Grammatical-Specific Language Impairment: A Window Onto Domain Specificity

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INTRODUCTION
There has been much debate as to which aspects of language are specific to language rather than shared with other aspects of cognition, and which aspects of language are specific to humans rather than shared with other groups of animals (Hauser, 2001; Hauser, Chomsky, & Fitch, 2002; Pinker & Jackendoff, 2005). In addition, there continues to be much discussion about how this specialized language system is represented and develops in the brain. New insight into this debate comes from studying people with a developmental language disorder, Specific Language Impairment (SLI), and particularly a subtype of this disorder known as Grammatical (G)-SLI. Such insight is bidirectional: our growing understanding of language and brain-systems enhances and directs our line of enquiry into SLI, furthering our knowledge of the underlying nature of both typical and atypical language development. In turn, this informs our enquiries about language and brain systems.

In this context, our chapter reviews the findings from G-SLI, and aims to contribute to our understanding both of specialized cognitive systems, specifically language, and of the nature of typical and atypical language acquisition. We argue that our data provide evidence that certain aspects of grammar are domain-specific and can be selectively impaired.

THEORETICAL FOUNDATIONS
SLI: WHAT DO WE AGREE ON?
SLI is a disorder of language acquisition in children, in the absence of any obvious language-independent cause, such as hearing loss, low nonverbal IQ, motor difficulties, or neurological damage (Bishop, 1997; Leonard, 1998). Children, teenagers, or even adults with SLI may produce sentences such as “Who Marge saw someone?” (van der Lely & Battell, 2003) or “Yesterday I fell over” (Leonard,
Dromi, Adam, & Zadounas-Ehrlich, 2000; Rice, 2003; van der Lely & Ullman, 2003; or may fail to correctly interpret sentences such as “The man was eaten by the fish” (Bishop, 1982; van der Lely, 1996). SLI is one of the most common developmental disorders, affecting around 7% of children in its “pure form” (Tomblin et al., 1997), and the prevalence is even greater when children with co-occurring impairments (e.g., Autism, ADHD) are included.

The disorder heterogeneously affects components of language such as syntax, morphology, phonology, and, to a lesser extent, the lexicon. It has a strong genetic component as shown by familial aggregation studies (for a review see Stormwold, 1998; twin studies (Bishop & Bishop, 1998), and genetic analyses (Fisher, Lai, & Monaco, 2003). The current view is that SLI is likely to have a complex geno-phenotypic profile, with different genetic forms of the disorder causing different phenotypes and possibly even the same genotype resulting in varied phenotypes (Fisher et al., 2003).

SLI: WHAT DON’T WE AGREE ON?

It is perhaps not surprising that, given the heterogeneous nature of SLI, there is disagreement over two areas: a taxonomy of SLI and its cause at the cognitive level.

The discussion surrounding the taxonomy of SLI concerns the variation and number of component deficits in children who fall under the broad umbrella of “SLI.” Broadly speaking, the following disorders and language component deficits are found in the literature. Note that we are focusing on the 7% of children who fall within the “typical definition” of SLI; that is, those who do not have co-occurring problems. It is the particular combination or specification of component deficits that characterizes the various definitions of SLI, some of which are considered SLI subgroups. On the one hand, Bishop and Snowling (2004) reviewed children with SLI who have a double deficit of phonological deficits plus “language impairments.” We understand this to mean some or perhaps any other component impairments within the language system. Therefore, we might expect a range of different profiles in the children they study. In contrast to this group of SLI, a highly restrictive subgroup is those called “Syntactic-SLI,” characterized by only syntactic and morphosyntactic impairments (Friedman & Novogrodsky, 2004). The “Grammatical-Specific Language Impairment” subgroup, however, is defined by similar core impairment in syntax and morphology, but in addition the majority suffer from phonological impairment too (Gallion, Harris, & van der Lely, 2007). Even within these component deficits in syntax, morphology, and phonology, the deficit is restricted to structures that are hierarchically complex, as we will discuss in due course. Interestingly, the distinction between phonology on the one hand and syntax and morphology on the other appears to be relevant to gene-phenotypic associations. Whereas a locus on Chromosome 16, now identified as CNTNAP2 is associated with children with phonological deficits and/or phonological memory deficits, a locus on Chromosome 19 is associated with expressive grammatical impairments, with no significant overlap between the groups (Bishop, Adams, & Norbury, 2006; Vernes et al., 2008).

