Chapter 11

Dissociation between Language and Other Cognitive Abilities

INTRODUCTION

Is language independent from other cognitive capacities? In this chapter we will examine this question by looking at two pathological conditions: specific language impairment and Williams syndrome. Specific language impairment is a condition in which language is impaired but other cognitive functions are normal. Williams syndrome is its mirror image: here, language outstrips other cognitive functions. This discussion has two goals. First, by looking at these patterns of skill dissociations, we will gather evidence that language, on the one hand, and other cognitive capacities such as reasoning, memory, action, and perception, on the other, are supported by different representations and mechanisms. If skill A is impaired, while skill B is not, it is likely that they are subserved by different mental and neural systems. Second, we will look at various characterizations of specific language impairment, with special attention to linguistically motivated accounts. Although these descriptions are based on behavioral data, they bear on the question of the biological foundations of language (see Lenneberg 1967). If the language capacity does not develop in the normal way, perhaps something is wrong with the genetic equipment that has caused abnormal neurological development of the brain circuits devoted to language processing. Investigations of language disorders shed new light on the nature of the linguistic capacity and on the process of language acquisition, by offering evidence that might be difficult to pin down in the normal course of development, given its rapid pace (see Rice 1996).

Although the discussion surrounding developmental language disorders is extremely lively and some interesting results have been obtained, linguistically motivated analyses of such disorders are a recent innovation in the psycholinguistic field. So far there are a respectable number of linguistically motivated studies of specific language impairment; similar studies are beginning to appear for Williams syndrome as well. In the future it would be desirable to use the tools of linguistic theory to study the development of language in other conditions (e.g., Down syndrome), to see how language emerges under different exceptional conditions and possibly to prepare the background for linguistically motivated rehabilitation programs.

This chapter is organized in three sections. Section 11.1 introduces the nature of specific language impairment and discusses whether its origin is genetic or environmental. Section 11.2 presents various accounts of this condition that locate the deficit either in a module of the grammar or in other cognitive systems, such as the perceptual system. Section 11.3 profiles the linguistic behavior of individuals with Williams syndrome and their performance in other cognitive domains.

11.1 IMPAIRED LANGUAGE IN OTHERWISE NORMAL CHILDREN: SPECIFIC LANGUAGE IMPAIRMENT

The term **specific language impairment** (SLI) is currently used to refer to a condition in which linguistic disorders are evident despite normal nonlinguistic development and in the absence of any obvious cause.[1] Hence, SLI is an example of **dissociation** between linguistic abilities and other cognitive capacities, the former lagging well behind the latter. SLI is diagnosed if a child scores two standard deviations below age level on a series of language tests (see appendix A for discussion of this point), yet exhibits no perceptual-motor deficits, like hearing loss, neurological dysfunction, or intellectual and socio-emotional deficits (see Bishop 1997 for discussion of these criteria; see Rice 1993 and references cited there for discussion of the social consequences of SLI). See appendix B for a discussion of tests used to assess SLI.

It is evident that these criteria are very loose, for they exclude only populations with mental retardation and populations with sensory deficits. Children with very different language problems may fall into the category of SLI. Although there are resemblances among children with SLI, there are also differences. Common features are the following:

(1) a. Language emerges later.
b. Language may show unexpected patterns and remains below age expectations.

c. The affected individual may exhibit problems with inflectional morphology.

Differences concern the extent of the deficit.

(2) a. Not every aspect of inflectional morphology is equally problematic.
b. Beyond inflectional morphology, other areas of grammatical knowledge may be affected.
c. The acquisition of words, especially of verbs, is sometimes vulnerable (see Rice et al. 1994; Oetting, Rice, and Swank 1995).
d. (Mild) phonological deficits can be observed.
e. The disorders may be receptive and/or expressive.
f. The disorders may last well into the elementary school years and even persist into adulthood.

This heterogeneity may have various sources. First, the methods for probing children's grammatical knowledge vary; second, the age of the children tested varies from study to study. Given our current state of knowledge, the possibility cannot be excluded that older children have more developed linguistic knowledge, be it because some mechanism has matured or for other reasons. Therefore, *SLI* will be used here as a cover term for possibly a whole range of language disorders (see Bishop 1997 for reviews). Part of the discussion will consist of an attempt to characterize the deficit of some populations with SLI by using linguistically motivated criteria. It is to be hoped that the advent of such linguistic analyses of SLI will help in better characterizing this pathology.

The etiology of SLI is not known. However, several studies have observed that SLI runs in families: the same linguistic disorder may be observed in different branches of the same family (see Tallal, Ross, and Curtiss 1989; Tomblin 1989), and it is more likely to find individuals with language-related speech disorders (e.g., reading, spelling) in the family of a child with SLI than in the family of a child without SLI. Rice, Haney, and Wexler (1998) report that the incidence of language disorders is about 22% among members of the family (mother, father, brothers, and sisters) of a child with SLI, and only 7% among members of the family of a child without SLI. This **familial aggregation** suggests that SLI has a **genetic basis**, rather than an environmental one, although there is no evidence for a link between a specific gene and linguistic disorders (see Rice 1996 for discussion). This hypothesis is also supported by Hurst et al.'s (1990) linkage study.[2] Additional evidence in the same direction comes from studies of mono- and dizygotic twins with SLI (see Lewis and Thompson 1992; Tomblin and Buckwalter 1994; Bishop, North, and Donlan 1995). Twins share a common environment, but while monozygotic twins also share the same genes (since they originate from the division of a single egg), dizygotic twins do not (and are therefore no more similar than other siblings). Therefore, if genetic endowment is somehow responsible for SLI, the chances that a language-impaired child's twin will also be language-impaired should be higher for monozygotic than for dizygotic twins. On the contrary, if SLI is caused by environmental factors, there should be no difference between mono- and dizygotic twins with respect to incidence of SLI. The evidence to date indicates that the risk for SLI is higher for monozygotic than for dizygotic twins, supporting the hypothesis that genes are implicated in the emergence of SLI. Again, this conclusion in no way implies that a specific gene is the cause of SLI. Genes may cause an abnormal neurological development, and this may be manifested in abnormal language behavior (see Plante 1991 for evidence of neurological anomalies in populations with language impairment). But exactly how these processes occur is a complex topic.

SLI is a natural experiment that offers a special opportunity to explore the contribution of nature and nurture in the acquisition of language.

11.2 APPROACHES TO SPECIFIC LANGUAGE IMPAIRMENT

Systematic comparisons of the linguistic behavior of children with and without SLI have been carried out to reveal patterns of weakness and strength in the linguistic production of children with SLI. Different groups of children display different abnormal language behaviors, and this finding has motivated various hypotheses about the nature of SLI. Linguistically oriented scholars argue that SLI is a modular deficit, that is, a deficit that affects only linguistic abilities (see Fodor 1983 regarding modularity). Some claim that the deficit alters local aspects of the grammar; for example, children with SLI produce sentences in which the feature tense (or finiteness) is absent and consequently the morphemes expressing this feature are not realized (see section 11.2.1.1). Others claim that children with SLI are weak at computing the subject-agreement relation (see section 11.2.1.2), or that SLI is a deficit affecting the ability to compute structure-dependent relations (see section 11.2.1.3), or that children with SLI do not build the same sort of grammar as children without SLI because their grammar lacks the features [±past] and

[±plural] (see section 11.2.1.4). A radically different view attributes the deficit to a weakness of the perceptual system that makes it difficult for children with SLI to perceive phonologically nonsalient morphemes (see section 11.2.2). To summarize:

(3) SLI is a deficit affecting grammatical abilities.
  a. Children with SLI fail to obligatorily express tense.
  b. Children with SLI fail to express agreement.
  c. Children with SLI cannot represent structure-dependent relations.
  d. Children with SLI lack the inflectional features [±past], [±plural].

(4) SLI is a deficit in the auditory processing system.

11.2.1 Modular Accounts of Specific Language Impairment

11.2.1.1 Specific Language Impairment as an Extended Period of Optional Infinitives A prominent characteristic of the speech of children with SLI is the optional omission of inflectional morphology. Interestingly, careful investigations have shown that for some populations the deficit does not encompass every aspect of the inflectional system. Rice, Wexler, and collaborators (see, e.g., Rice, Wexler, and Cleave 1995; Rice and Wexler 1996) claim that SLI is a linguistic disorder that consists in using optional infinitives (OIs) or root infinitives (RIs) for a protracted period. Recall from section 4.4 that normally developing children between 2 and 3 years of age use infinitives or bare verbs in their main clauses, as shown in (5).

