Specific Grammatical Limitations in Children with Specific Language Impairment

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CASE STUDY: CHILD WITH SPECIFIC LANGUAGE IMPAIRMENT

Jay is a rather ordinary little boy in general appearance and demeanor. He plays with other children in the usual ways, and his speech is quite clear. He was extraordinarily late in beginning to talk. His parents referred him for language intervention services because he was almost 3 years old before he began to talk, well beyond the age at which talking usually begins. His parents were concerned because his father had received speech and language therapy as a child. They are concerned, caring, and conscientious parents who sought out recommendations for enhancing Jay's language development.

In his clinical evaluation, Jay scored below age expectations on a standardized test of language acquisition, his utterances were shorter than expected for his age, and he showed poor performance on a test of receptive vocabulary. At the same time, audiological assessment showed his hearing to be within normal range and his nonverbal intelligence to be near normal levels for his age. His mother reported an uneventful birth history and early childhood development for Jay. The diagnosis was specific language impairment (SLI): receptive and expressive language development below age expectations without concomitant deficits of hearing, intelligence, or social-affective relationships. Jay was enrolled in a language intervention program for preschoolers offered by his local school district.

When Jay was almost 5 years old, he was enrolled in a longitudinal study of children with SLIs. The initial round of testing determined that Jay's morphological development showed a profile that proved to be characteristic of other children in the affected group. Some grammatical rules were evident, whereas others were not. On the unaffected side were rules governing plurals, the verbal inflection, -ing, and prepositions. Jay said these sentences clearly: (1) "Those guys got sore legs"; (2) "That baby's taking a nap"; and (3) "The babies sleep in this bed." In fact, in contexts wherein the adult grammar would require plural -s, as in sentence 1, Jay was accurate 96% of the time; for the verbal -ing as in sentence 2, accuracy was 96%; for the prepositions in and on, as in sentence 3, accuracy was 100%. In these ways, Jay's grammar was very similar to that of unaffected, typically developing children. In other ways, however, Jay's grammar was very different from that of his age peers. This was evident in utterances involving grammatical tense marking. These utterances included the following [the asterisk indicating an ungrammatical utterance that was produced in contexts in which an adult would say the utterance following the virgule (/): (4) "This thing drop/
this thing dropped”; (5) “Dad sleep here/dad sleeps here”; (6) “Her fine/she is fine”; and (7) “He going to fall/he’s going to fall”. In contexts wherein the adult grammar would require -ed past, as in sentence 4, his accuracy was 27%; for -s third-person present, as in sentence 5, accuracy was 13%; for forms of BE like those in sentences 6 and 7, his accuracy was 53%. These levels of grammatical performance are far below age expectations. Unaffected children at age 4½ years are at 90% levels of accuracy, very near the adult grammar.

Jay’s teachers (and even his parents) do not notice these details of his grammar. They notice instead that Jay is a somewhat withdrawn child. Although he seems to enjoy playing with other children, he hangs back somewhat from verbal conversations and is reluctant to assert his own wants and needs. He is not popular among his peers. When he goes to kindergarten, his teacher notices this apparent shyness and regards him as “socially immature.” For this reason, she does not promote him to first grade with his age peers but instead recommends that he move to a “developmental first grade.”

His reading readiness skills are limited, and he subsequently encounters difficulty with the transition to reading. If his academic outcome proceeds in a way similar to other children with SLI, he likely will be a modest student who ultimately achieves a high-school degree and perhaps a semester or two of college. When matched for children of similar socioeconomic status and nonverbal intelligence levels, his final educational levels will be lower. Finally, also likely is that when he becomes a parent, one or more of his children will demonstrate a similar language acquisition profile.

The little boy Jay is representative of a group of children who have been the focus of study in the author’s laboratory for some time. In all, we have detailed spontaneous language data on more than 100 such children, all of whom received the diagnosis of SLI, along with evidence from in excess of 100 unaffected control children. The children in this group meet the clinical profile of expressive and receptive language deficits. As described in the first two paragraphs of the case, younger children as Jay typically are referred for evaluation, during which they are given standardized tests of language acquisition and vocabulary development, supplemented by measures drawn from spontaneous speech, such as the mean length of utterance. In addition, measures of nonverbal intelligence are obtained, hearing is assessed, and parents are interviewed for information about other dimensions of development.

These diagnostic measures establish that Jay’s profile of performance meets the definition of language-impaired relative to age expectations, and he further meets the exclusionary criteria invoked for SLI, i.e., no known deficits of cognitive development, gross neuromotor development, or social-affective development and no hearing loss). In other words, no obvious associated conditions could account for the extreme delays in language acquisition. The causes of Jay’s language impairment are unknown, although current scientific inquiry is bringing new advances in our understanding of the condition.

A long-standing issue in the study of children with SLI is whether the language delays can be thought of as the primary area of impairment or as symptoms secondary to limitations in more general perceptual or cognitive mechanisms. This issue links up with one of the fundamental issues in theories of children’s language acquisition: the extent to which grammar emerges from dedicated cognitive mechanisms and processes or is intrinsic to more general perceptual and/or cognitive mechanisms. Do children with SLI have specific grammatical limitations or are any apparent language delays an epiphenomenon of faulty perceptual mechanisms or general learning processes?

The author would argue that the answer to these questions lies in careful consideration of the grammatical symptomology associated with the condition of SLI. With regard to the closely related disorder of dyslexia, Lyon (1995) argued that specifying the key symptoms and characteristics of affected children is essential. That specificity is the objective of the work discussed in this chapter. A preview of some key findings is offered in paragraph three of the foregoing case study, showing that some but not all morphemes are likely to be affected (where morphemes refer to words and meaningful affixes, such as the -ed on walked). Because of the selective deficits, SLI should not be thought of as a general problem of grammatical acquisition. Most importantly, a close consideration of the pattern of affectedness proves to be enlightening: We can rule out some possible interpretations and can propose some new explanations. The account discussed here focuses on fundamental properties of clausal construction, to propose that children with SLI do not know that tense marking is obligatory in simple declarative sentences and in this way are very far behind their age peers and even behind younger unaffected children at similar language levels. Furthermore, this symptom is not apparent in children with Williams syndrome (see chapter 4) who are also delayed in emergence of their grammar relative to their age peers. Thus, we know that it is not always to be expected in cases of language delay.

