ACQUISITION OF NOUN PHRASE STRUCTURE IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT

A Dissertation Presented
by
ELIANE B. RAMOS

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Communication Disorders
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This study investigated whether children with Specific Language Impairment (SLI) show difficulty acquiring Noun Phrase structure. A group of 10 children with SLI with an average age of 5 was tested with 3 experiments designed to probe their comprehension of articles, simple and complex possessive phrases, and their adherence to syntactic principles of binding and "wh" extraction. Their performance was compared with 2 groups of normally developing children, one group of 10 younger children matched to the SLI group according to Mean Length of Utterance (LM or Language Match group), and one group of 10 children matched to the SLI group according to age (AM or Age Match group). A spontaneous language sample was also obtained from the SLI and LM groups to compare their performances on spontaneous language and comprehension tasks. Significant differences
were found between the SLI and AM groups in all tasks subject to statistical testing, and between the SLI and LM groups in some of the tasks. In tasks where significant differences were not found, there were differences in the response patterns of the SLI and LM group.

These results suggest that children with SLI show marked difficulty with Nominal Phrases and that their difficulty can be described as a limitation in their ability to project fully hierarchical phrase structures that affect their verbal and nominal system similarly. Comparisons between performance on spontaneous language and comprehension tasks suggest that reliance on spontaneous language production only can lead to an overestimation of children's grammatical ability.
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CHAPTER 1

INTRODUCTION

Children who show difficulty acquiring their native language in the absence of sensory, neurological, behavioral, and non-verbal cognitive deficits are currently diagnosed as having a Specific Language Impairment (SLI) for clinical and research purposes (e.g. Leonard, 1981; Stark & Tallal, 1981). This group of children has been studied extensively and, despite some individual differences, most of them seem to have special difficulty acquiring function words, such as articles, prepositions, etc., and morphological endings, such as past tense -ed, third person singular -s, etc. (Johnston & Schery, 1976; Leonard, 1989). Additionally, they usually show a pronounced deficit in expressive language and a mild deficit in receptive language.

Attempts to determine the underlying cause of this condition have yielded 3 conflicting theories: (1) Auditory perceptual deficits in both linguistic and non-linguistic domains (Tallal & Pierce, 1973; Tallal et al. 1980); (2) General cognitive processing limitations, such as in working memory and symbolic representation (e.g. Johnston, 1982); and (3) Linguistic deficits unrelated to any perceptual or generalized processing deficits (Clahsen, 1989; Gopnik, 1990; Rice & Oetting, 1993). A fourth theory proposed by Leonard and his colleagues (Leonard, 1992; Leonard, McGregor, and Allen, 1992) combines some aspects of (1) and (2) to conclude that children with SLI have difficulty perceiving sounds of "low phonetic substance," which is
compounded by the added processing demands of grammatical morphemes, thus causing a breakdown in their acquisition of these morphemes.

It is possible that all of these theories are correct, and that what seems like the manifestation of a common language deficit may have different underlying causes in different children. What all these children have in common is that they are in the process of acquiring language, and whenever an interruption of the normal flow of language input occurs it will have an effect on those aspects of language that are dependent on input. Such effects may be undistinguishable from those caused by a deficit of linguistic representation. In other words, the child will probably construct a deficient grammar whether she came to the world with a deficient blueprint or the evidence she could gather from the input was incomplete, as would be the case if a perceptual and/or processing deficit existed.

While it is still important to determine causal factors of SLI, it is equally important to characterize what we mean by a deficient grammar. Research aimed at this characterization usually attempts to determine whether the child with SLI has a grammar that is comparable to that of a younger child at the same language level, and progresses through stages at a slower pace (a language delay), or whether there are important differences that may be preventing normal development (a language deviance). In general, these studies (e.g. Johnston, 1988; Leonard, 1989) have found that children with SLI use fewer grammatical morphemes than normal younger children matched for Mean Length of Utterance (MLU), but they seem to acquire the different morphemes in
the same sequence as their normal peers (as described in Brown, 1973 and de Villiers & de Villiers, 1973).

This evidence has been used both as an argument for a language delay explanation, when focus is placed on the seemingly normal sequence of development (e.g. Curtiss, Katz, and Tallal, 1992), or for a language deviance explanation, when focus is placed on the limited number of morphemes used given a certain MLU (e.g. Clahsen, 1989; Johnston and Kamhi, 1984). But the term "morphology" is a very general and descriptive one. In linguistic theory, grammatical morphology is associated with functional categories, which in turn have their own specific features and related structures. The presence or absence of specific morphemes shed little light on the status of these features and structures. More specific claims can be made when researchers attempt to narrow down which aspects of morphology are affected.

In addition, most studies of SLI have relied exclusively on language production, thus leading researchers to focus on superficial differences or similarities such as the number and variety of grammatical morphemes used. The underlying reason why differences are found cannot be explained and similarities are assumed not to need explanation.

As research in normal language acquisition is becoming increasingly sophisticated, some authors have cautioned that there is too much reliance on production data (e.g. de Villiers, 1992). Based on current linguistic theory, which places specific syntactic constraints on adult sentence comprehension, these authors are devising comprehension techniques to test children's adherence to these constraints. In many
cases, they have found that children's interpretations do not match those of the adults, even though production data alone might lead us to think otherwise. This same caution should apply in comparisons between the language of children with SLI and children developing normally.

A research outcome that has been especially influenced by this reliance on production data is the pervasive acceptance that children with SLI show deficits in their verbal system only, while their nominal system is mostly intact (e.g., Hadley, 1998; Bedore & Leonard, 1998; Rice & Wexler, 1996). Because English verbal morphology is much richer than its nominal morphology, deficits of production are much more likely to appear in the verbal system. But as cautioned before, just because the nominal systems of children with SLI and their normally developing peers are similar on the surface they do not necessarily have identical underlying representations.

The research described in this dissertation will attempt to characterize aspects of the grammar of normally developing children and children with SLI based on their performance on language comprehension tasks as well as their performance on spontaneous language production. More specifically, their comprehension of different NP structures will be analyzed from the perspective of current linguistic theory (Government-Binding (GB) theory (Chomsky, 1981, 1986)) to arrive at a description of structural forms available to these children in their nominal system. Their performance on spontaneous language production will also be analyzed from the same theoretical perspective to determine whether comprehension and production data can provide conflicting or converging evidence.
CHAPTER 2

REVIEW OF THE LITERATURE

Specific language impairment

Specific language impairment (SLI) is defined as a pronounced difficulty in the acquisition of language in the absence of sensory, motoric, neurological, behavioral, and non-verbal cognitive deficits (Johnston, 1988; Leonard, 1981; Stark & Tallal, 1981). A pronounced difficulty is described as a moderate to severe deficit in expressive language and a mild to moderate deficit in receptive language. Stark & Tallal (1981) defined a moderate to severe expressive language difficulty as a score on a test of expressive language of at least 1 year below chronological or non-verbal mental age, whichever is lower. A mild to moderate receptive language difficulty was likewise described, but with a difference in chronological/non-verbal mental age of 6 months.