(5) a. Dormir petit bébé. (Daniel, 1;11)
   sleep-INF little baby
  b. Zähne putzen. (Simone, 1;10)
   teeth brush-INF
  c. Papa have it. (Eve, 1;6)
  d. Cromer wear glasses. (Eve, 2;0)

While normally developing children cease to use OIs at about age 3, children with SLI still produce OIs at 5 or 6 years or even later; that is, children with SLI have a grammar that allows OIs for an extended period, according to Rice and Wexler. In other respects, the grammar of these children is like that of normally developing children; it includes the same grammatical processes (e.g., head movement) and the same grammatical categories (e.g., I). Thus, like normally developing children, children with SLI employ finite verbs in their main clauses and distinguish between finite and nonfinite verbs in terms of verb raising, the process that raises finite verbs from VP to IP (see section 4.2.4).

In section 4.4 we discussed two accounts of OI/RI. Rice, Wexler, and collaborators endorse Wexler's (1994) analysis of OIs, according to which OIs arise because the tense feature either is underspecified or is omitted from the clausal representation; that is, they adopt the tense omission model to explain OIs in the speech of children with SLI (section 4.4.2.1).[3] Unlike adults, children (with and without SLI) optionally leave the tense feature underspecified in main clauses; therefore, they do not use the morphemes that express this feature, they omit auxiliaries, and they produce main clauses including nonfinite verbs or OIs. For example, in French, German, and other languages an OI is an infinitive verb, as in (5a,b). The early English variant of OIs is the bare form. Thus, English learners omit morphemes expressing tense, the third person singular present ending *-s*, the past tense marker *-ed*, and the auxiliaries *be* and *do* and produce bare forms like (5c,d). The claim that SLI consists of an extended period of OIs amounts to making the following predictions:

(6) a. Only the tense feature is optionally missing and thus only tense morphemes are optionally omitted.
b. Other inflectional morphemes (e.g., the plural marker on nouns) and prepositions are not omitted.
c. When children do choose the tense feature, they respect all its morphosyntactic properties.

In their study of the spontaneous and elicited production of a group of English and German children with SLI, Rice, Wexler, and collaborators show that the predictions in (6) are borne out.

English-speaking children with SLI between 4;4 and 5;8 years of age display limited proficiency in the use of morphemes marking tense: third person singular present *-s*, past tense *-ed*, and the auxiliaries BE and DO, where *BE* and *DO* are labels for various forms of these verbs (see Rice, Wexler, and Cleave 1995; Rice and Wexler 1996). Figure 11.1 illustrates rate of correct use of these morphemes in obligatory contexts for children with SLI and for two control groups, age-matched (AM) and language-matched (LM).[4]

It is evident from this figure that children with SLI are much less proficient than AM peers on all morphemes tested. They are also weaker

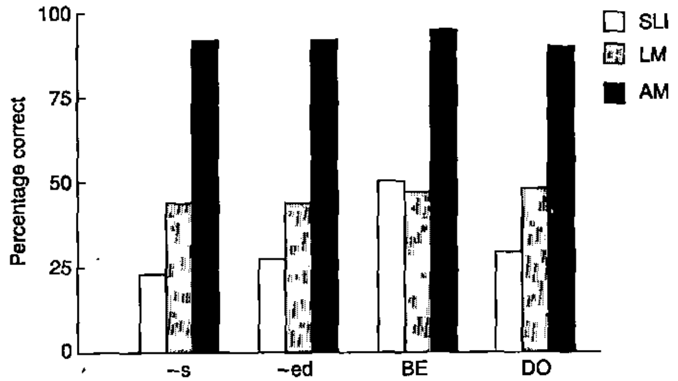

Figure 11.1
Percentage of correct use of the following morphemes in obligatory contexts (linguistic probes): third person singular present *-s*, past tense *-ed*, auxiliary BE, and DO. Data from 37 American English–speaking children with specific language impairment (SLI) (age range 4;4–5;8), from 45 language-matched (LM) controls, and from 40 age-matched (AM) controls. Based on data from Rice and Wexler 1996, table 2.

than LM children on all morphemes tested, except BE. As predicted in (6a), almost all errors illustrated in figure 11.1 are errors of omission. Children with SLI fail to use tense morphemes and say *I good child*, *He speak*, or *He not come* rather than *I am a good child*, *He speaks*, or *He does not come*. However, like normally developing children, when they use tense morphemes or auxiliaries, they use them correctly, as anticipated in (6c) (see Rice and Wexler 1996; Hadley and Rice 1996). For example, they use the third person marker with third person subjects, and they inflect auxiliaries. Similarly, German-speaking children with SLI, ranging in age between 4;0 and 4;8, use OIs for a protracted period (see Rice, Noll, and Grimm 1997), but demonstrate a great deal of linguistic knowledge; for example, they know the morphosyntactic correlates of the tense feature. Like normally developing children in the OI stage, German-speaking children with SLI distinguish between finite and nonfinite verbs in terms of verb movement, as proved by their adherence to the form-position correlation revealed in contingency table 11.1 (see also section 4.2.3.2). (Table 11.2 reports data from the LM control group.) Recall that finite verbs in German must move to second position in the clause (i.e., the head of CP), while infinitives remain in clause-final position. As table 11.1 shows, German-speaking children with SLI almost always raise finite

Table 11.1
Finiteness versus verb placement in the speech of 8 German-speaking children with specific language impairment (age range 4;0–4;8)

	+Finite	−Finite
V2	239	2
V-final	9	72

Source: Data from Rice, Noll, and Grimm 1997
$\chi^2 = 265.59$, $p < .005$

Table 11.2
Finiteness versus verb placement in the speech of 8 language-matched German-speaking children without specific language impairment (age range 2;1–2;7)

	+Finite	−Finite
V2	604	11
V-final	22	37

Source: Data from Rice, Noll, and Grimm 1997
$\chi^2 = 302.09$, $p < .005$

verbs to C (V2) and leave the nonfinite verb in final position (V-final). Comparison of tables 11.1 and 11.2 shows that these children in fact perform as well as the LM control group.

The weakness of children with SLI in marking tense contrasts with their strength in other areas of inflectional morphology, as predicted in (6b). English-speaking children with SLI are as accurate as AM peers and LM children in their use of the affix *-ing* (as in *eating*), the prepositions *in/on*, and the plural marker *-s*, which is homophonous with the third person singular present marker (see figure 11.2). Their level of accuracy on this set of morphemes, around 90% or above, is far superior to their level of accuracy on the morphemes marking tense (cf. figure 11.1; see also Oetting and Rice 1993). It is evident from figure 11.2 that children with SLI display the same level of accuracy as LM and AM children. For plural morphology there is also evidence that children with SLI control the rule for pluralization, as they regularize irregular plurals; for example, they say *foots*, *mans* rather than *feet*, *men*. Such productions cannot be the result of rote learning, for these forms do not exist in the target language, but arise through overapplication of the internalized rule for forming plurals (see Oetting and Rice 1993).[5]

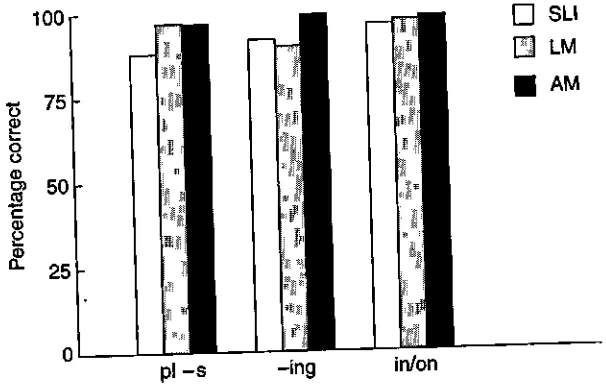

Figure 11.2
Percentage of correct use of the following morphemes in obligatory contexts (linguistic probes): plural *-s*, participle *-ing*, preposition *in/on*. Data from 37 American English–speaking children with specific language impairment (SLI) (age range 4;4–5;8), from 45 language-matched (LM) controls, and from 40 age-matched (AM) controls. Based on data from Rice and Wexler 1996, table 3.