In contrast, a subgroup who appear to have relative strengths in the grammatical aspects of language are those with “Pragmatic(P)-SLI,” who, as their name implies, have impaired pragmatic abilities (Bishop & Norbury, 2002). There is one subgroup—which we shall refer to as Familial-SLI (of which the most famous is the KE family), which has an identified simple genotype—a mutation of the gene FOXP2 with a simple autosomal, dominant inheritance—but which results in a rather complex phenotype (Fisher et al., 2003). Familial-SLI is characterized by not only impairments in language components, most notably morpho-syntax, morphology, phonology as well as the lexicon, but also outside the language system. Specifically the impaired family members have an oral dyspraxia concerning problems in motor programming of fine articulatory movements for speech sounds (Fish & DeFries, 2002; Watkins, Drakens, & Vargha-Khadem, 2002). It is also of note that some members of the KE family have a low IQ; however low IQ doesn’t segregate with the language impairment (Fish & DeFries, 2002).

In other children, low IQ is frequently (but not always) associated with a delayed pattern of language development, which we shall call the “delayed language” subgroup (Rice, 2004). Children in this group often exhibit delayed vocabulary acquisition and immature pragmatic development, alongside other language impairments (Rice, 2004).

In addition, many children with a diagnosis of SLI also have Dyslexia, and vice versa. However, these two disorders are not synonymous, and can occur in isolation, for the majority of children with Dyslexia, impairments center around the phonological component, either with the Phonological representations themselves, or with accessing and/or manipulating those representations (Ramus & Szenkovits, 2008; Snowling, 2000). Whether such phonological deficits are identical or different to those found in SLI children is the focus of much current research (de Bree, 2007; Marshall, Harcourt-Brown, Ramus, & van der Lely, 2009; Marshall & van der Lely, 2009 and papers in Massaad-Galusi & Marshall 2010).

The second area of discussion concerns the cognitive cause of SLI. Given the considerable heterogeneity in the phenotype, it could well be that different cognitive causes and pathways underlie different forms of SLI. But equally, there could be different routes to a particular surface impairment, for example, omission of tense marking. In this context, we now consider the two predominant approaches to the cognitive origins of SLI that can be broadly characterized as the domain-general and domain-specific perspectives.

Domain-General (D-G) deficit proponents identify the primary deficit in general cognitive mechanisms such as temporal discrimination, lower-level sensory processing speed, processing capacity, and short-term memory (Bishop, 1997; Leonard, 1998; Montgomery, 2000; Tallal, 2002). These deficits are considered to impair auditory processing of nonspeech and speech sounds, or alternatively memory and/or general learning. The resulting phonological deficit in turn causes problems in language learning (Joanisse & Seidenberg, 1998). Although the primary source of the domain-general deficit varies across
The CGC claims that the deficit in hierarchical structure is characterized by impairment in syntactic dependencies. Specifically, whereas dependences within SYNTAX impaired grammatical components, syntax, morphology, and phonology, and although these abilities, as with typically developing (TD) children, contribute to general language performance. These relations are shown by lines rather than arrows.

Auditory/phonological short-term memory components

Semantic/pragmatic components

Grammatical components

Object matrix

Influenlxal morphology

Synta.x

Linguistic contraction: e.g., wh-matrix object question

Structural phonology

Syntactic short-term memory

Phonological short-term memory

Lexicon

Figure 20.1 A component model of language acquisition and impairment. Note for clarity, only lines pertinent to the discussion have been included. There are clearly many more relations between components than depicted.