Such reliance on age-equivalent scores has been criticized in the literature for its lack of reliability and validity across ages (e.g., Aram, Morris, & Hall, 1993; Lahey & Edwards, 1996; McCauley & Demetras, 1990). Currently, scores of 1 and 1.5 standard deviations from the mean are preferred to describe mild and moderate delays respectively (Lahey & Edwards, 1996; Powell & Bishop, 1992). Tomblin, Records, & Zhang (1996) devised a system of 5 composite scores reflecting 3 domains of language (vocabulary, grammar, and narration) and 2 modalities (comprehension and production) to diagnose specific language impairment in Kindergarten children. Subtests of the Test of
the Language Development-2-Primary (TOLD-2-P, Newcomer & Hamill, 1991) and a narrative task were used to arrive at the composite scores. They found that a z-score of -1.14 in any single composite score represented the best cut-off for diagnosing these children.

Hearing acuity and oral-motor screenings are administered to rule out any sensory and motor deficits. Intact non-verbal cognitive ability is verified by administering a non-verbal test of intelligence. Neurological and behavioral deficits are ruled out by reviewing medical and developmental records, as well as by gathering teacher and parental reports.

Despite reliance on this broad definition with its exclusionary criteria, children diagnosed as having SLI seem to represent a fairly homogeneous group. Though any individual child with SLI may show problems in different domains of language, the one domain that seems to be especially weak across children is grammatical morphology (e.g. Bishop, 1992; Johnston, 1988; Leonard, 1992). Current research in SLI has been mainly concerned with finding a cause for this disorder. The most prevalent studies are generally divided along two broad explanations. One argues that the disruption occurs at the representational level, so that the SLI child comes to the language learning task with a grammar representation that is either deviant or delayed as compared to peers. The other argues that representation is intact and that the disruption occurs at the perceptual and/or at the processing level. These two distinctions are further differentiated according to the extent of the disruption involved.
Perceptual and processing accounts

Before describing the perceptual and processing accounts of SLI, it is important to keep in mind that what is meant by "processing deficit" in this literature is quite different from its meaning in the adult literature. When a reference is made to a "processing deficit" in an adult, the assumption is made that this adult has a complete "knowledge" or "representation" of the language in question and that a breakdown exists in the system that prevents the accurate access and/or computations necessary for comprehension and production of certain language forms. Such adult had a chance to acquire native language competence before this breakdown occurred, therefore the "knowledge" versus "processing" distinction makes sense. In children who are in the process of acquiring their language, this distinction is far from clear. If a child has a specific difficulty "processing" certain language forms, she is likely to have difficulty building a complete representation of that form during the acquisition process. The quotation marks are purposefully used here to denote the lack of specificity in the meaning of this word such as it is used in the child language disorder literature.

Tallal and colleagues have long proposed that the language difficulties experienced by children with SLI can be explained by a generalized perceptual difficulty (Tallal & Piercy, 1973; Tallal & Piercy, 1974; Tallal & Piercy, 1975; Tallal, Stark, Kallman & Mellits, 1981). They argued that even though this perceptual deficit seems to be specific to the auditory modality, it is not specific to the perception of speech sounds.
In a series of experiments comparing children with language impairments with their normally developing age peers, language impaired children were found to have difficulty discriminating between two tones that were presented in rapid succession. Children were required to listen to two tones that were separated by varying intervals. Language impaired children performed significantly worse than normal peers when the inter-stimulus intervals were smaller or equal to 150 msec. (Tallal & Piercy, 1973). This same result was obtained when verbal stimuli were used. Children with language impairments performed significantly worse than peers discriminating between 2 consonants (/b/ and /d/ in the syllables /ba/ and /da/). The authors argued that because the only acoustic difference in these consonants comes from a formant transition that lasts 45 msec., the language impaired children were not able to perceive this difference (Tallal & Piercy, 1974). In a follow up study, the authors artificially increased this transition to 95 msec and found that language impaired children improved their performance to normal levels (Tallal & Piercy, 1975).

These results have been criticized on the grounds that if language impaired children cannot differentiate between /b/ and /d/, their speech production should be permeated with substitutions of this type, which is not the case. Additionally, though these results have been replicated in the literature (e.g. Leonard, 1992; Leonard, 1982), it is often argued that the task these children are asked to perform is too difficult. For instance, they have to listen to a target stimulus, encode it in memory, listen to the following stimulus, and press a button only if it matches the target stimulus, something that four and
a half-year old normally developing children cannot do. It is possible that language impaired children have other processing and/or memory difficulties that are affecting their performance (Leonard, 1992). In a more recent study, Merzenich et al. (1996) concluded that language impaired children can improve their performance on perception tasks if they are trained to respond first with longer intervals, with which they had no difficulty, and progressively move to shorter intervals. Again, it is difficult to ascertain whether the improvement was really in perception, or in their overall ability to perform on this task.

Leonard (1989; 1992) agreed that children with SLI have a perceptual deficit, but argued that this deficit alone cannot explain the pattern of difficulty observed in these children. He observed that English morphemes have "low phonetic substance," that is, they are either nonsyllabic consonant segments or unstressed syllables with shorter duration than adjacent morphemes, which are difficult to perceive. However, he also observed that the same low phonetic substance is present in non-morphemic segments which present no difficulties for children with SLI. For example, these children are much more likely to produce the final /d/ in "braid" than in "played" or the final /s/ in "box" than in "socks".

In light of these discrepancies, Leonard (1992; Leonard, McGregor, and Allen, 1992) proposed that besides being difficult to perceive due to their low phonetic substance, morphemic segments require additional computational operations, e. g., the /d/ in played has to be related to the verb "play" and to the rule that forms the regular past tense. This extra work overloads a system that is already struggling to
overcome a perceptual limitation. He devised an experiment where the pair used for discrimination had a contrastive portion with shorter duration than the non-contrastive portion (/das/ - /da'/), which he argued can act more like morphemic segments than those used in the Tallal studies. Children with SLI also had more difficulty with this pair than their normal peers. However, the additional computation that is required in real morphemes could not be represented in this minimal pair paradigm.

The only way to ascertain whether both the low phonetic substance and the morphemic computation play a role in explaining the problem experienced by children with SLI would be to compare morphemes of low and high phonetic substance. McGregor & Leonard (1994) attempted to arrive at this comparison by having children imitate sentences containing identical pronouns and articles in either subject or object position. Children with SLI were found to omit these forms much more frequently in subject than in object position. The authors argued that since subjects appear in the beginning of sentences and are usually unstressed, this pattern shows a difficulty with weak syllables in initial position and not with a specific grammatical role. The same contrast could not be tested with bound morphemes, which are always unstressed in English.

The low phonetic content hypothesis (also known as the surface account) was tested in a cross-linguistic study that compared morphological use in monolingual English and Italian speaking children with SLI. Leonard et al. (1987) found that Italian speaking children with SLI had much less difficulty with bound morphemes than their English speaking peers. Because Italian places stress on bound

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morphemes, the authors attributed this difference to the phonological properties of Italian. However, in spite of this advantage when compared to their English speaking peers, the Italian children with SLI still produced morphemes at much lower rates than their normally developing Italian speaking peers matched for Mean Length of Utterance (MLU). Therefore, the surface account alone fails to explain the morphological deficit in Italian speaking children with SLI.