In sum, SLI can be characterized as an extended period of use of OIs, that is, a delay in the acquisition of a specific property: the requirement that tense be obligatorily marked in main clauses. Therefore, children with SLI are poor at using tense morphemes; but whenever they do employ these morphemes, they respect the syntactic processes associated with them (e.g., verb raising, as shown by German-speaking children with SLI; see table 11.1). Furthermore, children with SLI display full control of inflectional morphemes not related to tense, and an intact mechanism for forming rules, witness their command of the rule for forming plural.

Data conflicting with those discussed so far are reported by Leonard et al. (1992). These authors found that English-speaking children with SLI perform less accurately than LM controls on tests involving the plural marker. Thus, the performance of these children is at odds with the predictions in (6b). The conflict may arise because the population studied by Leonard et al. and the one studied by Rice and Wexler (1996) have different deficits. However, an alternative explanation is also possible. Leonard et al. report that the mean for the correct use of the plural marker is 68.6% and the standard deviation (SD) is 34%. These measures (of the central tendency and the dispersion, respectively) do not give much information about the real distribution of the sample. Since the values given by Leonard et al. are percentages, their distribution is likely to be skewed; and given the high value of the SD, a bimodal distribution can be conjectured. In other words, it is possible that there are two groups of children: ones who perform very accurately, like the children studied by Rice and Wexler (1996), and ones who perform very inaccurately.[6]

In section 5.2.2 we saw that when normally developing children produce OIs, they also omit subjects. It would be interesting to know whether this co-occurrence holds for children with SLI as well. If they have the same grammatical competence as normally developing children in the OI stage, we would expect them also to omit subjects, and subject omission and use of OIs should display a similar developmental trend. If children with SLI do not omit subjects (or do not do so in the same manner as normally developing children), we may suspect that the grammatical production of children with SLI is only superficially like that of normally developing 2- to 3-year-olds. These are hypotheses that future research will have to take up.

11.2.1.2 Specific Language Impairment as a Deficit in Establishing Agreement Relations Clahsen and collaborators claim that SLI is a deficit of the ability to mark agreement in an otherwise intact grammar (see Clahsen 1986, 1991; Rothweiler and Clahsen 1993; Clahsen, Bartke, and Göllner 1997). Agreement markers encode a relation between I, the head carrying the inflectional feature associated with the verb, and a subject in the specifier of I. Thus, a deficit in marking agreement is a deficit in computing the subject **agreement relation** (see section 4.3). This hypothesis predicts that

(7) a. children with SLI have trouble with agreement morphemes, and
b. children with SLI do not have trouble with other inflectional morphemes.

Indeed, the German-speaking children with SLI studied by Rothweiler and Clahsen (1993) (age range 5;8–7;11) have good control of plural and past participle morphology. They are proficient in using tense morphemes, but not agreement morphemes. Clahsen, Bartke, and Göllner (1997) report (see their table 4) that tense is accurately expressed 99% of the time on lexical verbs and 100% of the time on the verb SEIN (= BE). By contrast, agreement is correctly expressed only 67% of the time on lexical verbs and 93% of the time on the verb SEIN. While the difference between use of tense morphemes and use of agreement morphemes is statistically significant in the case of lexical verbs, it is not in the case of the verb SEIN, however. This discrepancy is surprising and raises the question of why the deficit in computing agreement is not evident with all kinds of verbs. One factor that may be responsible is that SEIN is an irregular verb whose paradigm may be learned by rote.

The error rate in the use of agreement morphemes on lexical verbs may be somewhat inflated, since some of the agreement morphemes are ambiguous. Specifically, *-n* marks the first and third persons plural and the infinitive; the 0 morpheme marks the first person singular and the verbal root. If one discards verbs inflected with these two morphemes, the overall error rate in the use of agreement morphemes decreases, but it is still 26%. While agreement errors are not abundant, the rate of such errors does vary from one morpheme to another: second person singular *-st* is used correctly 87% of the time; third person singular and second person plural *-t* (which are homophonous) together are used correctly 85% of the time; and first person singular *-e* is used correctly just 38% of the time. Thus, certain finite verbs are used incorrectly—and this is at odds with Rice and Wexler's (1996) expectation that when children with SLI use finite verbs, they use them correctly.

In the same study Clahsen, Bartke, and Göllner (1997) show that English-speaking children with SLI use the past tense marker much more accurately than the third person agreement marker (which marks agreement as well as present tense). Recall that on lexical verbs agreement is expressed only in third person contexts in English. The children used tense markers correctly 77% of the time and agreement markers 44% of the time. Similarly, out of 20 third person auxiliaries, only 7 (35%) were correctly inflected for agreement, but out of 154 auxiliaries, 137 (89%) were correctly inflected for past tense, a difference that is statistically significant ($\chi^2 = 36.12$, $p < .005$). Further evidence of a deficit with agreement markers is provided by Tsimpli and Stavrakaki (1999). These researchers studied the production of a 5;5-year-old Greek-speaking child with SLI. (Greek is a language with a rich agreement system and a six-way distinction in person.) This child used agreement markers incorrectly 33% of the time. This error rate is principally due to the second person singular and second person plural agreement markers, which displayed error rates of 78% and 97%, respectively. The other agreement morphemes were used correctly about 90% of the time.

Contrasting findings come from another language with a rich morphological agreement system, Italian. Cipriani, Bottari, and Chilosi (1998) recorded the production of an Italian-speaking child with SLI from age 6;2 to age 13;5. By age 6;2 this child used the first, second, and third person singular and third person plural agreement morphemes correctly. During the whole period of investigation the rate of agreement errors was about 3%. It is not known whether younger Italian-speaking children with SLI are less proficient in the use of verbal agreement. In any event, it is clear that the child studied by Cipriani, Bottari, and Chilosi, who is diagnosed as having SLI, does not have problems with computing the subject agreement relation.

11.2.1.3 Specific Language Impairment as a Representational Deficit for Structure-Dependent Relations Van der Lely and collaborators have carried out extensive investigations of the grammatical knowledge of a group of English learners with SLI (van der Lely and Stollwerck 1997; van der Lely 1997). Unlike the previously mentioned researchers, van der Lely has turned her attention to various aspects of language comprehension by children with SLI. She claims that SLI consists in a deficit with **structure-dependent relations** (van der Lely and Stollwerck 1997, 248). One example is the subject agreement relationship discussed in the previous section. Another is the relation involved in binding (see chapter 8). Recall that the binding principles govern the syntactic relations between reflexives and pronouns and their antecedents. Reflexives must be bound in some local domain, while pronouns must be free in the same local domain (but see chapter 8, note 3).

Van der Lely and Stollwerck show that children with SLI demonstrate a limited ability in applying Principles A and B of the binding theory and attribute this to difficulties in computing the local domain and in finding the proper c-commanding antecedent of a (reflexive) pronoun (see also Franks and Connell 1996).

Children with SLI (age range 9;3–12;10) were tested in comprehension experiments in which they were required to judge whether a sentence that they heard matched (match condition) or did not match (mismatch condition) a displayed picture. These children scored close to 100% when sentences contained a reflexive; that is, they judged the sentence in (8) as an accurate description of a picture in which Mowgli was tickling himself (match condition), but not of a picture in which Mowgli was tickling Baloo Bear (mismatch condition).

(8) Mowgli is tickling himself.

Table 11.3
Summary of experimental conditions used in the test for pronominal reference (reflexive pronouns)

Test sentence	Condition	Picture	Children's response
Mowgli is tickling himself.	Match	Mowgli tickles himself	Correct (yes)
	Mismatch	Mowgli tickles Baloo Bear	Correct (no)
Baloo Bear says Mowgli is tickling himself.	Match	Mowgli tickles himself	Correct (yes)
	Mismatch	Mowgli tickles Baloo Bear	Correct (no)
	Mismatch	Baloo Bear tickles himself	Chance

Source: Data from van der Lely and Stollwerck 1997

However, responses were less accurate when the children were tested with complex sentences, such as (9).

(9) Baloo Bear says Mowgli is tickling himself.