Important as these advances are in understanding the grammatical symptoms, one would not want to create the impression that children with SLI realistically can be considered as otherwise unaffected children. Our experience (and that of other investigators) with these children is that grammatical limitations during the preschool years can be associated with, and perhaps lead to, other developmental and life span risks as well. The final paragraph of the case study description lays out some of the other risks, including relatively mild but nevertheless significant social differences and not-so-mild academic risks and genetic risks. Elsewhere, the author and others have reported on the social risks during the preschool and early school years (Hadley & Rice, 1991; Rice, 1993a,b; Rice et al., 1993; Gertner et al., 1994; Redmond et al., 1998) and have argued that the ways in which young children with SLI show social differences is remarkably similar to the ways in which young children learning English as a second language seem to be socially different. Therefore, we should suspect that the limited language competence is a causal factor and not the other way around. The academic risks for SLI are well documented (Aram et al., 1984; Catts, 1993; Watkins &
Rice, 1994). Emerging evidence also substantiates considerable genetic risk (Crago and Gopnik, 1994; Rice, 1996; Tomblin, 1996; chapter 15). Because this chapter explores in detail the grammatical deficits, these other dimensions are not addressed beyond this acknowledgment that they exist and should not be ignored in the full picture.

A final point is that Jay's profile is one of several possible profiles encountered in a clinically referred sample of children who meet the exclusionary criteria of SLI. Jay's language deficits are apparent in the receptive and expressive modalities, and his speech generally is clear (i.e., he is ready intelligible and does not omit sounds in single-word productions).

Why is this profile selected for study? Again, borrowing from the observations of Lyon (1995, p. 3) about studies of dyslexia, "It is crucial to study individuals who meet well-specified selection criteria." The receptive-expressive disorder is a well-specified selection criterion. Furthermore, this clinical profile characterizes preschool children who are least likely to "outgrow" their early language impairment (Rescorla & Schwartz, 1990; Thal et al., 1991), so it is likely to be a stable condition that can be studied to determine persistence over time. Because the focus of inquiry is on morphology, it should eliminate children who cannot pronounce the sounds that appear as surface morphemes, sounds such as the final -s in two dogs or he runs. Otherwise, it would not be possible to tell whether the difficulties lie in motor performance, in acoustic representations, or in underlying linguistic representations.

The initial sections of this chapter contain an overview of the grammatical property of finiteness and how it emerges in children's grammar. An optional infinitive stage is described. The following sections lay out evidence of an extended optional infinitive stage in children with SLI, drawing the conclusion that tense marking is a significant clinical marker in the grammars of affected children but that this symptom does not characterize the early grammars of children with Williams syndrome. This finding is taken as evidence that selective deficits of tense marking are not characteristic of all cases of language delay and probably originate in cognitive mechanisms selective to the grammar. In the next section, an auditory-processing account of SLI is examined, critiqued, and found to be unconvincing as an explanation of the grammatical deficits of children with this condition. The chapter concludes with a discussion of the implications for cognitive neuroscience and neurodevelopmental disorders.

THE SEARCH FOR A CLINICAL MARKER

The identification of a distinctive grammatical marker for SLI long has been sought and long has proved to be elusive. In a recent literature review, Leonard (1987) concluded that available evidence did not support a unique linguistic characteristic of this condition. Lahey et al. (1992) concluded that the range of normal variation is great in young children's early grammatical acquisition and that the reported deficits of children with SLI fall within the broad range of typical development. The standing question has been whether the grammar of children with this condition differs in interesting ways from the profile expected for younger levels of language acquisition. The null hypothesis has been that the grammar of affected children can be considered as a simple developmental delay within the broad range of normal variation for younger children. This can be regarded as an extended development theory of SLI. Within this view, the underlying grammar of children with SLI is undifferentiated from that of unaffected children; some unknown factor causes language acquisition to start slowly. Under some readings of an extended development theory, children should be expected to "outgrow" the early problem. Perhaps this is what happens in many children identified as late talkers who "catch up" with their age peers around school entry age (Rescorla & Schwartz, 1990; Thal et al., 1991).

For a long time, however, some have hinted that something more is at stake. Recognized for some time is that, in English, certain morphemes are more likely to lag behind, especially a small set of verbal affixes, such as third person singular -s in she talks (Lahey et al., 1992; Leonard et al., 1992; Rice & Oetting, 1993; Rice, 1994); regular past tense in she talked (Leonard, 1987; Bishop, 1994); and (although relatively neglected for some time) the forms of to be as in she is talking and she is happy (Ingram, 1972). To account for these observations, an existing group of theories can be considered loosely as extended development theory plus processing constraints. One group of explanations targets input processing mechanisms as faulty. Several versions of this view exist. One posits a deficit in auditory processing of rapidly changing speech, which leads to difficulty in discriminating between speech syllables (Tallal et al., 1996). A second view assumes that the underlying paradigm-building mechanisms of language are in place but that the problem is in the processing of surface forms of low phonetic salience (i.e., the small, unstressed parts of the input grammar). In effect, this view posits a filter in which grammatical information is selectively screened on input, such that the low salience parts get dropped from input and, therefore, cannot be considered by the paradigm-building mechanisms. This interpretation, known as a surface account, was put forth by Leonard et al. (1992) and recently was revised to a low phonetic substance interpretation (Leonard, 1996, 1998), which stipulates that relative morphophonic duration determines the components likely to be dropped. Omissions are predicted to be morphophonemic material of shorter duration than neighboring material. Finally, an alternative version of a processing constraint is the production constraint explanation of Bishop (1994), in which observed surface omissions are attributed to constraints on the output side, such that as a child is formulating and producing an utterance, a ceiling of some sort influences available production resources. When this ceiling is exceeded, some parts of the utterance drop out. What the processing models, collectively, have in common is the expectation that the underlying grammar of SLI is basically intact and
does not differ in interesting ways from younger, normally developing children. Differences are attributable to processing breakdowns.

Important recent breakthroughs bring a new theoretical perspective and provide strong evidence that certain grammatical functions lag far behind in the language acquisition of children such as Jay. Also corroborated is that the grammar of SLI is in interesting ways like younger children's grammars but that, at the same time, the affected grammar is unlike younger grammars in the persistence of a specific grammatical difference over a long period. This account is the extended optional infinitive account (described later). The extended optional infinitive model can be viewed as a highly enriched version of the extended development theory, which assumes highly explicit models of the adult and child grammars, models that allow for specification of affected parts of the grammar. The theoretical import of the extended optional infinitive account is that the observed findings do not yield readily to processing accounts of linguistic limitations.

THE GRAMMATICAL PROPERTY OF FINITENESS

Contemporary theories of linguistic structure and language acquisition focus on the grammatical property of finiteness (cf. Chomsky, 1993, 1995). Finiteness is marked on verbs, which can appear in finite or nonfinite forms. Finite forms are those marked for tense and grammatical agreement. Each declarative clause must have a finite form to be grammatical. Consider the following sentences (asterisk indicates that the sentence is ungrammatical):

(1) a. Patsy walks.
   b. *Patsy walk.

(2) a. Yesterday Patsy walked home after work.
   b. *Yesterday Patsy walk home after work.

(3) a. Patsy is walking.
   b. *Patsy walking.

