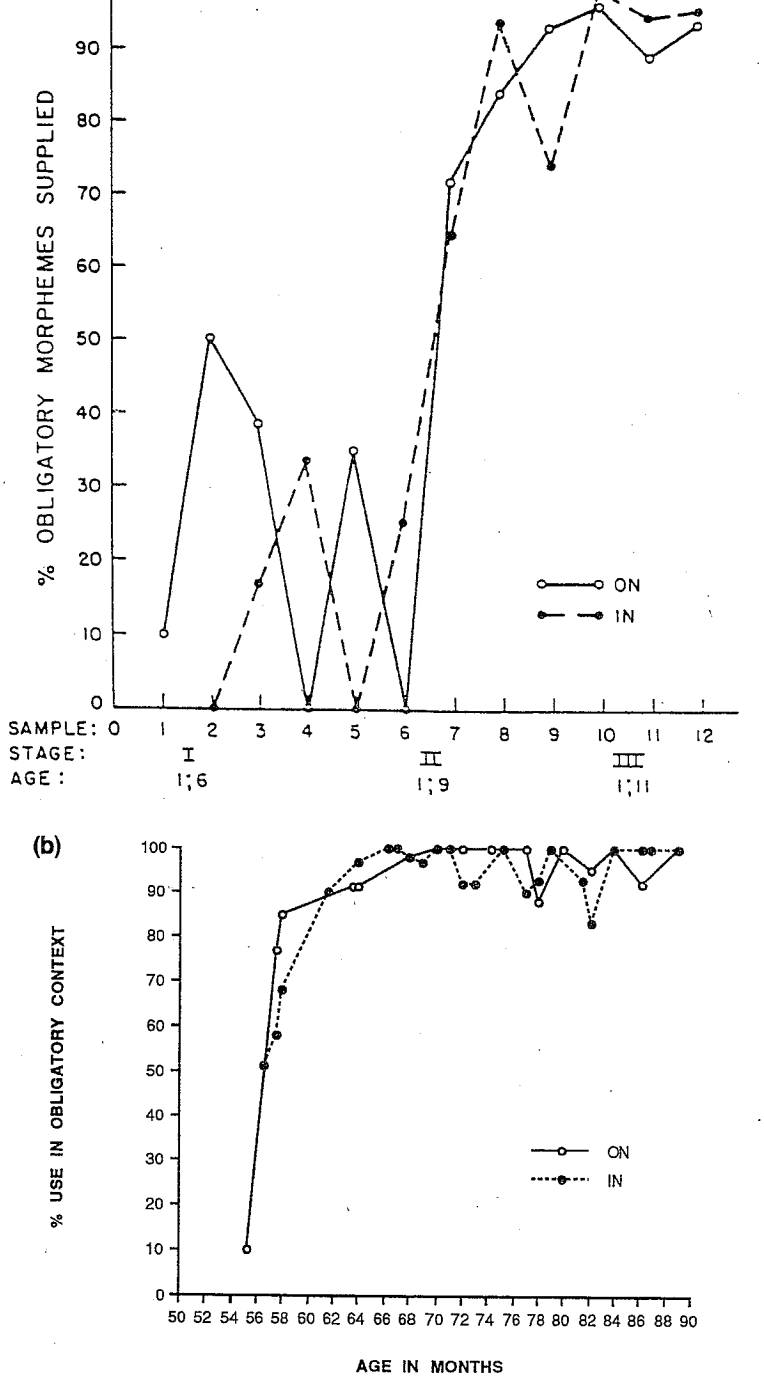

FIG. 5.5. Development of the prepositions *in* and *on* in (a) Eve, a normally developing child studied by Brown, 1973, and (b) Rebecca, a young child with Down syndrome. (Fig. 5.6a copied from *A First Language* by Roger Brown, 1973, Cambridge, MA: Harvard University Press. Copyright © 1973 by the President and Fellows of Harvard College. Reprinted by permission.)