In a study of SLI children learning Hebrew, a language where both stressed and unstressed morphemes are present, Dromi, Leonard and Shteiman (1993) found no consistent differences in children's difficulty with stressed or unstressed morphemes. They did find that children with SLI learning Hebrew had less difficulty with morphemes of verbal inflection, which are stressed in this language. But, they also observed no significant differences between these children and their language matches in the production of the definite prefix 'ha', which is unstressed. In general, Hebrew speaking children with SLI seemed to have less difficulty with morphemes than their English speaking peers. The authors argued that because Hebrew is so richly inflected, children tend to focus more on morphology, which carries important information in Hebrew. They concluded that English morphology presents a special problem for children with SLI not only because it is unstressed but also because it is so sparse.

As research on the auditory-linguistic processing abilities of children with SLI has provided conflicting evidence, some researchers have tried to look for evidence of other processing deficits that may influence linguistic output. One branch of this research has focused on SLI children's ability to store and access information. Swisher and
Snow (1994) argued that children with SLI have difficulty storing the amount of information necessary for rule induction, but that once this critical level of information is achieved, learning takes place normally. However, in a study on the effects of providing explicit metalinguistic instructions on bound morpheme use, Swisher et al. (1995) found that this type of information was helpful for normal children but detrimental to children with SLI. The authors then argued that children with SLI have a different learning style.

In studies comparing SLI children with language- and age-matched peers while learning novel morphemes presented auditorily, Connel and Stone (1992; Stone & Connel, 1993; Connel & Stone, 1994) found that unlike their peers, SLI children benefitted from having to imitate the forms provided. This difference was not obtained when the information was visual or non-linguistic. The authors concluded that imitation facilitated the storage and access of auditorily presented information for SLI children only. Thus, it is difficult to assess whether a different learning style, a difficulty with storage and access of information, or both are actually responsible for these combined results.

Gathercole and Baddeley (1990) argued that children with SLI have a deficit in short term memory (STM) storage. They found that compared with normally developing language-matched children, SLI children had difficulty repeating single non-words of three and four syllables. They also found a significant impairment in recall of word lists, so they argued that these children have a decreased phonological storage capacity. Contrastively, van der Lely and Howard (1993) could not replicate these findings. They found no statistical significance in
the difference in performance of children with SLI and language-
matched peers in a variety of tasks that tested phonological storage
capacity. They argued that Gathercole and Baddeley's (1990) subjects
may not have been compared to true language matches, because the
matching was accomplished solely on the basis of a test of single word
recognition.

Evans et al. (1997) attempted to apply the Limited Capacity Theory
(Carpenter, Miyaki, & Just, 1994; Just & Carpenter, 1992) to the
difficulties present in children with SLI. This theory holds that
working memory has a limited amount of resources available to perform
linguistic computations necessary for production and comprehension of
language. If this capacity is further reduced in children with SLI,
they should show difficulty following the temporal demands required
for spontaneous discourse and show slower responses as the complexity
of the forms presented in discourse increases. Longer response
latencies were found for children with SLI, suggesting that reduced
working memory capacity may play a role in the deficits observed in
children with SLI.

An even more general view of the deficits present in children with
SLI argues that they are not truly specifically impaired, but that our
testing procedures have failed to tap into subtle cognitive deficits
that accompany the language deficit. Johnston (1982) argued that
assessments of non-verbal abilities in SLI place too much emphasis on
perceptual and conceptual aspects of cognition rather than more
interpretive aspects, which she found to be deficient in children with
SLI. Other general deficiencies found in children with SLI include
non-linguistic symbolic representation difficulties (Johnston &
Ramstad, 1983), difficulty solving discrimination-learning problems (Nelson, Kamhi, & Apel, 1987), and even motoric problems evident in subtle clumsiness (Powell & Bishop, 1992), as well as in slow response time (Lahey & Edwards, 1996).

Such diverse findings are important to remind us that there is much we still do not know about SLI. Although the accumulating evidence of perceptual and processing deficits in children with SLI seem robust, the findings are far from providing a full explanation of the underlying causes of this disorder. Provided that such deficits are real, there is still a need to know what exactly makes inflectional morphology especially susceptible to their effects. Also, researchers need to be clearer about what they mean by “processing” and how it can be studied separately from “knowledge” in children.

**Representational accounts**

Representational accounts of the causes of SLI tend to focus on linguistic characteristics of the morphological system that may present special challenges to children with SLI. The focus is on what aspects of the child's internal grammar may be deficient and how this deficiency affects language output.

Gopnik (1990) studied 13 members of a large extended family with a genetic predisposition for SLI. After analyzing their spontaneous speech, she noticed that all affected members of this family had difficulty with abstract morphological features such as number, tense, gender, aspect, animacy, person, etc. She concluded that their
genetic makeup does not include a specification for these features in their underlying grammar.

Clahsen (1989) also argued that there is a deficit in the underlying grammar, though in his view the deficit is limited to agreement relations, which are manifested in verbal and nominal components of the grammar. He found that German speaking children with SLI have difficulty marking gender and number on determiners and verbs. They also produce verb-final main clauses because they lack agreement relations that mandate verb-second movement in German.

Some evidence for Clahsen's account comes from a study of 18 English speaking children with SLI (Rice and Oetting, 1993) whose underlying difficulty seemed to point to missing agreement relations. These children seemed to have difficulty both with subject-verb and with determiner-noun agreement. In a related study, Oetting and Rice (1993) compared production skills of plural "s" in children with SLI and their language-matched peers and found no differences. A surface account cannot explain these results, since plural "s" receives as little stress as third person "s" and yet children with SLI have much more difficulty with the latter.

Linguistic theory can provide some insight on why such differences should exist. Although bound morphemes are usually studied as a group, some morphological derivations are more dependent on syntax than others (Spencer, 1991). Agreement relations as described in X-bar theory depend on hierarchical structure and can only be obtained between head and specifier positions (Haegman, 1991), while such structural relationship does not seem to be necessary for plural marking. Therefore, a syntactic deficit should affect these morphemes.
differentially. Even in cases where there is plural agreement between a demonstrative and a noun, the agreement involved is referred to as "head-to-head" agreement, which is based on different hierarchical relationships. Munn (1999) described head-to-head agreement in some verbal constructions as well, and he noted that this type of agreement is in some sense "automatic" and more constrained by locality conditions than by syntax. This type of agreement will be further discussed in the Discussion chapter.

Syntactic deficits can be difficult to detect in the production of a language such as English, which has fixed word order and therefore very little margin for error. English speaking children with SLI make virtually no mistakes in word order, which led researchers to believe that their syntax is intact. Hanson and Nettelbladt (1995) studied Swedish children with SLI. Swedish has flexible word order, and yet, being a verb-second language, it places very specific syntactic constraints on where the verb should appear in main clauses. Children with SLI were found to ignore these syntactic constraints and thus produce sentences with ungrammatical word order.

There seems to be mounting evidence that some aspects of the grammar of children with SLI are deficient. To understand what is amiss in the grammar of children with SLI, the characteristics of an adult grammar representation and the developmental stages children developing normally go through must be clearly understood. The following section summarizes some pertinent developments in GB syntactic theory.
Syntactic theory

Chomsky's (1959) proposal that all children are born with a Language Acquisition Device (LAD) made it theoretically possible that some children may be born with a deficient LAD and thus show difficulties specific to language acquisition, as is the case in SLI. Current linguistic theory has expanded the notion of the LAD to include different modules that function relatively independently from one another. Some modules are believed to develop in all children independently from any language input. Such modules constitute language universals. Even though different languages may be subject to particular parametric variations, the same language universals apply to guide and constrain rule formation. Some disagreement about which modules are universal and to what extent they are input independent still exist (see de Villiers, 1994 for a thorough review), but these modules are collectively referred to as Universal Grammar (UG). One module that is generally agreed to be part of UG defines the hierarchical structure of languages and is described in X-bar theory (Chomsky, 1986).