In the match condition they correctly judged the sentence in (9) as an accurate description of a picture in which Mowgli was tickling himself. In the mismatch condition they performed less accurately, but significantly above chance; they rejected (9) as a description of a picture portraying Mowgli tickling Baloo Bear. Interestingly, in another mismatch condition, in which (9) was paired with a picture displaying Baloo Bear tickling himself, children with SLI performed at chance level; that is, they did not obey Principle A. The results for the two sentences in (8) and (9) are summarized in table 11.3.

What is the source of the response to (9) in the second mismatch condition? Van der Lely and Stollwerck argue that children with SLI cannot compute the binding domain and answer by relying not on binding knowledge, but on knowledge of the lexical properties of reflexives. For example, one can conjecture that children with SLI could take the lexical cue expressed by *-self* as an indication that a self-oriented action is to be expected, a strategy discussed in section 8.2.1 (see Grimshaw and Rosen 1990). Then, they could choose the antecedent by looking at the grammatical gender of the pronoun attached to *-self*. This strategy suffices to succeed in pairing a simple sentence like (8) with a picture of Mowgli tickling himself and in rejecting the same sentence as a description of a picture of Mowgli tickling Baloo Bear. It also suffices to succeed in pairing (9) with a picture of Mowgli tickling himself and in rejecting it as a description of a picture of Mowgli tickling Baloo Bear. However, it cannot help children with SLI when lexical cues are not unequivocally interpretable, as when (9) is used in a situation in which Baloo Bear is tickling himself. In this case these children perform at chance level. From the presence of *himself,* they infer that a reflexive action involving a male individual is to be found. However, there are two potential antecedents, *Baloo Bear* and *Mowgli*, and this is likely to confound them.

Reliance on lexical properties might also help children with SLI to interpret sentences including pronouns. These children accept sentence (10) when paired with the picture (match condition) displaying Mowgli tickling Baloo Bear.

(10) Mowgli is tickling him.

However, they perform at chance level (64% rejections) when the same sentence is paired with a picture depicting Mowgli tickling himself (mismatch condition). In so doing, these children take the pronoun to be anaphorically linked to the local antecedent. Table 11.4 summarizes these results.

With complex sentences we observe a similar pattern of responses. Children with SLI correctly accept sentence (11) when it is paired with a picture displaying Mowgli tickling Baloo Bear, but they perform at chance level when the same sentence is paired with a picture displaying Mowgli tickling himself. Table 11.5 summarizes these results.

(11) Baloo Bear says that Mowgli is tickling him.

Table 11.4
Summary of experimental conditions used in the test for pronominal reference (nonreflexive pronouns)

Test sentence	Condition	Picture	Children's response
Mowgli is tickling him.	Match	Mowgli tickles Baloo Bear	Correct (yes)
	Mismatch	Mowgli tickles himself	Chance

Source: Data from van der Lely and Stollwerck 1997

Interestingly, the performance of children with SLI improves when they can use gender or other cues to work out the interpretation of the pronoun. While these children rejected (10) at chance level (64% rejection) when presented with a picture portraying Mowgli tickling himself, they rejected (12) 94% of the time when they were shown the same picture.

(12) Mowgli is tickling her.

This response indicates that children with SLI take *Mowgli*, the name of a boy, as an unsuitable antecedent for the feminine pronoun *her*.

Although it is likely that children with SLI exploit lexical and morphological cues to interpret sentences including reflexive and nonreflexive pronouns, the available data do not warrant the conclusion that such children have no knowledge of binding, as van der Lely and Stollwerck (1997) claim. In all the match conditions children with SLI obtain very high scores; for example, they perform fairly well when the sentences including pronouns, (10) and (11), are presented in the context of a picture depicting Mowgli tickling Baloo Bear. It is not clear what kind of lexical and morphological knowledge guarantees this high performance. It seems that it is knowledge that a pronoun must be free in the local domain that helps children in discarding a local antecedent of the pronoun. One might object that children respond accurately in the match conditions because they take nonreflexive pronouns as an indication that a nonreflexive action is to be expected; their expectations are thus fulfilled when the sentences in (10) and (11) are paired with pictures displaying Mowgli tickling Baloo Bear. If this objection were sound, children with SLI should perform accurately in the mismatch condition, as well. They should reject (10) and (11) as descriptions of a picture displaying Mowgli tickling himself, because a reflexive action is displayed. Similarly, the data

Table 11.5
Summary of experimental conditions used in the test for pronominal reference (nonreflexive pronouns)

Test sentence	Condition	Picture	Children's response
Baloo Bear says that Mowgli is tickling him.	Match	Mowgli tickles Baloo Bear	Correct (yes)
	Mismatch	Mowgli tickles himself	Chance

Source: Data from van der Lely and Stollwerck 1997 gathered in van der Lely and Stollwerck's experiment do not warrant the conclusion that children cannot compute the c-command relation, a structure-dependent relation. One piece of data that would inform us about this is represented by sentences like (13).

(13) Mowgli's brother is tickling himself.

Here the c-commanding antecedent of the reflexive pronoun is *Mowgli's brother*, not *Mowgli* (which is too deeply embedded). If children with SLI accepted (13) as a description of a situation in which Mowgli is tickling himself, then we would be entitled to say that they cannot compute the c-command relation.

Note that 9- to 12-year-old children with SLI manifest a behavior that resembles that of 4- to 5-year-old normally developing children in dealing with nonreflexive pronouns (section 8.3.1). Recall that normally developing children accept an anaphoric reading of the pronoun in (10) and (11), taking *him* to be anaphorically linked to the NP *Mowgli*. But these same children do not accept an anaphoric reading when the possible local antecedent of the pronoun is a quantifier, as in (14).

(14) Every bear washes him.

This asymmetry between referential and quantified NPs was crucial for distinguishing between knowledge of binding and knowledge of coreference and for establishing that children's errors are errors of coreference. While a quantifier and a pronoun can enter an anaphoric relation only via binding, a referential expression and a pronoun can enter an anaphoric relation either via binding or via coreference. Normally developing children reject an anaphoric interpretation of the pronoun in (14), because they tacitly know Principle B. Although Principle B rules out a binding relation in (10), children may still interpret the unbound pronoun *him* as coreferential with *Mowgli.*

If children with SLI have knowledge of the binding principles, they should behave like normally developing children when asked to judge sentences like (14). Van der Lely and Stollwerck included this kind of sentence in their battery of tests, but the results they obtained are difficult to interpret. Children with SLI did not perform very well. Although this might suggest that they do not have knowledge of binding, results on control structures show that children with SLI have difficulty in interpreting quantifiers. Thus, their responses to quantified sentences including pronouns cannot reliably give evidence about their knowledge of binding.

In sum, on the one hand, children with SLI seem to rely heavily on lexical and morphological knowledge to work out the interpretation of pronouns and reflexives. On the other hand, it is not clear that their errors can be attributed to a lack of binding knowledge—specifically, to an inability to compute the local c-command domain.

Van der Lely and Stollwerck (1997) argue that children with SLI have difficulties with structure-dependent representations. Although some findings appear to show that this is correct (recall, e.g., that children with SLI find it hard to perform agreement), this claim might be too strong. Most linguistic knowledge is couched in structure-dependent terms. A deficit in building structure-dependent representations might have much more widespread consequences than those generally observed in studies on SLI. For example, it would prevent individuals with SLI from moving verbs in a hierarchical representation. As a consequence, we would expect finite and nonfinite verbs to have the same distribution in the speech of children with SLI, contrary to the findings discussed in section 11.2.1.1.

11.2.1.4 Specific Language Impairment as a Grammar Lacking Grammatical Inflectional Features According to yet another account, SLI is a disorder that affects the ability to construct a normal grammar. Gopnik and collaborators (see Gopnik 1990a,b; Gopnik and Crago 1991; Gopnik and Goad 1997) have studied the linguistic behavior of individuals with SLI in the use of inflectional morphology in several languages: Canadian and British English, Greek, Japanese, and Quebec French. They presented various tasks, administered in oral and written form, testing both comprehension and production (spontaneous and elicited). The results show that individuals with SLI display the same difficulties in handling inflectional morphology across all tasks and across all languages investigated. Previously Gopnik and collaborators claimed that the linguistic representations of children with SLI do not include the inflectional features [$\pm$past], [$\pm$plural]. More recently they have slightly modified this hypothesis and now maintain that children with SLI cannot construct implicit rules governing morphological and phonological processes in grammar (Gopnik et al. 1997). Normally developing children can abstract rules from the language input to build inflectional paradigms and establish agreement relations among elements of a phrase. By contrast, children with SLI do not see the internal structure of inflected words and are not able to build implicit rules for handling inflectional morphology. For them *walks*, *walked*, *houses* are not derived by a rule that assembles stems and inflectional morphemes, but are rote learned as independent lexical items and stored in the lexicon as unanalyzed chunks.