SYNTAX

The CGC claims that the deficit in hierarchical structure is characterized by impairment in syntactic dependencies. Specifically, whereas dependences within
Thus, G-SLI children produce questions such as “Who Joe see someone?” (van der Lely Battelli, 2003) and judge such sentences to be grammatical (van der Lely Jones & Marshall, in press). They also make “copying” errors of the wh-word in embedded questions as in (1) (Archonti, 2003). This pattern is sometimes found in young children (Thornton, 1995), suggesting that such structures are syntactically simpler and easier.

(1) “Who did Joe think who Mary saw?”

Furthermore, using a cross-modal priming paradigm, we found that G-SLI children showed no reactivation at the “gap” (marked by “p” in (2) in preposition object questions in scenarios such as (2), in contrast to age and language matched control groups (Marinis & van der Lely, 2007).

(2) Balloo gives a long carrot to the rabbit.

However, we found reactivation for the G-SLI children at the offset of the verb, where subcategorized arguments might be activated, suggesting that, in contrast to their peers, they were using semantic-lexical processing rather than syntactic processing (Marinis & van der Lely, 2007).

Following these findings, our next question was “Is there evidence at the brain level of impaired processing of just these syntactic dependencies, but normal functioning in other language processes?” If this was so, it would provide good evidence for the domain-specificity of this particular syntactic operation. However, the alternative domain-general hypothesis would be supported if brain correlates showed generally slow or abnormal characteristics to all (or most) language and auditory processing. To investigate these alternative hypotheses we recorded electrophysiological time-locked, event-related brain potentials (ERPs) in 18 G-SLI participants aged 10–21 years, plus age-matched, language-matched, and adult controls, when they were listening to questions containing a syntactic violation. The particular syntactic violation we were interested in concerns subcategorized arguments might be activated, suggesting that, in contrast to their peers, they were using semantic-lexical processing rather than syntactic processing (Marinis & van der Lely, 2007). The use of such a semantic system leads to the speculation that the optional pattern of performance for syntax that is commonly reported in the literature results from this imprecise form of sentence processing, rather than an optional functioning of the syntactic mechanism(s). Such imprecise processing may not sufficiently restrict interpretation or production. Further research is warranted to explore this possibility. Note that children who do not necessarily fit the G-SLI criterion exhibit syntactic impairments with similar characteristics in both English speaking children (Bishop, Bright, James, Bishop, & van der Lely, 2000; Norbury, Bishop, & Briscoe, 2002; O’Hara & Johnston, 1997) and languages that are typologically different from English, such as French, Greek, and Hebrew (Friedmann & Novogrodsky, 2004, 2007; Jakubowicz, Nash, & van der Velde, 1999; Stavrakaki, 2001; Stavrakaki & van der Lely, 2010). The largely similar characteristics of the component deficit across different SLI subgroups is also illustrated in morphology and indeed phonology, which we turn to in the next sections.

**MORPHOLOGY**

Within the morphology component, the CGC hypothesizes a hierarchical deficit that impacts on morphologically complex forms. Thus, over and above the syntactic deficits that affect both irregular and regular tense marking, regular forms are particularly problematic for children with G-SLI. Investigations using both elicited production (e.g., *Every day I walk to school. Yesterday I ...*) and grammaticality judgements of correct and incorrect forms reveal a lack of the regularity advantage found in typically developing children (van der Lely & Ullman, 1996, 2001). Furthermore, individuals with G-SLI show an atypical pattern of frequency effects for both irregular and regular past tense forms. The Words and Rules model of past tense forms (Marcus et al., 1992; Pinker, 1999) provides a
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cally illegal cluster

containing illegal clusters (Marshall
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developing children are able to compute regular past tense verb forms online, then
the stem whatever the legality of the final cluster.