Background in X-bar theory

Lexical categories

In X-bar theory, every phrase of any given language has the same structural form, so that we do not need a separate description for each phrase, such as Verbal Phrase (VP), Noun Phrase (NP), Adjectival Phrase (AP), but we can describe all of them with the generic XP,
where X can stand for any given phrasal category. Any XP in any
language has the following form:

1)     XP
       / \
specifier  X'
       / \
      / \
     X   YP
    head complement

Where the position "specifier" (spec) may be occupied by a determiner,
or a full phrase, X' is an intermediate category that is always a
sister to spec (directly dominated by the same XP), the head is always
of the same syntactic category as its full phrase (XP), and the
complement (YP) is a phrase selected by the head, its sister. Both
the spec and complement may be optional in certain constructions.
Languages vary as to whether the complement appears to the right of
the head (right branching or head first languages such as English) or
to its left (left branching or head last languages such as Japanese),
but the same rules and relationship between them still hold.
Following are examples of an NP and a VP according to X-bar theory:
Content words such as verbs, nouns, and adjectives and their corresponding phrases (lexical categories) are not enough to form sentences, and if we need function words/morphemes, such as articles and various inflections to form grammatical sentences, we also need to describe functional phrases (functional categories) to accommodate them.

Functional categories

Functional categories are subject to X-bar restrictions also, and thus follow the same shape shown in 1). Currently, three functional categories are widely accepted: Inflectional Phrase (IP), Complementizer Phrase (CP), and Determiner Phrase (DP). Because every sentence must have a verb and every verb must have a tense, tense or inflection (INFL or I) was hypothesized to be the defining phrasal category of every sentence. Its head "I" is occupied by tense and agreement features that are checked with the verb or by modals that carry tense such as "can", "could", "will", "should", etc. A simple
English sentence would then be an Inflectional Phrase (IP) and have the form:

3) \[ IP \]
   \[ \]
   \[ spec \]
   \[ I' \]
   \[ NP \]
   \[ I \]
   \[ VP \]
   \[ He \]
   \[ can \]
   \[ V' \]
   \[ / \]
   \[ V \]
   \[ NP \]
   \[ read \]
   \[ the book \]

Simple sentences may be embedded in higher sentences to form complex sentences, therefore a functional category higher than IP has been hypothesized to contain complementizers (Comp or C) such as relative pronouns and wh-words, this category is called CP:
4) IP
   / \ 
  spec I'
  I / \ 
  I VP
[pres.] / \ 
  V' 
 / \ 
 V CP
 know / \ 
  C' 
 / \ 
 C IP
 that / \ 
 he can read the book

A CP is also necessary to form questions, such as "who can read the book?";

5) CP
   / \ 
  who C'
 / \ 
 C IP
 can / \ 
 read the book?
More recently, a third functional category has been hypothesized, the Determiner Phrase (DP), a phrase headed by determiners which select NP's as their complements. The first person to have thought of a functional category associated with determiners seems to have been Brame (1981, 1982, cited in Fukui and Speas, 1986). Abney (1987) elaborated on this concept and described a structure of the DP that is widely accepted today. He observed that Noun Phrases could have structures that closely paralleled sentential structures.

In English, he argued, there is a nominal functional category that is headed by agreement features, which in turn assign genitive case (possession) to its specifier. When a determiner is present, the determiner, instead of agreement features, heads the DP and selects an NP as its complement. Therefore, the head of the DP may be occupied either by agreement features (or 's, depending on whether this morpheme is taken to be the actual case assigner or just a manifestation of case marking) as in 6), or by a determiner as in 7), but never by both, such as in *Paul's the car.

6) DP 7) DP
   / \  / \  
  Paul's D' D'
    / \  / \  
   D  NP D  NP
   (agr) / \  the / \  
     N' N'  N N
     |   |  |  |
     N N  car car
In considering the description of adult language representation provided by X-bar theory, many questions may be posed about how children acquire such representation. One question many researchers have attempted to answer is whether children are born with both lexical and functional categories already in place (provided by UG) or whether they acquire them in developmental steps.

**Acquisition of lexical and functional categories**

Theories of normal language acquisition follow three distinct accounts of the initial state of child language: 1) The maturational account assumes that child language is fundamentally distinct from adult language. As children mature, new forms become available at different stages of development until the "adult stage" is reached. This process is believed to be biologically determined; 2) The strong continuity account assumes that adult forms consistent with Universal Grammar (UG) are available to children from the start, and surface differences between adult and child language are attributed to incomplete parameter setting and/or performance limitations; and 3) the weak continuity account assumes an intermediate position, where children may start out with some specific forms that do not necessarily conform to the adult grammar and through a process of maturation and triggering strategies eventually reach the adult state.

Radford (1990) is a strong proponent of the maturational view. According to him, children start out at an agrammatical phase (one-word stage), then progress to a "lexical categories" stage, and finally to the "functional categories" stage. Each stage is brought...
about by biological maturation, and therefore the transition from one stage to the next is believed to occur rather abruptly. At the "lexical categories" stage (around age 2) children have acquired Verb, Noun, Adjective, and Preposition projections (VP, NP, AP, PP), but no functional projections. Using numerous examples of spontaneous utterances produced by children aged 1 year and 8 months to 2 years and 3 months, Radford found no evidence for an IP (lack of inflectional morphology and modals) or a CP (no use of complementizers). Because children this age also omit articles, he concluded that they also lack the DP. Some of his strongest evidence for the absence of functional categories at this stage comes from his analysis of these children's Case system. Case theory holds that nominative Case is assigned to the subject by INFL. Children at the lexical categories stage lack INFL and therefore cannot assign nominative Case to sentential subjects, thus producing sentences with Caseless subjects such as,

"Him come home"

which lacks the nominative case and inflection of its adult counterpart (He came home). The accusative form used in the subject, him, is believed to be a default pronominal form rather than a true accusative pronoun. Radford acknowledges that nominative forms and inflectional properties are sometimes evident in these children's utterances, but he dismisses them as being "formulaic expressions" that are not analyzed in terms of their structural properties.

Proponents of the strong continuity hypothesis criticize Radford's reliance on English speaking children to arrive at his conclusion. Since English has poor inflectional and Case systems, it
is not the ideal language to study acquisition of these properties. Hyams (1992) studied children learning Italian, which has a rich inflectional system. She reported that children as early as 1 year and 10 months use correct subject-verb agreement with pronouns appropriately Case marked. Although evidence for a full agreement system is not available because young children tend to use singular pronouns only, this is strong evidence for an early Inflectional system. Furthermore, object pronouns in Italian must be realized in pre-verbally attached clitics raised to INFL. Evidence from children's correct use of clitics in auxiliary and participial constructions suggests that the INFL position is available to them.