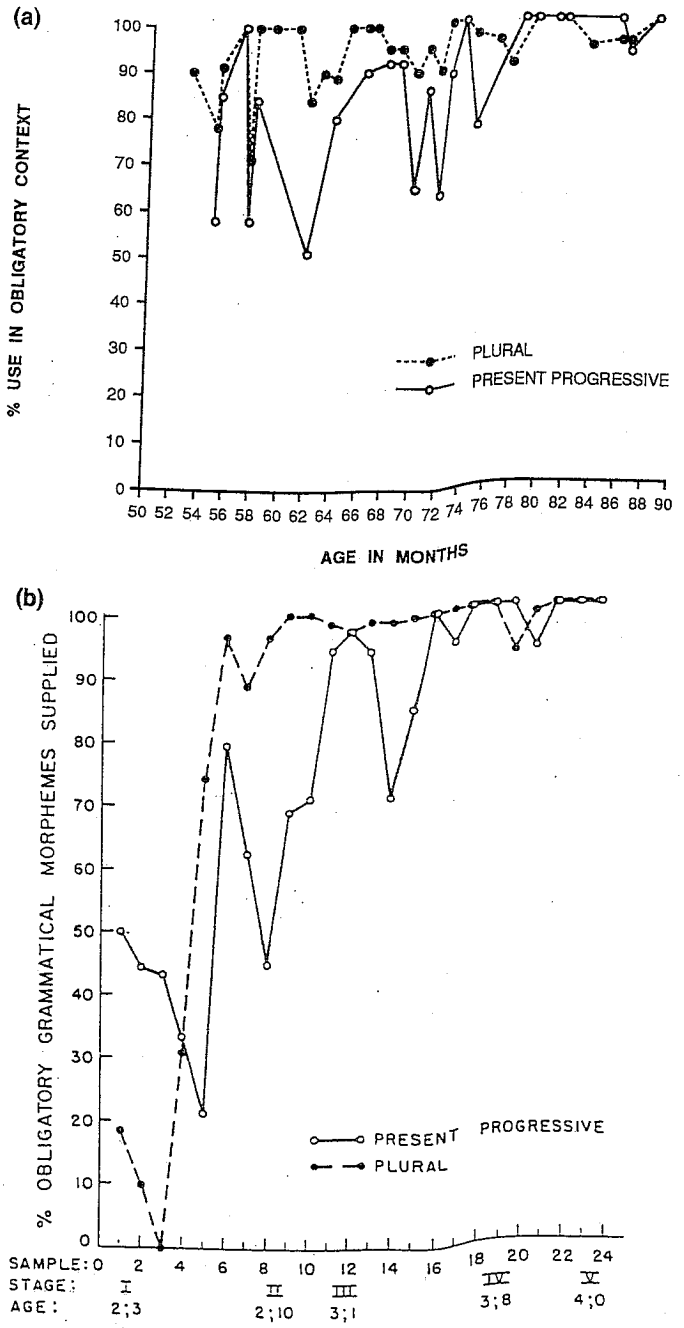

FIG. 5.6. Development of progressive and plural inflections in (a) Sarah, a normally developing child studied by Brown, 1973, and (b) Rebecca, a young child with Down syndrome. (Fig. 5.6a copied from *A First Language* by Roger Brown, 1973, Cambridge, MA: Harvard University Press. Copyright © 1973 by the President and Fellows of Harvard College. Reprinted by permission.

TABLE 5.9
Examples of Yes-No Questions Produced by Normally Developing Children, Studied by Bellugi (1967), and by Rebecca, a Child with Down Syndrome