We report two direct tests of van der Lely and Ullman’s hypothesis. The first
test explored plural compounds, building on Gordon’s study of young children
(Gordon, 1985). Gordon showed that 3–5 year olds use irregular plurals inside
compounds, such as mice-eater, but avoid using regular plurals to create forms
such as rats-eater. This is because only stored forms can enter the compounding
process (Gordon, 1985). Therefore, we hypothesized that if G-SLI children
were storing regular plural forms whole, then these would be available to the
compounding process, just like irregular plurals. Consistent with our hypothesis,
G-SLI children, in contrast to language-matched controls, produced compound
forms such as rats-eater (van der Lely & Christian, 2000).

The second test of the hypothesis considered the phonotactics of regular past
tense marking, and specifically the clusters formed at the verb end when the suffix
is added. Some of these clusters also occur in monomorphemic words, for exam-
ple the cluster at the end of missed (mist) and scowled (cold), and we refer to these
as “monomorphemically legal clusters.” In contrast, some clusters, such as those
at the end of slammed, robbed, and loved, only occur in morphologically complex
words (past tense or past participles), and we call these “monomorphemically
illegal clusters.” Because these illegal clusters only occur in inflected words, their
frequency is much lower than that of legal clusters. Thus if, as we hypothesized,
G-SLI children are storing past tense forms, they should find it harder to inflect
verbs when an illegal cluster would be created. On the other hand, if typically
developing children are able to compute regular past tense verb forms online, then
cluster frequency should have no effect, and they should be equally able to inflect
the stem whatever the legality of the final cluster.

Reanalysis of the past tense elicitation data collected by van der Lely and
Ullman (2001), a new elicitation experiment conducted with a new group of G-SLI
children, plus re-analysis of data previously collected by Michael Thomas et al.
(2001) confirmed our predictions. Whereas typically developing children from all
three studies showed no differences between regular past tense forms containing
legal or illegal clusters, the G-SLI children performed consistently worse on verbs
containing illegal clusters (Marshall & van der Lely, 2006).

A further investigation of this phenomenon studied past participle forms in
online processing of passive sentences, which contained a past participle with
either a monomorphemically legal cluster (kissed; see 4a) or a monomorphem-
cally illegal cluster (bathed; see 4b).

(4) a) I think that the squirrel with the gloves was kissed by the tortoise at his
house last weekend.

b) I think that the squirrel with the gloves was bathed by the tortoise at his
house last weekend.

We predicted that typically developing children would be able to use the pho-
notactic cues provided by an illegal cluster to identify the past participle, and
therefore interpret the passive sentence more accurately than when this cue was
not available; that is, in the forms with legal clusters. G-SLI children, however,
were predicted not to be able to use this parsing cue, and therefore show no advan-
tage for sentences where the past participle contained an illegal cluster. Using
a self-passed listening task involving a sentence-picture judgement task, this is
exactly what we found: typically developing children were significantly more
accurate on their judgements for sentences containing the monomorphemically
illegal past participle forms. In contrast, G-SLI children did not show a difference
between legal and illegal forms, suggesting that the phonotactic cue to the words
morphological complexity did not facilitate their parsing of the sentence.

Our investigations into the phonotactics of clusters with respect to morphology
are at the interface of morphology and phonology. We now turn to the phonology
component itself and our findings from G-SLI children.

PHONOLOGY

Just as the deficit in G-SLI affects hierarchical structures in syntax and mor-
phology, so it affects hierarchical structures in phonology. Phonological constitu-
ts such as syllables and prosodic words are grouped into successively higher levels of
the prosodic hierarchy (Selkirk, 1978). Certain aspects of phonological structure
cause difficulty for children with G-SLI. Children with G-SLI have clear and flu-
ent speech, and are intelligible for known words. Their phonological deficit mani-
fiests as a difficulty with forms that are complex at the syllable and foot levels of
the prosodic hierarchy (Gordon et al., 2007). In a nonword repetition task, G-SLI
children simplify consonant clusters in all word positions, while unfooted syllables
are deleted or cause syllabic simplifications and segmental changes elsewhere in
the word (Marshall, 2004; Marshall, Ebbels, Harris, & van der Lely, 2002).