(4) a. Patsy is happy.
   b. *Patsy happy.

(5) a. Patsy did not work today/Does Patsy work today?
   b. *Patsy not work today/ Patsy work today?

In examples 1 to 5, the a examples are grammatical, whereas the b examples are not. The reason they are ungrammatical is that they are missing finiteness markings, which in English can be seen in the use of -s as a verbal affix with third-person singular present-tense subjects (where both tense and subject-verb agreement are operative); in the use of -ed to mark past tense (irrespective of subject personhood, so that grammatical tense is evident but subject-verb agreement is not); in the use of BE forms (which includes the surface forms of is, am, are, was, were, so that tense and subject-verb agree-

ment are evident) as auxiliary verbs (as in example 3a) or as main verbs (as in example 4a); and in the use of DO forms (which includes the surface forms of do, does, and did, thus showing tense and agreement, as in example 5a). Notice that although these different surface forms share the grammatical property of finiteness marking, they do not share speech properties. Some are affixes (i.e., -s, -ed) and some are free-standing morphemes (i.e., BE and DO, although BE can appear as a contracted form attached as an affix, which is possible for examples 3a and 4a, and DO can appear as a stem carrying a contracted form of not, as in example 5a and b). The point to notice here is that perceptual properties do not define this set of grammatical forms.

Next consider that in English, finiteness marking may or may not appear on a surface form. This does not mean that finiteness marking does not exist but only that it is not apparent on the surface. This is illustrated in examples 6, 7, and 8 that follow. In example 6a, we see that the third-person singular present-tense -s does not appear for plural subjects and, in example 6b, for first person singular subjects. This shows that bare stems of lexical verbs can appear in finiteness-carrying syntactical positions.

(6) a. They walk.
   b. I walk.

In example 7a we see that not all bare stem verbs are in finiteness-carrying contexts. In example 7a, *walk cannot carry finiteness marking, as is evident in example 7b.

(7) a. Patsy likes to walk
   b. *Patsy likes to walks.

In example 8a, we see that nonfinite verb positions do not necessarily require the infinitival to evident in example 7a. We know this bare stem *walk is not finite because, as illustrated in example 8b, it becomes ungrammatical if overt finiteness is applied.

(8) a. Patsy made him walk
   b. *Patsy made him walks.

Examples 6 to 8 show that children learning English must know the syntactic contexts that allow finiteness marking and those that do not. They cannot follow a simple strategy of “find the verb and attach an affix.” If they do, it will be apparent in misapplications of overt morphemes. The main point here is that morphological marking of finiteness is related intrinsically to knowledge of the configurational structures of sentences (i.e., the syntax). Hence, the term morphosyntax.

Finally, consider that in English, small, unstressed grammatical morphemes share surface properties with the finiteness markers described, but these morphemes do not mark finiteness. For example, plural -s (as in example 9) is very similar to the -s affix for third-person singular present tense.

(9) Clocks tell time.
Note also that the -s affix is phonetically very similar to sounds that appear within word boundaries, such as the final sound of the words fox or box. A child learning English early on knows that the final sound of fox is linguistically different from the plural affix of dogs, and (as I will show) different from the affix of -s in walks. Keep in mind, however, that for children with problems in pronouncing the -s sound, it can be omitted in words as well as morphological affixes. In such cases, determining which level of linguistic representation is involved may not be possible.

Other plausible comparison morphemes are the prepositions in and on, as in examples 10a and b following, and the verbal -ing of examples 3a and b previously, which is thought to mark progressive aspect.

(10) a. Patsy is in the office
    b. The phone is on the desk.

Each of these, like the morphemes, third-person -s, -ed, BE, and DO, are small, unstressed parts of sentences. So, if small, unstressed parts of the surface grammar are vulnerable to processing constraints, plural -s, in, on, and -ing should be omitted as should the finiteness marking morphemes.

A final, important observation is that the finiteness markers are obligatory parts of each main declarative clause, whereas the acoustically similar morphemes for prepositions, plurals, and progressive aspect are not. Sentences without plurals are not ungrammatical; sentences without small words (e.g., the prepositions in and on) are not ungrammatical; sentences without the progressive aspect marker -ing are not ungrammatical. Many of the sentences that appear in the text of this chapter do not have one of these morphemes. On the other hand, literally every sentence in this text has a finiteness marker. In this fundamental sense in the adult grammar, finiteness is obligatory and must be carried in the mental representation of underlying sentence structures. Finiteness is part of “deep syntactic structures that interact with morphology to produce surface inflectional patterns” (Wexler, 1994, p. 319). (Currently, an extensive literature analyzes the formal linguistic properties of finiteness and sentence representations. See Pollock, 1989; Rizzi, 1990; Chomsky, 1993, 1995; and Haegeman, 1994, for discussion and references.)

CHILDREN’S ACQUISITION OF FINITENESS: AN OPTIONAL INFINITIVE STAGE

A recent and rather surprising discovery is that young, normally developing children for some time use nonfinite (infinitival) forms and finite forms of verbs in grammatical contexts wherein verbs are required. Wexler (1994, 1996) called this the optional infinitive stage, because infinitives were optional in finite contexts. In a given sample of young children’s utterances, children sometimes used infinitival forms and sometimes used finite forms of the main verb; in many of the languages studied, the infinitival form clearly differs from the finite form. This period has now been attested across many languages, including Danish, Faroese, French, German, Icelandic, Norwegian, and Swedish.

Among the current areas of investigation, interest focuses on how to characterize this period in terms of what children know and do not know about clause structure early on, and in terms of why some languages and not others show this period of language acquisition. (For reviews, see Bottari et al., 1990; Chlenski et al., 1994; Guasti, 1994; Lust et al., 1994; Rizzi, 1994; Wexler, 1994, 1996; Haegeman, 1995; Rice & Wexler, 1995, 1996a; Schütze et al., 1995.)

Wexler (1994, 1996) worked out predictions for English. He argued that even though many bare stems of English verbs reduce the number of contexts in which finiteness marking is clear, nevertheless some clear grammatical contexts would evoke an apparent optional infinitive grammar. In particular, he predicted the following: For the third-person -s and -ed markings on lexical verbs, bare stems may be used optionally where inflected forms are required, and auxiliary and main verb uses of BE may be omitted, as can auxiliary (but not main verb) DO. The predicted errors are those illustrated in the asterisk-marked sentences in examples 1 to 5 previously.

A further, and very important prediction is that when children do use a finite form in a given utterance—even when they are optionally dropping these forms from other utterances—they nevertheless know that the form used must agree with the subject of the sentence (i.e., subject-verb agreement must be evident) and that finiteness marking can appear only in the positions within the clause in which it is allowed (i.e., errors such as those in examples 7b and 8b should not appear). This is a strong prediction that says that children who do not know that tense is obligatory nevertheless know the structural configuration of a sentence (i.e., where finiteness can appear) and that the choice of a finiteness form is correlated with the subject of the sentence. In other words, grammatical morphology is intricately bound to knowledge of clausal structure (i.e., the syntax), and even young children know this.