Studying language acquisition in verb-second languages such as German, in which the CP plays an important role, Hyams (1992) found evidence for the availability of a CP in early child language. In German, the verb's underlying position is after its object, but it must raise first to I and then to C (second position) in main clauses to acquire its inflectional properties (finiteness). Although 2 year-old children seem to use finite and non-finite verbs optionally, these forms are not randomly distributed between second and underlying positions. Modals and finite forms appear in second position, while non-finite verbs appear in their underlying position. This distribution suggests not only that INFL is available, but also that once the verb raises to INFL it obligatorily raises to C. Wexler (1994) argued that children at this stage do not know that finiteness is obligatory in main clauses and he termed this period of acquisition the Optional Infinitive (OI) stage.
Vainikka (1994) also analyzed the development of the Case system to provide evidence for the weak continuity hypothesis. Her analysis assumes a gradual development from a possible lexical categories stage to an increasingly more complex functional categories system. In this account, there is an initial stage when sentences consist of a VP only (sentential VP), in which the subject occupies the specifier position of VP and receives genitive Case from V (this analysis is consistent with Case assignment in adult Finnish, and therefore a possible UG option). She searched the utterances of 5 children in the CHILDES (MacWhinney and Snow, 1990) database, and found many instances of genitive subjects, e.g. "My see that" (Adam 2;3) and "My close it" (Nina 1;11).

At a second stage, IP becomes available to the child via a yet unknown triggering mechanism. At this stage the subject moves to specifier of IP to receive nominative Case. However, CP is still not available. As the child moves into a pre-CP stage, CP material is beginning to appear without a particular projection. Evidence for this stage comes from utterances where children use wh-phrases and the subject receives accusative or genitive Case. Vainikka argued that these early wh-phrases occupy the specifier of IP, thus precluding the subject from moving into it and receiving nominative Case. At the last stage, a full CP is available and the use of nominative Case becomes consistent across constructions. Vainikka did not attempt to explain why accusative forms also appear in subject position, but she acknowledged that her analysis may not provide an appropriate account of all children's Case system development, that is, different children may follow somewhat different paths of language acquisition.
In general, weak continuity approaches (Lebeaux, 1988; Clahsen, Penke, and Parodi, 1994; Vainnika, 1994; and Clahsen, 1995) seem more consistent with acquisition data that show incremental development, though the triggering mechanisms proposed to account for acquisition are still somewhat vague. Lebeaux (1988) argued that at the very start, children's grammar consists of isolated lexical items and progressively develops to include lexical phrasal categories and then functional categories, and that this progression is gradual and directed by environmental triggers.

Searching for evidence of functional categories, Clahsen, Penke, and Parodi (1994) found that a functional projection above the VP may be present in German speaking children even at the first stage of acquisition. They argued that such early acquisition of a functional category is possible because German provides plenty of morphological and syntactic cues to allow children to project this category early on. This category is later differentiated into an IP and CP as more evidence is gathered. Clahsen (1995) also argued that the DP develops in this same gradual fashion. He claimed that there is a strong dependence between overt use of morphological markers and development of syntactic structure, so that the morphological markers function as triggers for syntactic structure. He pointed to evidence that as case marking is overtly used, there is also evidence of syntactic structure that assigns Case (e.g., Vainnika, 1994). Using this same mechanism for the creation of the DP, he argued that "the possessive genitive may serve as a lexical trigger for the creation of the DP." (p.4) According to Clahsen, even though some determiners are used early on, they are not true realizations of the Det category, but
just optional modifiers which are generated under Spec-NP. Only when there is productive use of genitive -s is the Det category available, which correlates with the appearance of nominal agreement, i.e. use of non-default inflected determiners and adjectives.

The research devoted to the question of the availability of functional categories in early child language has placed heavy emphasis on finding evidence for an IP or CP system, and very little emphasis on the availability of a DP system. As more researchers have accepted the theoretical basis for a DP system, some research on the emergence of this system is now beginning to appear.

**Acquisition of the nominal functional category, Determiner Phrase (DP)**

To examine how children acquire the functional category DP, it is important to determine whether every adult NP also has a DP above it. Linguistic theory still cannot provide a clear solution to this problem. Maturational and strong continuity approaches must assume that a DP is always projected above every NP. Whether the DP is available for the child from the start or it suddenly matures as the nominal functional category, children should project DP's above every NP, and if such projections do not match adult grammar, they would have to be removed from the child's grammar. This process of removing existing projections from the grammar is usually rejected by researchers because children must acquire their grammar in the absence of negative evidence. If, on the other hand, children acquire the DP in incremental steps as positive evidence becomes available, it would be possible for them to learn languages that vary in whether they
require DP projections sometimes, always, or never. Japanese and English are two of the languages that suggest that DP's are not always projected.

Before the DP had been fully proposed, Fukui and Speas (1986) argued that only functional categories project to a full phrasal level (XP) and that lexical categories only project to the intermediate (X') level. They argued that since in Japanese genitives can be iterated and pronominal forms can be modified, these forms do not occupy a specifier position, because NP's are not available in Japanese. Such explanation also accounted for the fact that Japanese has no articles, therefore N's in Japanese are only lexical categories, while in English they can project to a full phrase (NP) with a specifier position that is occupied by determiners. Adapting this account to Abney's DP account, we might say that Japanese only projects NP's while English projects both NP and DP. Assuming that Fukui and Speas are correct when they say that only functional categories (or function words) project to a full phrase, can we also assume that the same is true when function words are absent in English (such as in bare nouns) and that a function word will always project to a full DP?

Roeper (1995) argued that the nominal categories in English can consist of just an N or an NP or a DP, and that each category will entail semantic and syntactic differences. He argued that DP is always specific while NP is non specific and that determiners can be generated in either, thus acquiring some of their semantic characteristics from syntactic structure. The following examples clearly show the same possessive pronoun with different referents:
(8) John needs his wallet (his own wallet)
(9) John needs his help (someone else's help)

Roeper argued that in sentence (8) "his wallet" is a DP, because a DP is a binding domain, thus allowing "his" to be bound by "John" without violating principle B of the Binding Module. For the same reason, "his help" in (9) must be an NP, which is not a binding domain, so "his" must refer to someone else to avoid a principle B violation.

Roeper's account suggests important predictions for acquisition. The DP is not only a binding domain but also a barrier for extraction. If children must learn when to project DP's, they may go through a phase where they project only NP's for certain constructions, which can be verified by examining whether they allow wh- extractions in environments where adults do not. De Villiers and Roeper (1995) examined just this possibility. They observed that so called "light" verbs subcategorize for NP's only, which are non-specific. For example, in "make the decision to play", the NP "the decision" is non-specific, thus certain binding and extraction consequences follow. In sentences (10) and (11) "him" has different referents:

(10) Bert made the decision to shave him (someone else)
(11) Bert liked the decision to shave him (Bert or someone else)

---

Principle A of the Binding Module, as reformulated by Chien and Wexler (1990), states that a reflexive must be locally bound, that is, its antecedent must be within the same binding domain. Principle B, on the other hand, states that a pronoun must be locally free, or that its antecedent must never be within the same binding domain.
In (11) adults allow coreference because "the decision" was someone else's, not Bert's, therefore a DP is present, thus allowing coreference. If children project only NP's for both (10) and (11) type sentences, we would expect them to allow coreference in both as well as to allow wh-extraction in both. De Villiers and Roeper (1995) tested children ages 4-7 to 5-6 and found that they could be separated into one group of children who allowed coreference in both sentences and one who allowed coreference only in (11) type sentences. Those who allowed coreference in both types were also much more likely to allow long distance wh-extraction in sentences such as,

(12) When did the girl like __ the decision to play __?

which they answered by giving the time at which the girl was going to play instead of the time at which she liked the decision.