Bellugi Subjects	*Rebecca*
Late Stage I	
Fraser water?/	ə draw babies?/
Mommy eggnog?/	Play with it?/
See hole?/	Put your face?/
I ride train?/	My do it?/
Have some?/	Maxie going?/
Sit chair?/	Mommy cooking?/
No eat?/	Rebecca sit mommy's lap?/
Ball go?/	Eric watch t.v.?/
Stage III	
See my doggie?/	Things in here?/
That black too?/	This is for you?/
Mom pinch finger?/	I play this?/
You want eat?/	You have a sister?/
I have it?/	I take?/
This can't write a flower?/	Is your name Raggedy Ann?/
Stage III/IV	
Does the kitty stand up?/	You make it?/
Does lions walk?/	Binky, you talk?/
Is mommy talking to Robin's . . ./	I have phone now?/
Did I see that book?/	Mommy, I pour milk in here?/
Are going to make it with me?/	It's at your house?/
Will you help me?/	This is yours?/
Can I have a piece of paper?/	Do you?/
Can't it be a bigger truck?/	Can you leave that?/
Can't you work this thing?/	Will you carry me over snow?/
Stage IV/V	
	Could I sit down next to Esther?/
	'n can I have some food?/
	These be good right here?/
	You feeling all right?/
	Now play dolls?/
	You want something to eat?/
	It's done?/

TABLE 5.10
Examples of wh-Questions Produced by Normally Developing Children, Studied by Bellugi (1967), and by Rebecca, a Child with Down Syndrome

Bellugi Subjects	*Rebecca*
Late Stage I	
Who that?/	(What)'s that?/
Why?/	What a book name?/
What(s) that?/	How many in there?/
What cowboy doing?/	How 'bout this one?/
Where Ann pencil?/	Where are you?/
Where Momma boot?/	Where is it?/
Where kitty?/	Where taperecorder?/
Where milk go?/	Where the people?/
Where horse go?/	Mommy where they are where are scissors?/
Stage III	
Where my mitten?/	Where's Mommy?/
Where me sleep?/	Where's people?/
What book name?/	Where her sit?/
What me think?/	What that?/
What soldier marching?/	What happened?/
Why you smiling?/	Where is it?/
Why you waking me up?/	What's Chris on here?/
Why not he eat?/	
Why not me sleeping?/	
Why not me drink it?/	
Stage III/IV	
Where small trailer he should pull?/	Where's parking lot?/
Where I should put it . . ./	Now what's he go?/
Where the other toe will drive?/	Where's this little one sit/
Where's his other eye?/	Where was he?/
Where my spoon goed?/	Where is mailbox?/
What I did yesterday?/	What's Pat's phone number?/
What did you does?/	What's you want for your ice cream?/
What you have in your mouth?/	What's her want?/

(continued)

TABLE 5.10 *(Continued)*

Bellugi Subjects	*Rebecca*
Stage III/IV	
Why the Christmas tree going?/	What's this called?/
Why kitty can't stand up?/	What's that kid you got on your hand?/
Why Paul caught it?/	What you writing for?/
Which way they should go?/	Who wants pizza?/
How he can be a doctor?/	What large?/
How that opened?/	
Stage IV/V	
	How much in?/
	Where it goes?/
	Where's purple in here?/
	Who's eighteen?/
	Where's food play with this?/
	Where this go?/
	What this be?/
	'bout some more/
	What's you gonna bring it Mom? 20 minutes?/
	When it's done yet?/
	What's you want for some to eat?/
	Which color for her shoes?/

in MLU ceased altogether for 10 months; further gains were offset by large and erratic shifts downward, varying as much as .85 morphemes/utterance between two sessions (see Fig. 5.1). Although by the end of the study (89 months) she had achieved an MLU as high as 4.45, it was not at all clear whether she would maintain this level.

Grammatical Morphology. Despite the promising start in Stages I through III, Rebecca made little further progress during the rest of the observation period. Over the 22 months from the onset of Stage III to the end of the study (at 89 months), Rebecca had mastered only one additional grammatical marker: the contractible copula (e.g., *it's gone*) and even that morpheme was not used altogether accurately. Despite its consistent appearance in appropriate contexts, leading to a high score on Fig. 5.4, the copula was also used in a wide variety of inappropriate contexts. (Note, for example: *she's eat; what's you want; mommy's go water*). This overgeneralization persisted throughout the entire period from 67 to 89 months. A further point of potential interest concerns the fact that other, earlier

TABLE 5.11
Examples of Negative Constructions Produced by Normally Developing Children, Studied by Bellugi (1967), and by Rebecca, a Child with Down Syndrome.