To summarize: The optional infinitive account offers a view of normative language acquisition in which child grammars show a developmental delay in the obligatory use of tense marking. At the same time, children know about the relationship of morphology and syntax and the obligatory properties of subject-verb agreement. In this framework, children do not acquire morphemes one at a time independently of what they know about word order and other properties of a sentence. Inflectional patterns and underlying syntax are associated closely, and morphemes are understood in terms of grammatical function.

AN EXTENDED OPTIONAL INFINITIVE PERIOD FOR CHILDREN WITH SLI

In this section are reported findings from a series of studies investigating a possible extended optional infinitive stage in children such as Jay. These
studies were carried out in the author's laboratory, in collaboration with Ken Wexler. Detailed reports appear elsewhere (Rice & Wexler, 1995, 1996a,b,c; Rice et al., 1995; Rice et al., unpublished manuscript). Summarized here are some key findings.

The findings are both cross-sectional and longitudinal. The basic design includes an affected group of children who were identified in the year prior to school entry (when their mean age is near 60 months) and who meet the inclusionary and exclusionary criteria described in the case study. This group is compared to two control groups of unaffected children, one matched for chronological age (henceforth termed the 5N group because their mean age is right at 60 months at the time of first measurement), the other group of children at equivalent levels of language acquisition, as indexed by mean length of utterance. The members of this group are 2 years younger than those in the affected and age control groups at initial testing, with a mean age of some 36 months, so they are termed the 3N group. In the cross-sectional studies, the three groups of children were compared when all three groups were preschoolers. A group of 37 children with SLI participated in the cross-sectional study reported here, 45 5N children, and 40 children in the 3N group.

In a longitudinal study, 20 children in each of the three groups (N = 60) were followed for subsequent testing over a period of 4 years, for a total of seven data points, with testing at 6-month intervals. Collapsed over the three groups of children, the developmental interval observed encompassed ages 2.5 to 9 years.

Important methodological refinements in these studies are the exclusion from the affected group of those children who failed a screening for single-word pronunciation of the target sounds (final s, z, t, d) and specification of both receptive and expressive impairments. In these two ways, the sample of affected children is specified more fully than it is in many comparison studies reported in the literature. The full battery of assessments given and criteria for inclusion in the affected group are reported in table 14.1. A further methodological refinement is an a priori plan for measuring target morphemes in elicitation probes and in detailed analyses of spontaneous utterances. Thus, the available evidence for morphological use is more extensive than that in many other studies.

### Table 14.1 Assessment for the children diagnosed as specific language impaired

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Criterion</th>
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<tbody>
<tr>
<td>Peabody Picture Vocabulary Test-Revised (Dunn &amp; Dunn, 1981)</td>
<td>In clinical range</td>
</tr>
<tr>
<td>Mean length of utterance in spontaneous speech sample</td>
<td>In clinical range</td>
</tr>
<tr>
<td>Test of language development—primary speaker language quotient (TOLD2-P, Newcombe &amp; Hannell, 1988)</td>
<td>In clinical range</td>
</tr>
<tr>
<td>Goldman-Fristoe Test of Articulation (Goldman &amp; Fristoe, 1986)</td>
<td>Exclude for multiple and severe articulation errors</td>
</tr>
<tr>
<td>Phonological screening for final -s, -z, -t, and -d in single-syllable words</td>
<td>80% Accuracy required</td>
</tr>
<tr>
<td>Columbia Mental Maturity Scale (Burgemeester et al., 1972)</td>
<td>Within or above normal range</td>
</tr>
<tr>
<td>Audiological assessment</td>
<td>Within normal range on pure tones</td>
</tr>
</tbody>
</table>

#### Figure 14.1 Distribution of children's performance on third-person -s within groups.

and much, much lower than that of the 5N age-matched group, who are essentially at adult levels of use of the morphemes.

A representative example of the findings can be seen in figure 14.1. This boxplot depicts the performance of the three groups on -s third-person singular present in an experimental probe. In this task, children are shown a picture of a person doing something (e.g., a doctor seeing a patient), and the children are asked to tell what the doctor does (e.g., “He makes people get well”). The variable is the percentage of correct uses of third-person -s. The mean values for the groups are as follows: SLI, 23%; 3N, 44%; 5N, 92%. The figure shows for each group the median score (indicated by the line in the middle of the box for each group) and the deviation from the median (indicated by the width of the box, which extends from the twenty-fifth percentile to the seventy-fifth percentile, a box that includes half the children in the group).

Several findings are clear. One is that the affected group is considerably less accurate than is the younger group of children at equivalent levels of
utterance length, and the affected group is virtually nonoverlapping with their age peers. Their age peers, in the year before kindergarten, know that finiteness marking is obligatory, whereas the affected children are very likely to drop the third-person -s. The younger 3N group members also show optionality in their use of third-person -s, using it (on average) 44% of the time.

This pattern of results is evident for each of the morphemes in the tense-marking group (i.e., third-person -s, -ed, BE as either copula or auxiliary, and DO). Furthermore, this difference appears irrespective of task differences (i.e., it appears in spontaneous samples and in experimentally elicited probes as well).

In this domain of the grammar, the conclusion is clear: The affected children do in fact differ from unaffected children. By age 5, unaffected children are performing virtually as adults in this part of their grammar; they know that finiteness marking is required in clauses, and they insert the appropriate morphemes. The variance from one child to another is very small, within a narrow range at the uppermost levels of performance consistency. Younger unaffected children do not know that finiteness marking is obligatory, and they sometimes drop these markers in their utterances. What is strikingly true of the children in the affected group is that their rate of finiteness dropping is even greater than that of younger children and that it is far from the performance levels of their age peers.

A clinically relevant way to compare the affected children with their age peers is to evaluate the identification rates for individual children. This analysis yields levels of sensitivity and specificity, wherein sensitivity is the rate of identification of true cases (i.e., children in the affected group) and specificity is the rate of identification of true noncases (i.e., children in the control group). For this purpose, we calculated a composite score, collapsing across the different measures of tense marking morphemes (TNS). As can be seen in figure 14.2, if the cut-off is set at 80% correct, 97% (30 of 31) of the true cases are identified correctly, and 97% (36 of 37) of the true noncases are identified. These are very high levels of specificity and selectivity, indicating accurate classification of the children according to diagnostic categories.

Several important conclusions can be drawn. Tense marking is a robust clinical marker for young children who have SLI and meet the clinical profile studied here. Performance in this domain is low for affected children and high for unaffected age peers, a pattern desirable for an effective diagnostic marker. Furthermore, this grammatical difference exceeds the grammatical delay associated with younger children at equivalent utterance lengths, suggesting that the problem is more than a simple delay of early language skills.