If children with SLI do not have rules for inflecting verbs or nouns, how is it that they sometimes are able to produce correct inflected forms? According to Gopnik, although they do not have rules for inflecting words, they have access to compensatory mechanisms that simulate aspects of the normal language function. They can learn and memorize forms, as they learn and memorize any word, that is, as an unanalyzed chunk; they can learn explicit rules during rehabilitation (e.g., that a plural form is obtained by adding *-s* to a noun) or rely on analogy. This hypothesis predicts that the speech of individuals with SLI should exhibit

(15) a. frequency effects for regular and irregular words,
b. difficulties with the inflection of novel words,
c. incorrect segmental and prosodic features of inflected words.

According to the **word-and-rule theory** (see Pinker and Prince 1988; Pinker 1994b; Clahsen et al. 1992 for discussion of a model for learning inflectional morphology; section 1.5.3), there are two processes for producing inflected words depending on whether they are regular or irregular. Regular inflections are based on a productive mental operation that takes members of syntactic categories as input (e.g., verbs) and generates inflected words; for example, regular past tense inflection in English is obtained by an operation of affixation, which adds *-ed* to a verb stem. Regular inflection is extended to novel items. By contrast, inflected forms of irregular verbs cannot be easily predicted from their corresponding base form; they must be learned by rote and stored in long-term memory as unanalyzed wholes together with other lexical items.

In individuals without SLI the retrieval of irregular words is subject to frequency effects, more frequent forms being retrieved more rapidly than less frequent ones. Since individuals with SLI treat all inflected words in the same way (i.e., as irregular words), their speech should exhibit frequency effects not only for irregular forms but also for regular ones (15a). And indeed this is what has been found (see Gopnik et al. 1997). The more frequent a past tense form was, the greater the likelihood that individuals with SLI would use it, whether it was a regular or an irregular form. The fact that regular forms also exhibit frequency effects in the speech of individuals with SLI supports the idea that they are processing

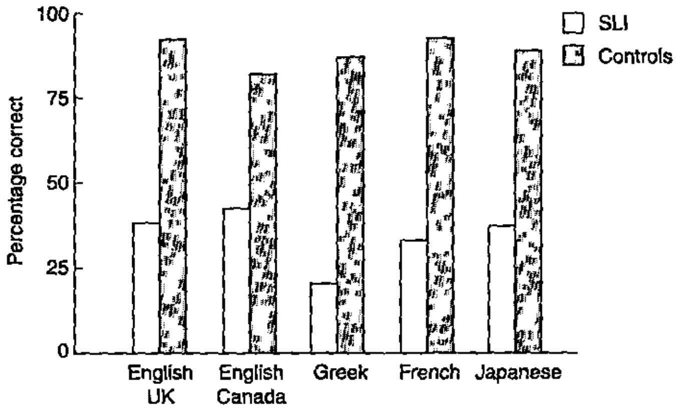

Figure 11.3
Percentage of correct past tense morphemes on novel words in the speech of individuals with specific language impairment (SLI), across languages. Based on data from Gopnik and Goad 1997.

them as irregular forms. For example, *walked* may be stored as an unanalyzed word lacking the grammatical specification of [+past], but including in its meaning the notion of "pastness."

If individuals with SLI do not have access to the morphological rules that introduce inflectional features, then they should be unable to inflect words they have not heard before, as anticipated in (15b). Indeed, Gopnik and Goad (1997) found that individuals with SLI are worse than individuals without SLI at inflecting novel words for past tense or for plural, an indication that their linguistic behavior is not rule-governed. Figures 11.3 and 11.4 show the percentage of correct past tense and plural forms, respectively, in individuals with and without SLI across different languages.

As noted earlier, individuals with SLI produce correctly inflected words (between 30% and 50%), but these are derived by means of compensatory strategies, according to Gopnik (see, e.g., Gopnik and Goad 1997). A closer inspection of the plural forms produced by these individuals reveals that only a small number have the segmental and prosodic shape of plurals of actual English words. In most cases the sound of the plural marker (or of other inflectional markers, when these are being tested) is not correct, as predicted in (15c). When asked to form the plural of [wʌg], individuals with SLI say [wʌgs] rather than [wʌgz], omitting the required voicing assimilation between the stem-final voiced consonant /g/ and the plural marker /s/. In other cases these individuals search their mental lexicon

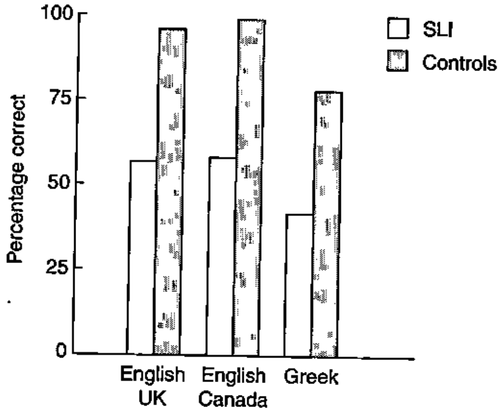

Figure 11.4
Percentage of correct plural morphemes on novel words in the speech of individuals with specific language impairment (SLI), across languages. Based on data from Gopnik and Goad 1997.

for words phonetically close to the target word and ending in a sibilant (/s/-like) sound, regardless of whether this sound encodes plurality. For example, they provide [brɑnz] (*bronze*) as the plural of the novel word [brɑm]. This happens because these individuals have learned, as an explicit rule, that plural is marked by a word-final *s*. Normally developing children unconsciously know that the plural morpheme has three allophonic variations: a voiceless sibilant, [s]; a voiced sibilant, [z]; and an epenthetic vowel plus [z], [ɨz]. These are added to nouns depending on phonological characteristics of their final sound: for example, *cat*[*s*], *dog*[*z*], and *glass*[*ɨz*]. When normally developing children have to pluralize a noun, they choose the correct allophone. By contrast, children with SLI do not, because they have not internalized the rule for forming the plural. Instead, they use a memorized rule or similarity between the target form and a form present in their mental lexicon. Therefore, often the seemingly correct inflected words that they produce are not correct at all.

The frequency effect in the production of regular inflected words, the failure to inflect novel words correctly, and the production of inflected forms that are segmentally and prosodically incorrect indicate that children with SLI do not approach the language-learning task like children without SLI; in particular, they cannot abstract rules for constructing morphological paradigms, instead compensating through other devices. Gopnik and collaborators' results also support the distinction between a rule-based system for learning regular inflection and a lexically based system for learning irregular inflection, as the word-and-rule theory proposes.

The characterization of SLI offered by Gopnik and collaborators may not be valid for all subjects diagnosed as having SLI, a fact that may depend on the previously noted heterogeneity of the SLI population. Clahsen et al. (1992) and Rice and Oetting (1993) have found that some populations with SLI process regular and irregular items in distinct ways.

11.2.2 Specific Language Impairment as a Processing Deficit: The Surface Hypothesis

If children with SLI have problems with functional morphemes, it might be that these morphemes have a special property that makes them especially hard to produce or comprehend. According to the **surface hypothesis** (Leonard et al. 1992), functional morphemes (in English the past tense, third person singular present, and plural markers, etc.) are particularly vulnerable because they are phonologically nonsalient owing to certain acoustic properties. Children with SLI have difficulty processing morphemes that are shorter in duration than adjacent morphemes (see, e.g., Leonard 1998; see also, e.g., Tallal 1976). They have trouble with morphemes that

(16) a. lack stress (e.g., the article *the*, the final inflectional ending in *kisses*),
b. are nonsyllabic (final *-s* as in *speaks*),
c. are subject to deletion in production,
d. do not occur in final position (a position where elements may be subject to lengthening effects).