Thus, the authors confirmed their prediction that once a DP is established, the expected syntactic consequences will follow. They then argued that such results can only be possible if children start out projecting only NP's and progressively learn to project DP's in constructions where information to do so is available.

Such mismatch between child and adult grammar is not seen as an obstacle to proposers of the strong continuity approach, who hold that the mismatch is only apparent due to hierarchies in parameter setting (Penner and Weissenborn, 1995) or underspecification of pragmatic principles (Hyams, 1996). However accurate these descriptions of the child grammar may be in accounting for why children would seem to project only an NP when adults project a DP, they still fail to
account for those NP's that do not project to a DP even in adult grammar, as demonstrated by Roeper (1995) and illustrated here in sentences (8) and (9). If children start out with full fledged DP's, do they have to eliminate some of these DP's for those constructions where only an NP is present? Since there are language variations as to where an NP or DP is required, children could not possibly come to the language acquisition task already knowing when to project a DP.

Romance languages also seem to allow both DP or NP only projections. Inalienable constructions have been extensively studied in French, but they follow the same pattern in other romance languages as well. Vergnaud and Zubizarreta (1992) defined an inalienable possession as being "inherently defined in terms of another object, of which it is a part." (p. 596) So body parts are the prototypical inalienable possessions. In romance languages, as opposed to English, both alienable and inalienable constructions take the same form and therefore are ambiguous, e.g. in sentence (12) "the hand" can either refer to each child's hand or a hand that is not part of any of the children's bodies, so the body part is lexically ambiguous, while only the second interpretation is possible in English.

(12) The children raised the hand

Vergnaud and Zubizarreta (1992) argued that only inalienable nouns take a possessor argument, and that the inalienable argument is dependent on another argument external to it. This external argument may be a subject or a dative complement of the verb. The following
example in Portuguese is an exact translation of the French example they provide.

(13) O medico lhes examinou a garganta
the doctor to-them examined the throat

Just as in example (12), the object here is expressed in the singular and has a bound reading interpretation. The same implied plurality can be observed in simple nouns such as in,

(14) Alguem deu o mesmo computador a Sofia, Justina, e Clea
Someone gave the same computer to Sofia, Justina, and Clea

The interpretation for sentence (14) is not that a single computer was given to three different people, but that they were given the same 'type' of computer. Vergnaud and Zubizarreta (1992) argued that a singular noun can have an implied plurality if it can be given a type interpretation. This interpretation is possible because the DP is non-denoting, that is, the definite determiner is an expletive from the point of view of denotation. They then argued that inalienable constructions in French have the same type-interpretation as these simple nouns, thus also having an expletive determiner. From this account, we can conclude that in their view a determiner is always the head of the DP, whether it denotes or not.

Noguchi (1995) also gave an interpretation of inalienable constructions that assumes a full DP projection. Based on a theory of anaphoric agreement developed by Borer (1989), he was able to account
for the facts presented above while still preserving a full DP.

However, if we return to the binding facts presented by Roeper (1995) we are still left with violations of the binding principles in some English constructions. In Roeper’s view, some English possessive pronouns occupy spec-DP and thus can be bound by the subject without violating Principle B. The same possessive pronouns however can occupy spec-NP when no DP is projected, but they have to refer outside the sentence or Principle B would be violated. Some data from Portuguese seem to corroborate this view. In Brazilian Portuguese when a possessive pronoun is used, the preferred interpretation is to have disjoint reference:

(15) João quer sua carteira (someone else’s wallet)

John wants his/your wallet

but,

(16) João quer a carteira dele

John wants the wallet of-him (his own wallet)

Apparently, in Brazilian Portuguese, possessive pronouns always occupy spec of NP, where they cannot receive genitive Case. When coreference is intended, the use of a pronoun construction forces a DP projection to allow coreference and Case is assigned by the dummy preposition ‘of’ (‘de’):
Another interesting co-occurrence is that the definite determiner 'a' is optional when the possessive pronoun is used, while it is obligatory in the second construction. Moreover, when the determiner is used in (15) the preference for disjoint reference is less strong. We can probably assume that a full DP is projected over NP in (16a).

These optional determiners have been analyzed as expletives, because they do not seem to carry the same meaning as obligatory determiners do. They often appear in conjunction with possessive pronouns and proper names. Longobardi (1994) examined these determiners in Italian and concluded that when the determiner is absent, there is N to D movement. He assumed that the D position must always be filled in arguments, so when it is not occupied by the determiner, the noun must fill it. A crucial piece of evidence for his argument comes from the pattern of co-occurrence of determiners, possessive pronouns and proper names in Italian, presented here in abbreviated form:
(17) a) Il mio Gianni ha...
    b) *Mio Gianni ha...
    c) Gianni mio ha...
    d) Il Gianni mio ha...

Because the possessive pronoun precedes the proper name in b), the proper name has not moved to D, which renders this construction ungrammatical. However, in Brazilian Portuguese all 4 constructions in (17) would be perfectly grammatical. If it is true that D must always be filled (when projected), then perhaps the DP is not projected at all for such constructions in Portuguese.

In inalienable constructions in Brazilian Portuguese, then, the determiner occupies spec-NP and is bound, as an anaphor, to the subject (or the dative object), and thus dependent on it for interpretation. If this account of Portuguese inalienable constructions is correct, perhaps children acquiring English start with a grammar that is very close to the Portuguese structure for these constructions. Thus, they may keep determiners in spec-NP until they have enough evidence that a DP must be projected in certain constructions. Presumably, Portuguese speaking children might take longer to posit a DP when a determiner is referential, because so much of their evidence does not require a DP.

Though some evidence exists that children learning English produce NP's that seem compatible with Portuguese or Italian NP's (e.g. the my car), conclusive evidence about the syntactic status of the determiner can only come from experimentation regarding their comprehension of these forms. For example, in a study comparing
English and French monolingual children's comprehension of inalienable constructions, Lamet (1995) found that given a sentence such as "Raise the hand", English speaking children are more likely to select a hand that was placed in the middle of the room, while French speaking children were more likely to select their own hands. If young English speaking children do not project DP's, then we would expect them to perform like the French speaking children in an experiment such as the one described above.

reported on a study of English speaking children age 3.5 to 5.9 in which they found that 2/3 of these children interpreted phrases such as "the kicking of him" just as adults would interpret "his kicking" (with a man being the subject of "kicking"). Such interpretation would be compatible with the adult interpretation in languages such as Italian and Portuguese. They also found that 3-4 year old children allowed a substance interpretation to phrases such as "Crystal's bowl", taking it to mean "a bowl of crystal". So, they hypothesized that children's use of possessives may apparently match that of adults', but in reality these possessives are syntactically represented as noun modifiers.