Comparison of Preschool SLI Children and Normal Controls in Non-Tense Marking Morphemes

Perhaps the morphological difficulties of children with SLI should not be thought of as specific to tense marking but instead as representing a general-

![Figure 14.2. Distribution of individual children's performance on a composite tense marking score: SLI and age-matched controls.](image)

ized problem with acquisition of grammatical morphemes. This would be one possible interpretation of an extended development theory view. Another possible alternative view is that morphemes with similar surface characteristics, such as the -s of plurals, will be affected, showing that it is surface properties, not underlying grammatical properties, that account for the dropping of surface morphemes, a prediction most clearly put forth by Leonard (Leonard et al., 1992; Leonard, 1996). An earlier investigation by Rice and Oetting (1993) reported that third-person singular -s (but not plurals) were affected (see Oetting & Rice, 1993, for further evidence of what children with SLI know about plural marking). The cross-sectional study reported here renders possible examination of the non-tense-marking morphemes in spontaneous utterances (i.e., plural -s, progressive -ing, and the prepositions in and on), and a comparison of them to the tense-marking set of morphemes. Third person -s, -ed, and BE DO appears so infrequently in spontaneous utterances of young children that it was not included in the spontaneous analyses.

The findings are illustrated in figure 14.3, which reports the findings for plural -s. Obviously, the group performances are much more similar for the non-tense morphemes than they are for the tense-marking morphemes, even when the comparison involves the -s morphemes, which are highly similar acoustically for plurals and third-person singular present tense. Children with SLI are very similar to those in their comparison groups for their use of regular plural affixes. Mean accuracy levels are as follows: SLI, 88%; 3N, 97%; 5N, 97%.

In a separate study carried out by Rice and Oetting (1993), the affected children appeared likely to drop plural affixes in only one particular context.
that in which a plural noun is preceded by a numerical quantifier, such as two cats, which those authors suggested may be indicative of the way children represent number marking in semantic items, such as two. Whatever the reasons for the occasional dropping of regular plurals, obviously plural -s does not show the strong optionality apparent with tense marking for either the children with SLI or the younger unaffected children. Furthermore, this finding holds for progressive -ing and the prepositions in and on as well. This leads to the following conclusion: By age 5, children’s performance on plurals, prepositions, and progressives is not likely to differentiate affected from unaffected children. A further implication is that a generalized measure of morpheme performance, summarized across morphemes, is not likely to reveal affectedness, a point that will come up again in subsequent discussions.

An important part of the analyses carried out in the studies summarized here is detailed investigation of the records for possible errors. The extended optional infinitive account predicts that errors of application and form choice will not appear (see Rice et al., 1995; Rice & Waxler, 1996c; and Waxler, 1996, for detailed discussions of these predictions). Children’s attempts to apply affixes or to insert finiteness marking in non-finiteness-carrying sentence positions (as in the errors illustrated in examples 7b and 8b), would suggest that they do not know the underlying sentence configurations. The extended optional infinitive account posits that the children do know where finiteness markers can appear in sentences. An alternative possibility is that, because of faulty input-processing mechanisms, they are confused as to the possible location of an affix. Presumably because they do not hear or process the incoming information, under this explanation they would have to make some guesses as to where a morpheme may appear.

The evidence shows that children with SLI and the control children seldom make errors of misapplication. For the affected children, the error rate is 1% to 2%; for the control groups, it is 0.5%. The conclusion is that applica-

tion of the tense-marking morphemes is highly constrained by syntactical knowledge.

Another possible kind of error can be seen in the use of BE and DO. Children could be confused about which form of BE goes with which subject, in which case they would make errors such as illustrated in example 11:

(11) a. *I is happy.
    b. *She am happy.
    c. *They is happy.

The extended optional infinitive account predicts that children will know subject-verb agreement (i.e., that they will know that if a form of BE is in the surface structure, it will be the form specified by the person and number features carried by the subject). Even affected children who drop BE forms frequently will know this; the evidence strongly supports this prediction. The group means for correct form choice are as follows: SLI, 89%; 3N, 91%; 5N, 94%. Clearly, although the affected children do not know that BE must appear in such utterances as those in examples 3a and 4a, at the same time they know a lot about the underlying paradigm of forms assigned to subject person and number and about the need to choose the form of BE that is required for subject-verb agreement. That is to say, the paradigm is available, and their choice of forms is governed by the paradigm. As will be argued further, the robustness of the paradigm would be rather mysterious if we assume that the children have faulty input-processing mechanisms.

Persistence of Tense-Marking Deficits in SLI Children

Findings from other laboratories have reported that past-tense marking is not mastered fully by individuals who have SLI and are elementary school age or older (Bishop, 1994; Marchman & Weismer, 1994; Tomblin, 1994; Ullman & Gopnik, 1994; King et al., 1995; Oetting et al., 1995). What have been unknown are the developmental trajectory in this part of the grammar and the way in which multiple morphemes change over time. The extended optional infinitive framework generates the prediction that the set of morphemes that mark grammatical tense should cohere over time and should show—both as a set and individually—protracted slower development for affected children.

As we followed the children in the longitudinal study, we were impressed with how long the extended optional infinitive stage persists. This is evident is growth curve data shown in figure 14.4, which illustrates the development of children’s performance on the experimental probe task for the -s third-person singular present-tense affix. In this figure, the 3N group is shown in the dotted line to the left, over the time from 3 to 5 years, when this group overlaps with the first round of data available for the 5N group, which is shown in the uppermost dashed line on the right, from 5 to 7 years (when
they are 8 years old at the last time of measurement, they do not consistently insert tense marking in obligatory contexts.

Although the rates of acquisition differ for the affected children, in other and important ways they are similar to those of their younger controls. For both groups of children, much of the growth curve shows steady change over time (i.e., linear components) and times of uneven acceleration (i.e., nonlinear components), and the overall patterns of change look highly similar. Thus, the underlying mechanisms for change probably are very much alike.

What accounts for the observed patterns of change? To explore this question, we examined four different predictors measured at the first time of data collection (Rice et al., unpublished manuscript): the children's nonverbal intelligence performance and their performance on a picture vocabulary test; their mean length of utterance (as a simple index of general language growth); and their mothers' educational level (as a simple indicator of the richness of maternal input in the home). The outcomes showed that the only significant predictor was the child's initial mean length of utterance. Thus, children whose mothers are better educated are not necessarily more likely to show faster acquisition of these morphemes, nor do children with higher vocabulary levels or nonverbal intelligence scores have an advantage. In fact, even when the mean length of utterance is included in the predictor set, only 1% of the variance in grammatical growth is explained. This means that the change over time in this set of morphemes is driven by factors outside the domain of nonverbal intelligence, vocabulary size, mother's education, or length of sentences. Thus, although the exact mechanisms driving the emergence of this part of the grammar are unknown, they seem to be similar for affected and younger unaffected children and not part of a general trajectory of growth in other cognitive and linguistic domains.