Why is short duration or lack of salience problematic for children with SLI? According to Leonard (1998), it is not the duration per se of functional morphemes that is at the heart of children's difficulties, but the fact that the perception of nonsalient morphemes exhausts the processing resources available to these children. In so doing, it prevents them from identifying the grammatical function of these morphemes and from placing them in a morphological paradigm. In short, children with SLI have difficulties in handling inflections because they cannot process the inflections' function.

As support for this proposal Leonard et al. (1987), Rom and Leonard (1990), and Leonard et al. (1992) gathered evidence from English-, Italian-, and Hebrew-speaking children with SLI. English learners with SLI omit a range of grammatical morphemes (e.g., the plural marker, the past tense marker, the copula, and articles), because these are nonsalient. By contrast, Italian and Hebrew learners with SLI use grammatical morphemes—the inflections on verbs and nouns—as accurately as their counterparts without SLI, because these are salient (they are final and syllabic). Because of their salience, Italian grammatical morphemes are not difficult to perceive, and thus the processing resources of children with SLI suffice to incorporate these morphemes into a morphological paradigm. Like their English-speaking counterparts, Italian-speaking children with SLI omit articles. According to Leonard and collaborators, this happens because Italian articles are considered nonsalient since they occur in a position where they cannot receive stress.

However, investigation of the speech of Italian- and French-speaking children with SLI reveals an interesting asymmetry. In Italian and French, articles and clitic pronouns are homophonous. Now, if salience were responsible for the accurate use of functional morphemes, we would expect children with SLI to be equally weak in the use of articles and of clitic pronouns. This seems to be the case in Leonard et al.'s (1992) study, although they do report a small advantage for articles over clitics. But this is not confirmed in other studies, in which clitics and articles are differently affected. Jakubowicz et al. (1998) found a significant advantage for articles over clitics in the speech of French learners with SLI. According to Bottari et al. (1998), a dissociation between articles and clitics is manifested in the speech of Italian learners with SLI, but unlike in the French case, the production of articles is more affected than the production of clitics. Why such a discrepancy is found is not clear, but one thing is certain: salience cannot be the relevant factor, since articles and clitics have the same phonological status in both French and Italian. The same point can be made on the basis of data discussed by Rice and collaborators. Recall (section 11.2.1.1) that the children with SLI studied by these researchers have trouble with the *-s* morpheme when it marks third person on verbs, but not when it marks plural on nouns (see figures 11.1 and 11.2). Salience cannot be responsible for this difference since these morphemes are homophonous. This observation carries over to another troublesome aspect of the production of children with SLI. Besides omitting functional morphemes, English learners with SLI may use accusative pronouns as subjects in place of nominative ones, as illustrated in (17) (examples from Wexler, Schütze, and Rice 1998; for evidence that this phenomenon characterizes normal development as well, see Loeb and Leonard 1991; Rispoli 1994; Schütze 1997).

(17) a. Him stand on chairs.
b. Her watching TV.

The relative salience of nominative and accusative pronouns can hardly be invoked to explain this kind of error, as their salience does not appear to differ.

A final problem for the surface hypothesis is this. According to this hypothesis, children with SLI differ from normally developing children in that they have a perceptual deficit that makes them weak in the use of functional morphemes. But note that in Leonard et al.'s (1992) study, normally developing English-speaking children (LM controls) perform as badly as children with SLI in the use of articles, but not in the use of other functional morphemes. This is unexpected. How could we explain the poor performance of normally developing children in the use of articles? Is it also due to processing limitations, or does it have another cause? Why do normally developing children in control groups perform better than children with SLI when tested on a range of functional morphemes, but the same as children with SLI when tested on articles?

11.2.3 Intermediate Summary

It is evident that researchers hold diverging views about SLI. For some it is a modular deficit affecting some aspects of the grammatical competence; for others it is a processing limitation. We have evaluated different proposals. Four of these maintain that the impairment affects the organization of the grammar. According to Rice and Wexler and collaborators, SLI is a delay that manifests itself in optional omission of the tense feature from the clausal representation and thus of the morphemes expressing it. Clahsen and collaborators see SLI as the result of an inability to compute subject agreement. Gopnik and collaborators have proposed that SLI arises because children affected by it are not able to build morphological paradigms and abstract symbolic rules from the input. Under this view these children tackle the language acquisition task differently than normally developing children. Van der Lely and collaborators have proposed that subjects with SLI cannot compute structure-dependent relations. Finally, Leonard and collaborators suggest that the grammar of subjects with SLI is intact and that the deficit results instead from an impairment in the processing system. In the next section we will look at another pathological condition: one in which language is relatively good in spite of mental retardation.

11.3 RELATIVELY INTACT LANGUAGE IN AN OTHERWISE IMPAIRED SYSTEM: WILLIAMS SYNDROME

SLI is a case of dissociation in which cognitive abilities are stronger than grammatical abilities and in which language is defective in spite of normal cognitive development. The opposite dissociation is displayed by individuals with **Williams syndrome** (WS): their linguistic ability outstrips their cognitive abilities.

11.3.1 Some Features of Williams Syndrome

Unlike the etiology of SLI, the etiology of WS, also called infantile hypercalcemia, is well understood. It is a rare metabolic disorder, affecting calcium and calcitonin metabolism (see Culler, Jones, and Deftos 1985), whose features include mental retardation, an elfin facial appearance, and several medical anomalies including supravalvular aortic stenosis and renal anomalies (see Williams et al. 1961; Beuren, Apitz, and Harmjanz 1962). Individuals with WS are described as friendly and talkative (see Bennett, La Veck, and Sells 1978). They have intellectual limitations, including difficulties with everyday tasks like tying shoelaces. Moreover, they have trouble with a number of Piagetian cognitive tasks that normally developing children master at the age of 7 or 8. For example, they are unable to put items in order from larger to smaller or higher to lower (seriation task). They do not recognize that certain properties (e.g., the quantity of a liquid) do not change as a result of perceptual transformations (conservation task), and they are weak in problem solving.[7] They are also very poor at drawing (see Bellugi et al. 1993; Bellugi et al. 1999). A striking feature of the drawings of individuals with WS is the lack of integration among the parts of an object, as shown in figure 11.5, free drawings of houses by individuals with WS. The poverty of their drawing is not due to the fact that these individuals had not noticed the parts of the house, since they label them and can explain their role. Nor is it due to a motor deficit. Bellugi and collaborators suggest that instead it results from a visuospatial deficit (see Bihrle et al. 1989).

In contrast with their weakness on nonverbal tasks, the language of individuals with WS is relatively spared, more than that of other populations with similar mental retardation, such as Down syndrome (see Bellugi, Klima, and Wang 1996; Mervis et al. 1999). Despite its late emergence, by adolescence language reaches a level that exceeds the levels reached by other cognitive skills, although it remains below chronological age levels.

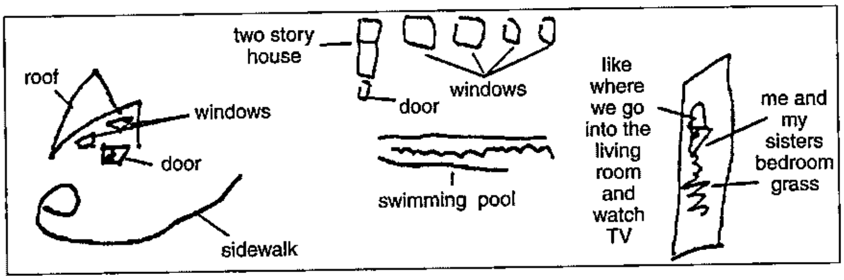

Figure 11.5
Free drawings of houses by individuals with Williams syndrome. The drawings contain many parts of houses but these are not coherently organized. Reprinted from Bellugi et al. 1999. © Dr. Ursula Bellugi, The Salk Institute for Biological Studies, La Jolla, Calif.

This discrepancy, the most outstanding feature of WS, is the source of a lively debate (see, e.g., Thal, Bates, and Bellugi 1989; Capirci, Sabbadini, and Volterra 1996; Volterra et al. 1996; Karmiloff-Smith et al. 1997; Mervis et al. 1999). Some scholars stress that the language of these individuals is not intact, even though they recognize that it is by far better than the language of other populations with mental retardation. Others see the discrepancy as evidence for the autonomy of language from other cognitive functions. They do not claim that language is intact in individuals with WS, only that it is ahead of other cognitive functions. If language were not an independent module, with its own principles of organization, this discrepancy would be unexpected. Language is a complex function, and in principle it is not surprising that individuals with WS may manifest weakness in some area of language. Moreover, as in the case of SLI, individuals with WS may display somewhat different language impairments. As in the case of children with SLI, it is desirable to obtain a precise linguistic profile of individuals with WS, to sort out what is spared and what is not spared and to understand better what kind of linguistic representation these individuals have.