To investigate this hypothesis further, De Villiers et al. (1996) also tested children's interpretation of phrases such as, "The two bears' trees". Adults can only combine "the two" with bears, because as we saw in the description of the structure of the DP, the same DP cannot have both a possessive and a determiner. Therefore, the number of trees is not specified. In a bracketing paradigm, the adult interpretation would be represented by, "the [two bears]' trees", i.e. all trees that belong to the two bears. Children,
however, allowed the interpretation, "the two [bears' trees], when they acted out a sentence such as "Mickey knocked over the two bears' trees", by specifically making Mickey knock down only two of the bears' four trees. The specific structures for these types of phrases are examined in more detail in chapter 3 where task 2b of experiment 2 is detailed.

The data on language acquisition provided so far seem compatible with a gradual development from a lexical category only (NP) stage to an incremental use of the functional category (DP) as positive evidence for its projection becomes available to the child. It is also possible that functional categories are acquired in stages. The Inflectional Phrase, for example, contains agreement and tense features, therefore children might start by acquiring tense features only and later add agreement features (or vice-versa). Functional categories that lack some of their features are said to be "underspecified" (e.g., Clahsen, 1994). The DP is also believed to contain "feature bundles" that may be acquired incrementally. Linguistic theory has not yet determined what features are contained in the DP, and these bundles are likely to be language specific, but there is converging evidence that agreement is one component feature of the DP. Another likely candidate seems to be a pragmatic component that gives definite articles a referent in discourse (Hyams, 1996). There is also a semantic aspect of the NP/DP distinction that children must acquire as they learn to use definite and indefinite articles appropriately. Because this semantic distinction seems to interact with a syntactic distinction between NP's and DP's, its
acquisition is summarized below and it is further explored with experiment 1 in following chapters.

**Acquisition of the definite/indefinite article distinction**

Before determiners were associated with a functional category, researchers were mainly interested in how they were represented semantically. In his book on children's use of definite and indefinite reference, Maratsos (1976) identified two conceptual basis that children needed to master before they could use definite and indefinite articles appropriately. First, they would have to associate definite articles with specificity and indefinite articles with non-specificity. Then, they would have to overcome egocentrism to be able to discern what would be specific or not from the listener's point of view. Brown (1973) had already observed that children were productively using definite and indefinite articles from ages 2 to 3 years. Maratsos devised comprehension and production tasks to test how well children 3 and 4 years of age could differentiate between the two types of articles. He found that even 3 year-olds had no difficulty with the distinction and very little difficulty with taking the listener's point of view.

The dichotomous view of definite and indefinite articles used by Maratsos is still useful and prevalent, but it fails to account for all uses of these articles. As we saw in section 2a, the article lexically defined as a definite article in constructions such as "make the decision" does not behave as a definite article syntactically. It is possible that determiners get their full semantic interpretation
only after the lexical item is associated with its syntactic structure, and that a more accurate description of an article's specificity or definiteness would come from its association with a DP or an NP.

Contrary to such a semantic-syntactic dependence, Jackendoff (1991) argued that whatever correspondence we find between the syntactic and semantic structure of determiners is purely coincidental, because determiners are dependent on our conceptual structure, which is contextually based and completely independent from language. Perhaps our full conceptual understanding of definiteness and indefiniteness is dependent on syntax but it is only complete after context is added to the picture. Maratsos' finding that 3 year-olds have a full understanding of definiteness coupled with findings presented earlier that 3 year-olds may not have fully acquired the DP, seem to provide evidence for a semantic-syntactic independence at least in children. However, this question will only be resolved when researchers investigate children's knowledge of these determiners in much more detail.

**Functional categories and SLI**

Some researchers of child language disorders have attempted to use syntactic theory to explain the deficits present in SLI. The most common feature in the language of children of SLI is their difficulty with function words and inflectional morphology, precisely those aspects that are associated with functional categories in syntactic theory. Though research in this area is only beginning, a few
researchers have provided important evidence regarding the status of functional categories in children with SLI.

According to Case theory, nominative Case is assigned to the subject pronoun by agreement features (Agr) contained in IP. If children with SLI lack IP or Agr, they should not be able to assign nominative Case. Connel (1986) observed that SLI children receiving intervention for correct subject pronoun usage seemed to acquire other features not being taught, such as the copula and auxiliary inversion, which he termed "subjecthood elements." He concluded that these elements must be learned as a whole. It is possible that Connel was witnessing the appearance of a functional category (IP), which entailed concurrent learning of nominative pronouns and other IP material such as the copula and auxiliary.

Loeb and Leonard (1991) examined pronoun usage in SLI and normally developing (ND) children as it related to their use of the auxiliary and copula. Their analysis was limited to the third person singular masculine (he, him), as related to the use of the copula or auxiliary "is" or "'s". They found a significant correlation between this form of verb agreement and nominative case both in the ND and SLI children, thus showing a delayed, but not deviant grammar in children with SLI, as both groups tended to use nominative case when IP features were present. In a case study of a single 5-year-old child with SLI, Ramos and Roeper (1995) found evidence for a deviant grammar, as this child frequently used tense and modals (which are associated with the IP) in conjunction with accusative subjects. Some examples of his utterances are:
"Me said me gotta hurry up"

"Her can cook something"

"Me don’t know"

Because the IP has been hypothesized to contain both agreement and tense features, it is not clear from these data whether children with SLI have difficulty with the entire functional category or just its agreement features. The child in the Ramos and Roeper study (initials JC) used tense and modals frequently, but he never used third person singular -s agreement. As mentioned earlier, Clahsen (1989) argued that the deficit seen in children with SLI is limited to agreement relations, and that such deficit is not only apparent in noun-verb agreement, but also in determiner-noun agreement. In a study of German speaking language disordered children as old as 10 years old, Clahsen (1995) found that these children still omitted the possessive genitive marker -s, which may also be explained by the lack of agreement features in their DP. JC never used possessive -s either, and he also showed difficulty assigning genitive Case to possessive pronouns. His most illustrative utterances was, "Me sister name Dawne" (my sister’s name is Dawne). In comprehension probes, JC interpreted stimulus utterances such as "the girl saw me dress" as "the girl saw my dress". Therefore, JC’s grammar may not be deviant, because even though he shows evidence of IP projection with accusative subjects, he seems to lack agreement features in both his IP and DP systems, a crucial feature for nominative and genitive Case assignment.
Rice and Oetting (1993) examined children with SLI's production of number agreement in both verbal and nominal constructions as compared to their MLU-matched normally developing peers. They concluded that although children with SLI have great difficulty marking verbal agreement (evidenced by their omission of 3rd singular -s marker), they seem to produce nominal agreement (plural marking along with determiners such as those, some, etc.) at levels comparable to their normally developing peers. The authors concluded that their difficulty must be related to the verbal system and not to an abstract agreement feature.

The data provided by Rice and Oetting (1993) are difficult to interpret for several reasons: 1) English has a very poor agreement system, especially in nominal constructions where articles do not denote plurality and therefore do not agree in number with nouns; 2) Their study was based on spontaneous production data only, which coupled with reason 1) can only yield a limited number of instances for analysis; 3) Syntactic theory has not completely worked out how the agreement relations work between determiners and nouns. Subject-verb agreement involves a relationship between a specifier and a head, while determiner-noun agreement seems to involve head to head agreement, which may be handled differently by the grammar. This last point seems particularly important given that the authors acknowledged that their language impaired subjects did show difficulty in nominal agreement when a numerical determiner was used, e.g. "two eye", "one dishes". Some recent developments in syntactic theory have proposed a separate Numerical Phrase (NumP) (e.g. Ritter, 1991) to deal with
numbers, which may add another functional category with agreement features to the system.