Evidence of Extended Optional Infinitive Stage in Williams Syndrome Children

Perhaps an extended optional infinitive stage is characteristic of any condition in which language delay is apparent. This would be interesting to know because, if this is true, it would suggest that tense marking is one symptom of children whose language emerges late and follows a slow trajectory of acquisition. Perhaps this symptom may emerge anytime in the presence of risk for language development, which could be intellectual limitations, hearing loss, or differences in the integrity of the nervous system.

Children with Williams syndrome present interesting comparison profiles. These children are known to have significant intellectual limitations and to have a late appearance of language. By adolescence and young adulthood, however, their grammatical abilities are strong relative to their general cognitive abilities. Possibly, given their early language delay, children with Williams syndrome also show tense as a clinical marker.
In a recent study (Rice et al., unpublished manuscript), we examined a sample of children who had a diagnosis of Williams syndrome and whose language development was at a general level equivalent to the children with SLI in the cross-sectional Rice and Wexler sample (1999b). We identified Williams syndrome children whose mean length of utterances were equivalent to the children with SLI. This allowed for comparison of the Williams syndrome children, the children with SLI, the 3N group, and the 5N group. As shown in table 14.2, the first three groups were at equivalent mean length of utterance levels. The groups varied in cognitive performance, with the children in the SLI and normal control groups within normative range and the children in the Williams syndrome group in the range of intellectual deficits. Also, the groups varied in chronological age, with the Williams children older than those in the other three groups.

The findings show that the children with Williams syndrome do not have selective difficulty with tense marking, as reported in table 14.2. In their spontaneous samples, their mean percentage of use in obligatory contexts for third-person -s was 83% for -ed, it was 85% for BE, it was 91%. In this part of their grammar, their performance exceeds that of those in the SLI group and that of the younger 3N children at equivalent language levels (and pairwise comparisons carried out with t-tests yielded statistically significant differences: P < .05). This suggests that tense marking is not a concomitant by-product of the utterance expansions measured by mean length of utterance but instead is to some degree independent of utterance length. This is not surprising within the extended optional infinitive framework because finiteness marking is not defined in terms of utterance length.

Finally, the children with Williams syndrome perform at levels of accuracy that do not differ from those in the 5N group. Essentially, the Williams syndrome children with the much lower cognitive abilities are functioning very near adult levels on tense marking. The conclusion is that children with Williams syndrome know that tense marking is obligatory at a time in which their general language development is comparable to that of children who have SLI and do not know that tense marking is obligatory. Whatever the source of the early language delay of children with Williams syndrome, it does not seem to show the same grammatical properties as does the early language delay of children with SLI.

Considered as a collection of findings, the evidence strongly points in the direction of grammatical tense as a clinical marker for SLI. This symptom is proving to be highly informative. It shows a selective difference in affected children's grammar relative to the adult grammar, not unlike what is seen in younger unaffected children. Morphemes unrelated to tense appear not to be affected, at least not beyond the delays attributable to the initially slow emergence of language, a pattern of findings that points away from a general problem of morphological acquisition. For the affected children, this part of the grammar can remain undamaged for a very protracted period. Change over time shows similar patterns across tense-marking morphemes and shows similar trajectories for affected and unaffected children, although the affected children trail behind the younger controls to a significant degree. Finally, change in this domain seems to be driven by relatively specific factors, independent of general intelligence, vocabulary development, or environmental differences linked to mother's education.

Elsewhere, Rice and Wexler propose that an extended optional infinitive stage is a strong candidate as a phenotype for an inherited language disorder, a phenotype involving a slowly maturing linguistic system (Rice & Wexler, 1996c; Rice, 1997; see Gilger, 1996; Tomin, 1996; and chapter 15 for relevant reviews of genetic bases of language impairments). The possibility of a genetic contribution to an extended optional infinitive stage is supported by a recent study (Rice et al., 1997), which shows that, for the children in the study summarized here (Rice and Wexler, 1999b), the reported occurrence of speech and language impairments in the family members of these children is higher than that in the families of the control children. For example, for the affected children, the rate of reported positive histories for fathers is 29%, compared to 9% for those in controls; for brothers, 26% versus 3% for sisters, 29% versus 4%. Thus, seemingly, an extended optional infinitive stage very likely could run in families (or at the very least, families with a child with this symptom are also very likely to have other individuals with speech-language impairments).

A final and important characteristic of this symptom is that it appears in a generally very robust grammatical system. That is to say, children who have SLI and show an extended optional infinitive stage know a great deal about the adult grammar, and much of this knowledge is apparent in the sentences they generate. Their general language acquisition mechanisms are very, very robust, probably in much the same way as are those seen in unaffected children. In this regard, the extended optional infinitive account is similar to the position of other scholars who assume that the underlying grammatical competence is intact (Bishop, 1994; Leonard, 1996). What is distinctive about the extended optional infinitive account is the conclusion that tense marking is a selective area of the grammar not fully specified for children with SLI.
The new findings with the Williams syndrome children support the possibility that tense as a clinical marker may be selective for children with SLI, the import of which is discussed later.

RELATION OF AUDITORY PROCESSING DEFICITS TO EXTENDED OPTIONAL INFINITIVE STAGE

A very different view of the language impairments of children with SLI has been put forth by Tallal et al. (1990): an auditory processing deficit account of language impairments. Because the auditory processing deficit account is a strong version of a perspective referred to earlier as extended development theory plus processing constraints and because this view is important in current scientific forums, it is worth close consideration. More importantly (for the purposes of this chapter), a critical examination of the auditory-processing deficit account in terms of the findings of the extended optional infinitive account will help to clarify the ways in which a grammatical approach to SLI can contribute to our understanding of the phenomenon.

According to the auditory-processing deficit account of Tallal et al. (1990), the surface grammatical symptoms of language impairment arise because a certain kind of
“basic temporal processing deficit may disrupt the normal sharpening of neurally represented phonetic prototypes for the native language in [language] [learning] [impaired] children. resulting in a cascade of negative effects on subsequent receptive and expressive language development (p. 82).

... the symptomology of [language] [learning] [impaired] children may reflect primarily bottom-up processing constraints rather than a defect in linguistic competence per se. (p. 83)

The auditory processing deficits, some claim, cause affected children to have difficulty in differentiating between syllables such as [ba] and [da]. Such a problem is thought to extend to the contrast between uninflected and inflected words, such as pack and packed, wherein the interpretation is that affected children cannot perceive these two as unique words (i.e., that they literally perceive pack and packed as the same; see Travis, 1996).