For example, in Gallon et al.’s study, fs, kles, ts, ta (where dots indicate syllable
boundaries) was repeated by some children as, fa, kes, te, ta is with cluster simplifi-
cation, and by others as, fa, greys, te, ta, with erroneous voicing of the velar stop
and deletion of the final unfooted syllable (Gallon et al., 2007). Furthermore, system-
atically increasing the complexity of phonological structure resulted in a system-
ic increase in errors, regardless of the number of syllables, indicating that it is
not just the length of phonological material to be retained in phonological short-
term memory that is relevant to repetition accuracy, but the arrangement of that
material in the prosodic hierarchy. Even monosyllabic nonwords with two clusters
(e.g., klest) were more difficult for G-SLI children than those with one cluster
(e.g., klet) or no clusters (e.g., kles), and for disyllabic nonwords, a marked initial
weak syllable caused weak-strong forms (e.g., drempe) to be more difficult than
strong-weak forms (e.g., drempe). This contrasts with previous studies of non-
word repetition in children with SLI, which have not shown group differences

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word repetition in children with SLI, which have not shown group differences
between SLI and typically developing children when nonwords are only one or two syllables long.

However, it is how these deficits in phonology and other components of language impact on language processing and production that is of ultimate concern to both researcher and clinician.

THE CUMULATIVE EFFECT OF COMPONENT DEFICITS

The CGC model hypothesizes that for children with G-SLI, the deficit is in representing linguistic structural complexity in three components of the computational grammatical system—syntax, morphology, and phonology. Deficits in these components impact on a variety of linguistic constructions as a function of their syntactic, morphological, and phonological complexity. The regular past tense deficit that is found not only in children with G-SLI, but also the vast majority of children with SLI, has been explored most thoroughly. We have already discussed the impact of syntactic and morphological deficits on G-SLI children's realization of tense. Here we complete the picture by considering the effects of phonological complexity. Using an elicitation task we manipulated the phonological complexity of the inflected verb end, and found that, as predicted, phonological complexity impacted on suffixation. G-SLI children were less likely to inflect stems when the suffixed form would end in a consonant cluster, for example *jumped* and *hugged*, compared to when no cluster would result, for example, *weighed*. Furthermore, stems ending in a cluster (*jump*) were less likely to be suffixed than stems ending in a single consonant (*hug*). In contrast, typically developing controls showed no effect of phonological complexity on inflection (Marshall & van der Lely, 2007b).

In another study, we found that morphological and phonological deficits impact even on an aspect of language that is not traditionally noted as being problematic for English-speaking children with SLI—derivation morphology (Marshall & van der Lely, 2007a). We elicited two types of derived forms—adjectives derived from nouns by the addition of *-s* inside *-ly* (holey, rocky, frilly) and comparative and superlative adjectives (*happier*, *narrowest*). In the former case, the stimulus was either a singular or a regular plural noun, while in the latter the adjectival stem was either one or two syllables long. G-SLI children almost invariably supplied the *-y*, *-er*, and *-est* suffixes, in stark contrast to their high omission of the past tense suffix. Moreover, increasing the morphological or phonological complexity of the stimulus did not trigger suffix omission, but did result in nonattainment of targets that were characteristic of typically developing children. Some G-SLI children included *s* inside *-ly* when presented with a plural stimulus, producing forms such as *holesy*, *rockey*, and *frilley*, whereas typically developing children very rarely did so (*holey*, *rocky*, *frilly*). In forming comparative and superlative adjectives, both G-SLI and typically developing children reduced three-syllable outputs (e.g., *happier*, *narrowest*) to two-syllable outputs, providing evidence of a maximal word effect on derivation; that is, pressure to limit the output to the size and shape of a trochaic (strong-weak) foot, a constraint that is characteristic of young English-speaking children. However, the groups responded differently—G-SLI children's favored strategy was to truncate the stem and retain the suffix (*happier*, *narrowest*), whereas for typically developing children the favored strategy was to omit the suffix and retain the stem-final weak syllable (*happy*, *narrow*).