Bellugi Subjects	*Rebecca*
Late Stage I	
More . . . no/	No read it/
No singing song/	No Easter/
No the sun shining/	No top/
No money/	No feet/
No sit there/	No • Carol's/
No play that/	No • me this one/
No fall/	Not Anne Mowrer picture/
No heavy/	Not me • Eric/
No want stand head/	No sit on table/
No Mom sharpen it/	Can't open it/
No Fraser drink all tea/	
Stage III	
I can't catch you/	I can't shut it/
I can't see you/	I can't put it on her/
We can't talk/	Don't color/
I don't sit on Cromer coffee	Don't want it book/
I don't want it/	Don't put your hand in/
I don't like him/	No . . . that is trunk/
No . . . Rusty hat/	No color/
Book say no/	No hug/
Touch the snow no/	These not staying/
Don't leave me/	I not ready/
Don't wait for me . . . come in/	You got no curly hair/
That not "O," that blue/	She's no shoes/
That no fish school/	No monsters ride/
That no Mommy/	No holes/
There no squirrels/	Anne, this thing won't work/
He no bite you/	Nobody in there/
I no want envelope/	Not anyone's room/
I no taste them/	

(continued)

TABLE 5.11 *(Continued)*

Bellugi Subjects	*Rebecca*
Stage III/IV	
Paul can't have one/	We can't play/
This can't stick/	I don't have broccoli/
I didn't did it/	Not you eyes closed • I like your eyes open/
I don't want cover on it/	I not cheat, AF/
You didn't caught me/	I not get Pat yet/
I didn't see something/	Her not fall or anything/
Cause he won't let go/	No, I can't make it • AF does/
No, it isn't/	It's not funny • it's not/
That was not me/	Miss Piggy's don't have cold/
I am not a doctor/	We didn't have popsicle, we have ice cream cone/
This not ice cream/	Ellen's not being good/
This is no good/	Her not talk, her clap/
Paul not tired/	Her not fit in there/
I not crying/	Her's not sit too well/
He not taking the walls down/	Not for you/
Don't put the two wings on/	I not get these at store/
I not hurt him/	Not start with that point . . ./
I not see you anymore/	Don't need anymore/
Ask me if I not made mistake/	Pat's not call me/
Stage IV/V	
	'cause we can't open them/
	I don't need brown/
	Look - this doesn't work/
	'n tree . . . not no witch can't have any cookies/
	The count say she can't have any cookies/
	I not brought anything/
	Esther did not bring anything/
	Dog didn't ate it/
	Don't open it/
	It's not a message/
	I'm not/
	I not [i.e., won't] get it/

acquired, grammatical morphemes were now being used inconsistently. Whereas Brown (1973) reported that "once a curve has passed above the 90% line for several consecutive sessions, it levels off within a range of 90 and 100 percent" (p. 258), this failed to hold for Rebecca. For all but one of the six morphemes meeting this criterion, percentage correct dropped below 80% at some later point.

Syntactic Measures. Beyond 67 months of age, Rebecca also failed to make further progress in mastering negative and interrogative constructions. Between 67 and 89 months of age, the auxiliary system underlying mature constructions, involving subject–auxiliary inversion and do-support, was almost totally lacking in Rebecca's grammar. Only in the final session were there clear signs of further progress in this domain. Once again, a persistent overgeneralization was apparent. In this case, the term *what* served to introduce most wh-questions, largely replacing other wh-terms *when*, *where*, *how*. For example, *what's you go*? was used to ask about location, and in *what's you gonna bring it, Mom*? *20 minutes*? the omnibus wh-form is used to replace *when*.