11.3.2 The Language of Individuals with Williams Syndrome

In this section we will examine some aspects of the language of individuals with WS. However, since linguistically motivated investigations like the ones carried out for children with SLI are rare, the discussion of WS will be less detailed than the discussion of SLI.

11.3.2.1 The Acquisition of Words The lexicon of children with WS is quite unusual for children of their mental age. In a study by Clahsen and Almazan (1998), children with WS (ages 11, 12, 13, 15) obtained scores above their mental age on the British Picture Vocabulary Test (Dunn et al. 1982). However, children with WS enjoy using low-frequency words and know their meaning very well. For example, the children tested by Bellugi et al. (1993) (ages 11, 13, 16) could match the words *canine*, *archaeologist*, and *cornea* with the correct picture by choosing among four pictures (see also Volterra et al. 1996 for similarity between individuals with and without WS in lexical comprehension). They could explain what a word means using long definitions and many examples; they knew how to use the words, for they gave appropriate contexts; however, their definitions were peculiar in that they did not use the most salient feature to explain the word meaning. Examples from Bellugi et al. 1993 are shown in (18) and (19).

(18) a. "*Sad* is when someone dies; someone is hurt, like when you cry."
  b. "[*Sad* is] when you lost somebody that you love and care about. It means something happens to you like your grandmother died ..."

(19) a. "I wish I could *surrender*. That means I give up."
  b. "I would like to *commentate* it. It means that ... like all the sportscasters do ... they tell who's doing what."

11.3.2.2 Inflectional Morphology Unlike children with SLI, children with WS accurately use a number of inflectional morphemes. Even though they start speaking late, children with WS are more accurate than children with SLI in the use of inflectional morphology, as shown by Clahsen and Almazan (1998) and Rice (1999). As we have seen, English-speaking children with SLI have difficulty marking tense (see section 11.2.2.1). They frequently omit the third person singular marker *-s*, the past tense marker *-ed*, and the copula. By contrast, children with WS do not display such selective difficulty. Table 11.6 compares the performance of children with SLI, children with WS, and two groups of normally developing children. Children with SLI, children with WS, and language-matched (LM) children are at the same MLU level. Intelligence testing shows that the children with SLI and the two control groups are within

Table 11.6
Performance of children with specific language impairment (SLI), children with Williams syndrome (WS), and unaffected children (language matched (LM) and age matched (AM)) in the use of inflectional morphemes in English (*-s*, *-ed*, BE)

	SLI	LM	AM	WS
MLU	3.58	3.57	4.53	3.35
Intelligence testing	96	109	106	60
Age (in months)	58	36	60	91
-s	35%	61%	88%	83%
-ed	22%	48%	92%	85%
BE	47%	70%	96%	91%

Source: Rice 1999

normal range of cognitive performance, while the children with WS show an intellectual deficit. Children with WS are older than children in the other three groups. Yet their performance on morphemes marking tense is more accurate than that of children with SLI and of LM children; in fact, they achieve adult accuracy, despite their lower cognitive abilities. "The conclusion is that children with Williams syndrome know that tense-marking is obligatory at a time when their language development is comparable to that of children with specific language impairment who do not know that tense marking is obligatory" (Rice 1999, 348). Similar results are reported by Clahsen and Almazan (1998). These researchers elicited past tense forms of regular and irregular verbs from individuals with WS. They showed that these individuals have no trouble with inflecting regular existing and nonce verbs, while matched individuals with SLI (from the study reported in van der Lely and Ullman 1996) achieved lower scores. However, production of irregular past tense forms by individuals with WS was quite poor; moreover, they displayed a marked disposition to overgeneralize *-ed* to irregular verbs. Interestingly, errors of tense affixation by individuals with SLI consist in omitting the tense affix with all verbs, thus producing bare stems, while errors by individuals with WS consist in overgeneralization of the regular inflection.

Therefore, in terms of the word-and-rule theory mentioned in section 11.2.1.4, the dissociation displayed by individuals with WS is the opposite of that displayed by the individuals with SLI studied by Gopnik and collaborators: while regular inflection is spared, irregular inflection is impaired.

Other studies report that children with WS make unusual morphosyntactic errors, but these are often found when the children are tested in very demanding situations—for example, in describing stories, which requires a logical sequencing of events (see Capirci, Sabbadini, and Volterra 1996). We cannot discard the hypothesis that individuals with WS are less accurate when the task is more difficult and demands the application and coordination of various skills. Obviously, testing individuals with WS in different experimental conditions is of interest and may better highlight their linguistic profile.

11.3.2.3 Syntactic Structures By recording spontaneous speech samples and administering several linguistic tests, Bellugi et al. (1993) determined that children with WS display good comprehension and production of complex structures, such as reversible passives, conditionals, relative clauses, and comparatives. Some spontaneous sentences produced by three children with WS, from Bellugi et al. 1993, are given in (20).

(20) a. The dog was chased by the bees. (Crystal)
b. Maybe you could ask your son if I could have one of your posters. (Van)
c. After it stopped hurting, I was told I could go to school again and do whatever I feel like doing. (Ben)

Clahsen and Almazan (1998) show that individuals with WS perform at ceiling level on all kinds of passives: reversible verbal passives, as in (21a); short verbal passives, as in (21b); and adjectival passives, as in (21c).

(21) a. The teddy is mended by the girl.
b. The teddy is being mended.
c. The teddy is mended.

By contrast, children with SLI whose chronological age was similar to the mental age of children with WS performed poorly on reversible verbal passives (with and without a *by*-phrase) and at ceiling level on adjectival passives (see section 7.1). Unaffected controls also made some errors (19%) on full verbal passives.

Children with WS performed at ceiling level in another task devised to assess knowledge of Principles A and B of the binding theory (see sections 8.3 and 8.4). They accepted sentence (22a) when it was paired with a picture in which Mowgli was tickling himself and rejected the same sentence when it was paired with a picture in which Mowgli was tickling someone else, say, Baloo Bear. They accepted (22b) as a description of a picture in which Mowgli was tickling Baloo Bear, but rejected it as a description of a picture in which Mowgli was tickling himself. They performed equally well when the potential antecedent was a quantifier, as in (22c,d), rather than a referential expression.

(22) a. Mowgli is tickling himself.
b. Mowgli is tickling him.
c. Every boy is tickling himself.
d. Every boy is tickling him.

By contrast, we have seen (section 11.2.1.3) that children with SLI are poor at rejecting sentence (22b) when shown a picture displaying Mowgli ticking himself. They also obtained low scores with sentences like (22c,d). Thus, children with WS perform better than children with SLI on sentences probing knowledge of binding. Moreover, they obtained higher scores than children without WS matched in mental age.

The evidence examined here indicates that at least some syntactic aspects of the language spoken by children with WS are spared and that their language may even be superior in those respects to the language of populations with linguistic impairments, such as children with SLI. Superior performance with passives shows that children with WS can handle movement operations. High scores on sentences including reflexive and nonreflexive pronouns indicate that these children have some knowledge of the binding principles. More evidence is necessary to establish exactly which pieces of knowledge are available and which are not.

11.4 SUMMARY AND CONCLUDING REMARKS

We have discussed two pathological conditions: specific language impairment (SLI) and Williams syndrome (WS). SLI is a disorder affecting language, but leaving other cognitive capacities intact. Researchers have advanced a wide variety of hypotheses about the nature of SLI. The existence of these widely varying perspectives might have its source, at least in part, in the nonhomogeneity of the population being diagnosed as having SLI: Individuals with SLI are selected for studies on the basis of different language tests; their ages vary considerably (e.g., between 3;1 and 6;0 in Leonard et al. 1992; between 4;4 and 5;8 in the work of Rice, Wexler, and collaborators (see Rice and Wexler 1996); between 5;8 and 7;11 in Clahsen, Bartke, and Göllner 1997; and between 9;3 and 12;10 in van der Lely and

Stollwerck 1997). It would not be surprising that the language of these children grows, as does the language of children without SLI, and that the manifestation of the deficit changes, something that only longitudinal studies can determine. It is also possible that SLI encompasses a range of language pathologies that, it is to be hoped, can be characterized with the tools of linguistic and psycholinguistic theories. Despite all these differences, one point is agreed upon: that children with SLI have normal intellectual development. This fact is evidence for the autonomy of the language module, whose disorders are independent from the functioning of other cognitive capacities.