Although this account has much appeal, it is unconvincing as an account of language acquisition or language impairment of the form demonstrated earlier in this chapter. Other scholars have challenged this interpretation of auditory temporal perception deficits (Studdert-Kennedy & Mody, 1993) and have questioned whether an auditory processing deficit of the kind proposed by Tallal could account for children’s language impairments (Leonard, 1987). We take up the argument by assuming that the auditory-processing deficit account is true, projecting some predictions for observed morphology (keep in mind that the advocates for auditory-processing deficit account have not specified such morphological predictions) and evaluating the extent to which the predictions concur with foregoing evidence for the observed grammatical deficits of children with SLI.

What are the predictions of an auditory-processing deficit account? To simplify matters, the predictions examined here are limited to the English language, even though English provides a greatly reduced set of relevant evidence and the challenges to the auditory-processing deficit account become greater if evidence from other languages is brought to bear. If children literally do not hear the difference between pack and packed, what are the plausible consequences? If they have “bottom-up processing constraints” of this sort, how can they arrive at a “language competence?”

We propose the following predictions generated by the auditory-processing deficit account. First, children will be likely to omit surface morphology. As we can see from the evidence already presented this prediction would capture some (but not all) of the evidence. It would account for why children drop tense-marking morphemes but not for why they do not drop all morphemes with similar surface properties. In short, this prediction overpredicts morpheme dropping to include both morphemes that are not dropped (e.g., plural -s and prepositions and -ing) and those that are. A way would have to be found to constrain the application of the “bottom-up processor” such that it allows some morphological information to be processed but screens out other instances even when the surface acoustic properties are similar.

Also, children will be likely to make errors of application when they do attempt to insert morphemes. If the input is filtered or masked in a way to lead a child to confuse pack versus packed, how is a child to know that the affix can appear in some contexts but not in others? For instance, in examples 7b and 8b, we see that affixes cannot be attached to every occurrence of the lexical verb. What would block such errors from occurring? We can see from the evidence that these errors are very unlikely. Thus, this prediction also is overly broad, predicting errors that do not appear. A related possible error does not appear. Children, even those with SLI, do not seem to apply third-person -s when they mean -ed (i.e., no evidence corroborates that children confuse present and past tense affixes). How could they sort this out if they were getting faulty information about the third-person -s and -ed? If children hear walk, walks, and walked as interchangeable, how would they ever determine when the -s is required rather than the -ed? Again, the prediction is overly broad and predicts errors that do not happen.

Further, children will be likely to confuse the surface forms required for subject-verb agreement. Consider the third-person -s of walks. In children’s speech, this morpheme appears with third-person singular subjects, as in “He walks,” and only rarely (at best) is applied to subjects that are not third-person singular, such as “I walks,” a generalization that holds both for children with SLI and for unaffected children. What would block this application to subjects other than third-person singular? Consider the forms of BE. Children who have limited or filtered input processing of BE might be expected sometimes to hear the -s in sentences such as example 3a when pronounced as “Patsy’s walking” and sometimes not to hear them. So, they would be expected to drop the contracted form more frequently than an uncontracted
form, such as appears in such sentences as “She is?” That, however, is not the case. Detailed analyses reported by Cleave and Rice (1997) clearly show that BE in the contracted context is more likely to appear in the sentences than in the uncontracted context. Now, let us go further and examine how children who may not detect the appearance of a form of BE will be able clearly to separate is, are, and to pair them with the subjects with which they appear. The problem is: How could children build a paradigm for subject-verb agreement and tense marking? One would expect considerable confusion of form choice as children were trying to sort out whether’s can go with both I and he’s. If children cannot consistently hear the final sounds for ‘m and he’s, how are they to know that ‘m is restricted to I?

Additionally, children will learn morphemes one at a time, without knowing the common functions of a diverse set of surface forms. Presumably, children who sometimes hear morphemes and sometimes do not will experience difficulty in noticing that third person -s appears in the same syntactical contexts as does -ed, and that if BE appears, DO cannot. Finiteness markers follow distributional rules such that they can appear in certain places in the syntax, but only one of the small set of finiteness markers can appear at a time, and if one is present, it blocks the appearance of others. If children cannot consistently detect the presence of these forms, how will they come to know their syntactical functions? How will they come to know the small set of morphemes that shares the grammatical function of finiteness marking and the fact that it does not include, for example, in or is? Again, how will they come to know that if one appears, another is blocked? As with the other predictions, this prediction falsely expects children to make such errors as “He is does running” or “He is makes paper” or “I is makes paper” and so forth. Such errors do not appear.

Finally, children will not know the deep syntactical processes that interact with morphology to produce inflectional patterns. Children know that a set of morphemes shares the property of finiteness marking, as is evident in their use of third-person -s, -ed, BE and in the near-perfect avoidance of errors in their application. Evidence also suggests that they know the syntactical processes that interact with morphology. For example, in English, children must learn that DO is inserted when the lexical verb cannot raise (i.e., move to the left in the sentence). This happens when not appears, as in example 12a following:

(12) a. Patsy does not fly.
   b. *Patsy flies not.
   c. *Patsy does not flies.

This is a property of English unlike that of many other languages, such as French, where the lexical verb can raise. As indicated in example 12b, this option is not grammatical in English. Children must know that DO is inserted. Furthermore, they must know that when DO is inserted, finiteness marking shifts to the DO. As illustrated in example 12c, the lexical verb cannot carry the affix if auxiliary DO is inserted. If children cannot hear the difference between fly and flies or between do and does, how are they ever to sort out the relationships with DO and negation? Yet young children (and children with SLI) do in fact generate sentences that show that they know these relationships.

The conclusion to be drawn is clear: An auditory-processing deficit account predicts omissions that do not occur and errors that do not happen; presents a piecemeal approach to grammar instead of the finely tuned distributional regularities that are evident in the use of finiteness marking; and results in an impoverished sentence formulation process instead of the complex interrelated morphosyntax that is evident. Understanding how children with an auditory-processing deficit of this sort could arrive at a coherent form of the adult grammar is difficult.

IMPLICATIONS FOR COGNITIVE NEUROSCIENCE AND NEO DEVELOPMENTAL DISORDERS

The focus of this chapter has been a careful analysis of the grammatical symptomatology of a well-specified clinical group of children having a diagnosis of SLI. What is revealed is a group of grammatical characteristics shown to occur in an extended optional infinitive stage of development. At the core of the extended optional infinitive model, according to the theoretical framework, is an incomplete knowledge of the obligatory property of tense marking. In this chapter and elsewhere, we argued that these findings point clearly toward a specific grammatical limitation. Alternative accounts that put the source of limitation outside the grammar, such as the aforementioned auditory-processing deficit account, do not provide a satisfactory account of what is known and not known by children with SLI, in part because such accounts tend to overpredict errors and omissions. The grammatical limitations evident in the extended optional infinitive grammar are highly constrained in terms of linguistic function, and at the same time are generalized across different surface forms. The most parsimonious account of these patterns, we argue, is one that recognizes the grammatical properties and processes involved.