Discussion

In this study, we examined language learning under conditions of cognitive impairment, seeking to determine what aspects are subject to variability (causing a slowdown) and what remain constant (causing "no deviance"). To this end, we examined growth in language in a young child with Down syndrome with a focus on the character of the language-learning curves and the appearance of overgeneralizations. We juxtaposed two hypotheses:

1. On the one hand, we considered whether language learning might proceed from a single accretion of information over time; this would be supported if learning curves are simply flatter than those of normally developing children.
2. In contrast to this possibility, we considered whether language learning might be better characterized as a series of stages in which the available information is reorganized and resystematized by learners over the course of cognitive-linguistic growth; we suggested this might be evident if periods of relative growth were interspersed with periods of no growth. By examining individual learning curves, and taking note of unusual overgeneralizations, we were specifically interested in the modifiability of rule learning. Finally, following up on Study I, we asked whether learning curves for different facets of development (e.g., MLU) would develop with the same synchronicity as in the normal case.

In the case of Rebecca, a child with Down syndrome, the fundamental differences between Stages I through III and beyond III provide suggestive evidence in support of a *stage reorganizational* account of language development. Once she began to provide two words in a productive fashion, Rebecca's growth progressed upward at a nearly normal rate, despite the fact that she was 3 years late at the outset. Interestingly, her progress was unaffected up until the point where simple phrase structure grammar could no longer suffice to describe her linguistic system. She, like the adolescents discussed in Study I, stopped short of the point where she had to analyze and represent a complex auxiliary system in order to master the intricacies of interrogative and negative formation. That Rebecca stalled at a language level characteristic of many adolescents with Down syndrome suggests to us that their stopping point is not due to the arbitrary imposition of a critical period at adolescence, but is concomitant with some fundamental change in the grammar. We are following up this observation with further experimental work comparing children, with and without Down syndrome, at either side of this threshold. On both comprehension of syntactic structures and, particularly, imitation of auxiliary structures, both normal children and those few children with Down syndrome who do break the barrier display dramatic increases in performance level once beyond Stage III (Fowler, 1990).

The case of Rebecca also bears importantly on the shallow generalization hypothesis, which suggests that the delay of children with Down syndrome might result from the acquisition of the same facts as are normally acquired, but in smaller pieces. Rebecca's development cannot be simply characterized as a flatter, slowed-down version of the normal case, with smaller generalizations taking the place of the rules observed in the normal case. Rather, a drive to extract regularities in the input is evident in the nature of her errors, in her far-reaching overgeneralizations that cut across the grammar, in her growth curves for individual grammatical morphemes, and in the synchrony of her development (or lack of development) across grammatical categories. In short, the tendency to regularize remains strong even where cognition is impaired.

OVERALL DISCUSSION

The two studies presented focus on partial language learning in children with Down syndrome, a well-documented case of extreme language delay associated with a more general cognitive impairment. Whereas the data obtained are consistent with the prevailing view of retarded language as "delayed, without deviance," they provide an interesting perspective on how constraints on language learning may continue to exert an effect, even in the case of language failure.

An initial concern, much neglected in prior research on language impairment, was to characterize just how far language learning progresses and to consider what might preclude further development. Although it remains to be determined whether other children with language impairment, or even with Down syndrome, will stop at the same point as the children studied here, the slowdown at Stage III observed in both adolescents and a much younger child raises the possibility that linguistic factors are one important determinant in explaining a child's failure to progress. It is difficult to ignore the fact that the stopping point in this group of children precedes the dramatic growth in syntactic development that has captured the imagination of linguists. Although this break is implicitly adhered to in child language research (syntacticians study children from age 3 and up; early child language folks study children up to age 3), in the present research it gains some empirical validity as a possible and important difference in language representation.