The cumulative impact of independent component deficits in the grammatical computational system is illustrated in Figure 20.2.

FIGURE 20.2 The computational grammatical complexity model of G-SLI. The impact of component deficits on different linguistic constructions.

DO AUDITORY DEFICITS MAINTAIN G-SLI?

One possibility is that an auditory deficit causes and maintains the grammatical impairments found in G-SLI. Evidence of subtle auditory deficits would conflict with domain-specific hypotheses and, instead, support domain-general perspectives. However, neither behavioral nor electrophysiological data have revealed any consistent auditory deficit in individuals with G-SLI that is independent of their language deficit. First, we explored G-SLI children's auditory perception for speech and nonspeech sounds, at varying presentation rates, and controlling for the effects of age and language on performance (van der Lely et al., 2004). For nonspeech formant transitions, 69% of the G-SLI children showed normal auditory processing, whereas for the same acoustic information in speech, only 31% did so. For rapidly presented tones, 46% of the G-SLI children performed normally. Auditory performance with speech and nonspeech sounds differentiated the G-SLI children from their age-matched controls, whereas speed of processing did not. A further set of experiments looked at “backward masking”, that is, their ability to detect a brief tone in quiet, and in the presence of a following noise (Rosen, Adlard, & van der Lely, 2009). Here group analyses showed that mean
deficits would individually impact on processing of linguistic forms, such as each grammatical component. This model has led to clear predictions with will be impaired.

A further possibility is that a more sensitive measure might identify an impairment. To test this we explored the neural correlates to auditory processing using event related potential techniques. ERPs can measure brain responses with a millisecond precision, and therefore have the time resolution to detect delayed or deviant brain responses. We recorded Auditory Evoked Potentials (AEPs) of G-SLI and age matched control participants to pure tones in a classical auditory oddball paradigm. Auditory processing elicits early electrophysiological responses known as the N100/P200 (or N1/P2) complex. This complex is associated with perceptual detection of a discrete change in the auditory environment. In addition, they elicit a later P300 component that reflects attentional control processes to detect and categorize a specific event. We discovered that children with G-SLI have age-appropriate waveforms for the N100, P200, and the P300 components (latency, amplitude, distribution on the scalp; Fonteneau & van der Lely, 2008). Our results reveal that G-SLI children have normal auditory processing during the discrimination of pure tones.

These findings, along with those investigating nonverbal cognitive abilities thought to possibly co-occur with, but not cause SLI (or G-SLI; see van der Lely et al., 1998), are consistent with a number of other researchers in the field investigating other SLI subgroups (Bishop et al., 2000; Bishop, Carlyon, Deeks, & Bishop, 1999) and dyslexia (Ramus, 2003). Auditory and nonverbal deficits are more prevalent in the SLI population than in typically developing populations, but no consistent nonverbal deficit has yet been found to co-occur or cause any form of SLI. This of course does not mean that such deficits, when they do co-occur, do not have an impact on language development: it is likely that they do to some extent. We set out in the discussion of our model just why and how we see different components of language affecting performance.

THE CGC MODEL OF LANGUAGE IMPAIRMENT IN THE CONTEXT OF A COMPONENT MODEL OF LANGUAGE ACQUISITION

Our discussion above provides details of the nature of component deficits within the CGC model, and specifically the nature of the hierarchical deficits within each grammatical component. This model has led to clear predictions with respect to precisely those structures in syntax, morphology, and phonology that will be impaired. In addition, the model has enabled us to predict how component deficits would individually impact on processing of linguistic forms, such as wh-questions, and tense marking. The model provides a parsimonious explanation for the pattern of impairments in G-SLI: cumulative effects of component deficits, alongside compensation by components that potentially function normally. Although the CGC model was originally developed to account for G-SLI, the component nature of this model and the detail within the grammatical components enables it to be applied to other forms of SLI, in both English and other languages, and indeed to typical language acquisition. For example, the model predicts that an auditory speech deficit will impact on phonology (specifically at the segmental level) due to mapping relations between the two, and thereby impact on language. It will not, however, directly cause the basic mechanisms and representations of phonology to be impaired. The CGC differs from domain-general perspectives in this respect, and this is, of course, an empirical issue. However, the specification of the CGC goes some way to helping understand how different components can affect language processing and performance. There is still much to understand about the role of mapping relations between components in normal and impaired acquisition, but we hope that this model will contribute to clarifying these relations.