What implications do these conclusions present to cognitive neuroscience and the study of neurodevelopmental disorders? As noted earlier, a longstanding issue is the relationship between language acquisition and more general cognitive processes, such as those measured by nonverbal intelligence testing. Because the intellectual development of children with SLI meets normative expectations, we assume that general intellectual limitations do not contribute to the extended optional infinitive stage. This assumption is certainly not universally held: Johnston (1994), among others, argued that children with SLI show differences from control children in a variety of cognitive tasks. Johnston also acknowledged the limitations of this viewpoint. Paramount among them is that the nature of the underlying deficits is
unknown, as is the way in which those deficits would account for the surface symptomology of language impairment.

The previously reported natural experiment comparison of the sample of children having SLI with the sample of children with Williams syndrome brings new evidence not obtainable in experimental manipulations nor in clinical versus normative control comparisons. In this comparison, the two clinical groups yield complementary profiles regarding cognitive and morphosyntactic competencies. The Williams syndrome children are surprisingly consistent in tense marking, almost at adult grammar levels, even though their intellectual competencies are far below those of their comparison group of children with SLI. On the other hand, the children with SLI are surprisingly inconsistent in tense marking, given their intellectual competencies and their chronological age. At the very least, the performance of the two clinical groups indicates that the relationship between general intellectual development and children's morphosyntactical development is not a direct, positive association. Children can have strong morphosyntax with limited intellectual ability; an extended optional infinitive stage is evident in children who have normative levels of intellectual development. What is suggested is that an extended optional infinitive stage is not caused by an intellectual factor missing in the children with SLI but evident in the Williams syndrome children. Instead, tense marking seemingly can be either strong or weak, at either midrange or lowrange of intellectual aptitude. Note that this conclusion also is congruent with the result of the growth curve analyses reported earlier, which showed no predictive effect for nonverbal intelligence for either the children with SLI or the younger control children.

Further group comparisons of the natural experiment sort could further clarify the extent to which the grammatical symptomology of SLI (i.e., the extended optional infinitive stage) appears in other groups of children known to have a late emergence of language and subsequent language impairment. For example, it would be interesting to know whether children whose primary impairments are social-affective disorders also would manifest an extended optional infinitive stage. Such a comparison would help to clarify the relationship between fundamental social-affective development and grammatical development.

The natural experiment comparisons have proved to be a very informative scientific strategy for sorting out the role of factors inherently confounded in nature; see the comparisons of individuals with Down syndrome and individuals with Williams syndrome in chapter 4; comparisons of autistic children and children with Williams syndrome (Tager-Flusberg, 1995) and comparisons of autistic children with deaf children (Gale et al., 1995). However, to date the group of children with SLI seldom have entered into such comparisons. The implication put forward here is that such comparisons could be very productive in sorting out the extent to which grammatical limitations, such as the extended optional infinitive stage, are symptomatic of SLI alone or can be found in other clinical conditions as well. Perhaps morphosyntax can run, to an interesting degree, either ahead of or behind general intellectual developments or can run (to an equally interesting degree) either ahead of or behind other markers of general linguistic development (e.g., the mean length of utterance) as suggested by the growth curve analysis of the children with SLI and by the comparison to the children with Williams syndrome. Strategic comparisons across selected clinical populations would be crucially significant in determining the ways in which morphosyntax is represented in the mind and its associated neural and cortical pathways.

Another major implication derives from the fact that careful specification of the grammatical symptomology of SLI is essential for evaluating possible etiological factors. As described, when children drop grammatical forms, it could be because they have problems with speech and pronunciation or because they do not realize that grammatical forms must appear in the surface structure of clauses. Sorting out which level of performance is involved requires at the very least, checking to see whether the first level of speech pronunciation could be implicated. If the method of characterizing a given sample of children is not clear, then the investigator can make erroneous conclusions about causal factors.

For example, auditory-processing deficits may (or may not) account for one symptom but not the other. Neuromotor deficits, for example, may be related to speech (i.e., motor) performance but not to higher-order morphosyntactical representations. The phonological processing deficits known to be associated with dyslexia, for example, can be related to one kind of speech or language symptom but not to others (Catts, 1993; Lyon, 1995; Gilger, 1996; Lefly & Pennington, 1996; Smith et al., 1995; see chapters 12 and 13). The point to make here is that the standards of contemporary inquiry require careful specification of language symptomology. In fact, careful specification is essential for evaluation of potential clinical markers for subject identification, for evaluation of possible concomitant conditions or factors, and for investigation of etiological contributions. As we move into sophisticated studies of neural and cortical processing associated with language disorders, the establishment of a clear sense of the pertinent dimensions of language is imperative. Just as we would not confuse a motor balance problem with epilepsy, we should not confuse speech production with morphology or confuse grammatical affixes with morphosyntax.

One conclusion to be drawn from the evidence and arguments presented here is that behavioral scientists who want to understand conditions of language impairment can profit from considering the insights of contemporary linguistics. Global characterizations of language aptitude are not as illuminating as are carefully specified distinctions, and such distinctions are to be found in the current models and descriptions of the human linguistic capacity and the essential features of a given language. If we are to move to a stage of
inquiry in which we can meaningfully compare linguistic performance with genetic material and brain functioning, precision is essential in all three areas of inquiry.

To return to the case study of Jay, the child with SLI: It is fitting to note that though the symptoms of grammatical impairments can be fairly specified and unobvious to a casual observer, at the same time affected individuals face pervasive and long-standing consequences that in all probability play out over their entire lifetime. Accurate description of the phenotype is an important first step toward the ultimate goals of determination of the etiology of the condition, the way it is manifest in the cortical cognitive structures and functions, and the provision of effective intervention. Because language impairments are evident in many syndromic conditions, advances in our understanding of SLI may hold the key to a better understanding of other developmental impairments. If, as many scholars suspect, children with SLI go on to comprise much of the group of children later given diagnoses of dyslexic study of the linguistic underpinnings of SLI ultimately may yield information relevant to reading aptitude as well. Studies of these highly related disorders in a comparative manner surely will add to our understanding of neurodevelopmental disorders in general and of the ways in which cognitive abilities and impairments are manifest over the course of child development.

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NOTE

1. In this chapter, the term BE stands for all uses of the verb to be in auxiliary or main verb (copula) contexts. This would include is in “He is running” and “He is happy,” am in “I am running” and “I am happy;” and are in “They are running” and “They are happy.”

REFERENCES