Unfortunately, the present studies contribute little to the question concerning exactly what factors might preclude further development, and why it is that these children fail to surmount this particular linguistic obstacle. For, although it might be quite simple to implicate "retardation," this account was deemed most unsatisfying early on in the discussion. Although it was noted that children with Down syndrome suffer particular problems with memory and articulation, the role of these factors in explaining language impairment could not be fairly addressed in the present studies. Here, only language production was assessed; further research is required examining whether the obstacle is evident even when memory and production factors are minimized (see, for example, Miller, 1988). We can at least report that a simple-minded view of the role these factors play will probably not account for the delay. For one thing, children with Down syndrome also display problems with comprehension of syntax (see Fowler, 1990, for review). A more complicated view of how memory and articulation may play into language acquisition could, however, prove very interesting, both for individuals with Down syndrome and for the normal case. With regard to yet other explanations for failure to progress, we refer you to a discussion in Fowler (1988); there, it was clear that age, IQ, and language level all played a role in determining rate of language growth.

A second concern addressed in the present research was whether certain facets of language acquisition are relatively more disrupted than others by a general cognitive impairment. Despite the large disparity between MLU and both chronological age and mental age, and despite intensive efforts to find disparities within the linguistic system, the language levels were very coherent, with very little deviation one way or the other. Where there was failure to progress, the failure appeared to be across-the-board. For example, where Bellugi had observed broad application of the use of a new

auxiliary form, we observed broad nonapplication. This internal coherence of syntactic development was supported in the longitudinal study as well. Rebecca, at any point in the study, was comparable to preschoolers going through the same process. Whereas both experiments provide suggestive evidence that there is a difference between semantic and syntactic domains consistent with the MA/MLU disparity, this bears further study with more clearly delineated semantic measures.

Where we had anticipated—and found—a distinction between open- and closed-class items, this split was not inconsistent with the normal developmental course. Adolescents with Down syndrome, like very young children, are lacking in closed-class items. However, perhaps because complex syntactic structures crucially depend on these closed-class items, it was not the case that the adolescents made progress in one without the other.

The third area of interest concerned the possibility of different strategies of acquisition to yield the same effect, but at a slower pace. As discussed previously, we did not find evidence in the present research to support such a hypothesis. Indeed, the extreme normalcy of Rebecca's growth from Stage I through III, combined with Dooley's (1977) analyses of two other children with Down syndrome in Stage I, provides compelling evidence for constraints on language acquisition. These longitudinal studies suggest that a child either moves forward normally or fails to move at all. It would appear that language does not readily lend itself to piecemeal acquisition. Despite her lack of success, the case of Rebecca, once within Stage III, suggests that even the most language-impaired child will try to extract broad regularities from the input. The kinds of mistakes Rebecca displayed in overgeneralizing *what* to cover all wh-terms and in applying the copula *'s* in situations where it clearly does not apply are, we suspect, not wholly aberrant. Indeed, we have since observed both of these overgeneralizations, for brief periods, in the first author's own children. Rather, what separates Rebecca from the normally developing 3-year-old may be the inability to recover from the error, to learn anew.

Though not a strategy per se, one characteristic of language in children with Down syndrome does bear further mention. In both Study I and Study II, it was noted that once a structure was acquired, it was inconsistently applied. This particular observation is consistent with clinical report, but has not been addressed formally. Although we currently have no clear account for either this behavior or what effect it might have in making further progress toward linguistic mastery, it is clearly a replicable phenomenon that demands an explanation.

In summary, the story of language learning in children with Down syndrome is wholly consistent with the view that the language-learning process exerts a well-defined influence on the grammars a child will construct. Whereas a fully specified grammar clearly depends on an intact cognitive-linguistic system in order to move forward, it does appear that, in

this group anyway, whatever forward progress is made or even attempted is governed by constraints on the learning process; the cases presented here do not permit alternate learning strategies. Finally, and most interestingly, the story of language learning in children with Down syndrome raises the possibility that cognitive factors may play an important role in advancing, or even reorganizing, the grammatical system. A slowdown at Stage III adds credence to the sense that there is a major stumbling block in language acquisition that needs to be addressed in syntactic theory and in theories of normal language development. We suspect that a focus on this stumbling block—this failure to progress—will force attention on the mechanisms of language growth and may yield important insight into the relation between language and cognition.

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