CONCLUSION

This chapter has focused on the G-SLI subgroup. It has shown the existence of a relatively pure grammatical impairment that affects syntax, morphology, and phonology, but spares other cognitive abilities. More specifically, the deficit affects particular aspects of the grammatical system: complex hierarchical structure. This deficit in the CGC system manifests itself as an impairment in the computation of syntactic dependencies at the level of clause structure, complex morphological words, involving abstract rules, and complex phonological forms involving, for example, clusters and unfooted syllables. All these aspects of language are those learned through development and vary in interesting ways from language to language. Our data challenge views denying that some forms of language impairment are caused by underlying deficits to highly specialized domain-specific mechanisms that normally develop in the young child to facilitate language learning. The fact that other subgroups of SLI show deficits that have similar characteristics in syntax, morphology, and phonology, regardless of any co-occurring problems (Norbury et al., 2002), points to multiple genetic causes impacting on these components, with some genetic causes being more discrete than others.

Finally, the CGC model explains how processing in many different components of language—some within and some outside the grammatical system—in addition to factors pertinent to language such as phonological memory, contributes to language performance. In other words, processing is a reflection of "multiple processing systems." Our model clarifies how each component impacts on language performance in highly predictable ways. Thus, language performance will depend on both the linguistic characteristics of the material with respect to its complexity in each component, and the basic functioning of each component itself. We have shown how G-SLI children appear to use their strengths in certain components to
compensate, at least partially, for deficits in others. Thus, for G-SLI children and perhaps other SLI subgroups too, a relative strength in semantic processing could be targeted to help compensate for their syntactic impairment.

In conclusion, our data from the G-SLI subgroup show how some components in grammar can be selectively impaired, supporting a domain-specific view of at least some cognitive systems. These findings provide a valuable window onto the functional architecture of the brain and the development of uniquely human and specialized higher cognitive systems.

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REFERENCES


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### 21 The Developing Mental Lexicon of Children With Specific Language Impairment

**Holly Starkel**

**INTRODUCTION**

The mental lexicon refers to "the collection of words stored in the human mind" (Trask, 1997, p. 140) with each entry "detailing the properties of a single lexical item: its pronunciation, its meaning, its word class, its subcategorization behavior, any grammatical irregularities, and possibly other information" (Trask, 1997, p. 130). This chapter will focus on a subset of the properties of lexical items that are frequently incorporated in adult and child models of spoken language processing, namely phonological, lexical, and semantic representations (Dell, 1988; Gupta & MacWhinney, 1997; Levelt, 1989; Luce, Goldinger, Auer, & Vitevitch, 2000; Magnuson, Tanenhaus, Aslin, & Dahan, 2003; McClelland & Elman, 1986; Norris, 1994). The phonological representation includes information about the sound structure of the word as an integrated unit. Continuing the illustration, the lexical representation for "cat" would be /kæt/ (i.e., one unit). Lastly, the semantic representation consists of information about the meaning or referent of the word. Here, the semantic representation for "cat" would include, but not be limited to, information such as "four-legged furry pet that purrs."

For the developing mental lexicon, there are two processes of critical importance. The first process involves the actual creation of the mental lexicon. That is, children are not born knowing the words of their language. Instead, words must be learned through exposure to the language during every day interactions. The second process involves accessing the words in the mental lexicon for language production or comprehension. This is the process that allows children to use the words that they know to communicate. It is critical to understand the potential