Children with WS present the opposite dissociation, with language outstripping other cognitive capacities. These children have an unusual cognitive profile: they are mentally retarded, yet their language is relatively well preserved compared with other cognitive functions. Thus, the WS population shows that some aspects of language may develop in spite of weakness in other cognitive domains. There is some evidence that not all aspects of language are equally preserved. While regular inflectional affixation is spared, irregular affixation is not. According to Clahsen and Almazan (1998), this suggests that (contrary to Karmiloff-Smith et al.'s (1997) claims), children with WS are good at "system building." Their problem is with irregular verbs, which are assumed to be learned by rote and stored in memory. Notice that the double dissociation between regular and irregular verbs observed with children with WS and SLI supports the view that the systems that subserve their processing must be distinct, contrary to what connectionist models would hold (see section 1.5.3). Clahsen and Almazan suggest that the computational system that supports syntactic processing is well preserved, while the associative memory system that supports irregular inflections is not.

Children with WS and SLI provide evidence for a dissociation between language and other cognitive functions, indicating that language is not the manifestation of a general cognitive capacity, but the expression of a separate module, with principles of organization not shared by other cognitive functions. Although this claim is much debated, it is undeniable that the speech of individuals with WS is not as damaged as their other cognitive skills, a fact that per se deserves explanation. How intact the language of individuals with WS is may vary from person to person; some researchers point out within-domain dissociations (e.g., Karmiloff-Smith et al. (1997) show that French-speaking individuals with WS have trouble with gender). It is certainly desirable to obtain more evidence about these dissociations and understand which process subserves a given linguistic phenomenon, as Clahsen and Almazan's study shows. It is also desirable to carefully investigate the weaknesses and strengths of the speech of children with WS and to compare their linguistic production with that of children with SLI or with other kinds of mental retardation, such as Down syndrome (see Fowler 1988; Randall 1993). Then we would better understand the course of language development in atypical conditions and possibly gain information about normal development and more generally about the nature of language.

A final point deserves to be mentioned. Individuals are diagnosed as having SLI if they do not have other cognitive deficits. This criterion is the basis for excluding the hypothesis that some cognitive deficit is the cause for the language impairment. Notice, however, that there is no a priori reason to exclude the possibility that an individual with mental retardation also has SLI, although for this case defenders of the non-autonomy of language can claim that the mental retardation is sufficient to account for the language disorder. But logically, this is not the only explanation. Assuming that language is an autonomous module, the different linguistic performances of individuals with mental retardation plus SLI and of individuals with only SLI may be explained as follows:

> If impaired subjects cannot use their normal instinct for acquiring rules of inflectional morphology and, therefore, have to resort to other cognitive skills to simulate these aspects of language, then those individuals who have better general cognitive skills should be better at, for example, applying compensatory strategies which simulate unimpaired linguistic forms. Thus, while an impairment in intelligence may not cause the language disorder, it may affect the ability of speakers to use various strategies to compensate for the deficit. (Gopnik and Goad 1997, 122–123)

Appendix A: Normal or Gaussian Distribution

The tests used to assess verbal and nonverbal skills are standardized by administering them to a sufficiently large population representative of the subjects for which the tests are prepared. As with many biological measures, the scores obtained in this kind of test form a bell-shaped curve, called the Gaussian or normal distribution. A typical curve of this type is shown in figure 11.6. This distribution can be characterized by, among other things, a central tendency and a measure of dispersion from the central tendency. A measure of the central tendency is the mean (μ), transformed into z-scores; a measure of the dispersion is the standard deviation (σ). The area under the curve between -1σ and $+1\sigma$ from the mean has a probability of 67%; that is, 67% of the population obtains a score

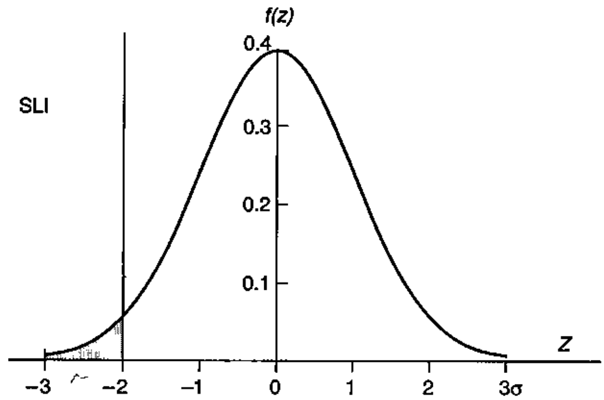

Figure 11.6
Normal or Gaussian distribution

included in the boundaries between -1σ and $+1\sigma$. The area included between -2σ and $+2\sigma$ has a probability of 97%. Thus, beyond 2σ from the mean, the probabilities are very low. The scores that are very far from the mean have a low probability. One criterion for diagnosing SLI is that the scores obtained in various language tests be lower than 22σ (or -1.5σ) from the mean (Bishop, 1977). In other words, the scores obtained must be located in the shaded area in figure 11.6.

Appendix B: Tests to Assess Specific Language Impairment

To establish whether a child has specific language impairment, one must know the average level of verbal and nonverbal performance at different ages. This information is obtained from standardized tests, which may vary from one study to the next. The nonverbal tests assess children's abilities in various tasks: for example, in completing pictures, assembling blocks, arranging pictures into a sequence to tell a story (*Wechsler Intelligence Scale for Children-Revised*, WISC-R; Wechsler 1992); in singling out an item unrelated to the others from an array of three to five, which requires the ability to formulate a rule for organizing the items (*Columbia Mental Maturity Scale*; Burgemeister, Blum, and Lorge 1972). The verbal tests assess children's speech discrimination abilities: for example, in selecting an object matching a spoken word from an array including objects whose names sound similar to the name of the target (*Goldman-Fristoe-Woodcock Test of Auditory Discrimination*; Goldman, Fristoe, and Woodcock 1970); in comprehending single words, for example by selecting a picture matching a spoken word from an array of four pictures (*Peabody Picture Vocabulary Test-Revised*, PPVT-R (US); Dunn and Dunn 1981; *British Picture Vocabulary Scale* (UK); Dunn et al. 1982); in selecting a picture from an array of four that matches a spoken sentence, a test of grammatical competence (*Test for Reception of Grammar*, TROG; Bishop 1989).

Further Reading

Bishop 1997 extensively surveys SLI and the accounts offered in the literature. Other books and collections devoted to SLI are Leonard 1998, Gopnik 1997, issue 7 of *Language Acquisition* (1998), and issue 2/3 of *Journal of Neurolinguistics* (1997).

The language of children with SLI and WS develops in unusual circumstances since the biological equipment is impaired. Regarding other unusual circumstances in which language does or does not develop normally, see Bishop and Mogford 1993.

Key Words

Agreement relation
Dissociation
Familial aggregation
Genetic basis
Specific language impairment (SLI)
Structure-dependent relations
Surface hypothesis
Tense omission model
Williams syndrome (WS)
Word-and-rule theory

Study Questions

1. What factors indicate that SLI has a genetic origin?

2. How do twin studies bear on the question of the nature of SLI?

3. What are the most salient characteristics of SLI?

4. What are the sources of differences among SLI populations?

5. Discuss the evidence in favor of and against the idea that SLI is an extension of the OI stage.

6. Discuss the idea that SLI is an impairment in computing agreement relations. Consider also the discussion in section 4.3.

7. Discuss the idea that SLI is an impairment in establishing structure-dependent relations.

8. Discuss the hypothesis that the grammar of individuals with SLI does not include grammatical features. What would the structural implications of this hypothesis be? (What kind of structural representation could an individual lacking the feature [past] have?)

9. What is the evidence for and against the surface hypothesis?

10. Why is it relevant to contrast SLI and WS?

11. Describe some salient features of WS.