More recently, Rice, Wexler and Cleave (1996) have argued that SLI children's difficulty with the verb system is related to the optionality of finiteness also seen in the grammar of younger normally developing children. They argued that just as younger children acquiring language normally, children with SLI do not know that finiteness, and therefore Tense, is an obligatory feature in main clauses. They observed that these children often omit tense markers, but when they do use them, they usually provide the correct form. The authors concluded that for unknown reasons children with SLI present with an Extended Optional Infinitive (EOI) stage. Because it is difficult to separate Tense from Agreement in English, Agreement can also be a component of finiteness. However, unlike Agreement, Tense is only present in the verbal system, which would explain why this system is more affected in children with SLI than the nominal system.

Rice & Wexler (1996) compared tense-related morphemes (3rd singular -s, past -ed, be, and do) with morphemes unrelated to tense (plural -s, in, on, and -ing) in the speech of children with SLI and found that only tense-related morphemes are affected. They concluded that the optionality of Tense can be used as a clinical marker for specific language impairment. In a longitudinal study of the development of Tense in SLI children and their normally developing peers, Rice, Wexler & Hershberger (1998) found that non-affected children master Tense features by age 4, while SLI children only show mastery after age 7, and may never achieve accuracy levels comparable to non-affected children.
While Bedore and Leonard (1998) agreed that verb morphology seems to be more sensitive in the identification of SLI, Leonard et al. (1997) pointed to the fact that the Extended Optional Infinitive theory fails to account for the difficulty SLI children show producing the possessive -s, a nominal feature. These authors also found that children with SLI also show difficulty with plural -s, a finding generally not supported in other studies.

In a longitudinal study of a single specifically language impaired child at ages 3;9, 4;3, 4;5, and 5;2, Eyer and Leonard (1995) found that in general this child showed late emergence and protracted development of grammatical morphology. They examined spontaneous productions for any evidence of material associated with functional categories, such as determiners, auxiliaries, and verbal inflections. Even though the child used these forms only inconsistently, the authors concluded that his deficit was not specific for functional categories, or he would not have used them at all.

Using this same type of rationale, Leonard (1995) examined the spontaneous speech of a group of 10 children with SLI ages 3;8 to 5;7 for evidence of the functional categories DP, IP, and CP. Again, because all children seemed to use some of the forms associated with these categories, he concluded that functional categories must be available for children with SLI. Interestingly, the children with SLI seemed to have more pronounced difficulty with certain forms, such as possessive -s (correct use in 32% of obligatory contexts as compared to 91% in their MLU-matched peers) or third singular -s (34% as compared to 59% in their peers). Both of these forms are dependent on agreement relations, IP Agr in the case of third singular -s, and DP
Agr in the case of possessive -s, which may present particular difficulty for children with SLI.

As de Villiers (1992) pointed out, there is no clear agreement as to what constitutes enough evidence for functional categories in the language of normally developing children. Some authors rely on only one instance of a form, while others examine percentage of correct use in obligatory contexts. She also warns that there is over reliance on production data in most language acquisition research in normally developing children. The same is true for research in language impaired children. Comprehension data is not only important to determine whether children represent the forms they are using in the same manner as adults, but also to determine whether they show sensitivity to these forms even in cases where they are not used.

Statement of the problem

Although researchers of specific language impairment in children disagree on the cause of this impairment, they do agree that affected children have a pronounced difficulty with function words and grammatical inflections. Whether the difficulty is due to an inborn representational deficit or to a perceptual/processing deficit, it is likely that either determining factor will cause these children to build syntactic representations that do not match the adult representation. If only perceptual/processing factors are at play and inborn representations remain intact, then children with SLI are in a sense input deprived, because the input they receive does not reach their brain in its intact form. Therefore their grammar will deviate
from the adult grammar but will be guided by UG principles and they will build syntactic structures that are similar to those of younger children developing normally. If, on the other hand, there is an inborn representational deficit, then we would expect their syntactic representations to differ not only from adults, but also from younger children developing normally, because the constraining principles of UG would be disrupted.

The rationale described above has been used in most research in which children with SLI are compared with younger children matched for language developmental stage. One serious limitation of this method has already been discussed and refers to the lack of specificity on what is meant by a processing deficit in a system that is still developing. Another serious limitation comes from a heavy reliance on speech production to make inferences about syntactic representations.

This reliance on production data has provided no conclusive evidence about the status of functional categories in children with SLI. It has also biased research to find deficits only in the verbal system of these children. Because English has richer inflectional morphology in its verbal system, deficits of production are more likely to appear in this system. But the fact that a deficit in the nominal system may not be verified in production does not constitute evidence that the two systems are affected differently. If functional categories are present in both systems and the deficit is specific to functional categories, both systems should be similarly affected. Only carefully designed comprehension probes can give us some insights on the nature of these deficits. Adherence to UG principles should entail syntactic representations that are hierarchical in nature and
that obey principled constraints in rule formation. However, finding adherence to these principles is not enough evidence that the deficit is not one of representation.

Children acquire their grammar in steps, and a deficit of representation may occur at any point of development, for instance, with a specific difficulty in setting certain parameters or in abandoning certain default parametric setting. Therefore, although it is possible to find a deficit of representation if principled constraints are not obeyed, the reverse is not true. Namely, it is still possible to argue for a deficit of representation even if those principles are obeyed. Consequently, the aim of this research will be to provide a characterization of the status of the grammar of children with SLI as compared to their normally developing peers and not to arrive at an explanation for the cause of this impairment.

The present investigation will focus on the status of one functional category, the Determiner Phrase (DP), in children with SLI and their normally developing peers matched for language developmental stage and for age. The DP has been either neglected or studied very superficially in previous SLI research. Because most studies focus on morphology, the intricacies of the DP system are often overlooked in favor of a system that is morphologically richer (the IP). The complexity of the DP system lies not on marking plural and possession with an "s" ending, but on the different interpretations that can be obtained given different structural relationships. For example, in phrases such as "the yellow horse's signs", the -s marker attaches to a whole phrase, "the yellow horse", and not only to the noun "horse", which entails a specific interpretation (all the signs that belong to
the yellow horse). Such interpretation requires three levels of grammatical knowledge: 1) the projection of the functional phrase DP; 2) the full specification of this phrase, including agreement features; and 3) the projection of specific positions within the phrase that are necessary to hold these features and to allow specific structural relationships. It may not be possible to separate each of these levels, but the third level is crucial for the interpretation of possessive markers that attach to a whole phrase, as exemplified above. If children with SLI show a limitation in their ability to project specific structural positions, they should show non-adult interpretation of such phrases.

The overall research question to be answered in this dissertation is whether children with SLI show more limited structure in their nominal system (NP and DP) than their normally developing peers matched for age and language developmental stage. The answer to this question will be obtained by answering 3 related and more specific questions:

1) Can children with SLI and their normally developing peers distinguish between specific and non-specific determiners (i.e. definite and indefinite articles)?

2) Can children with SLI and their normally developing peers use hierarchical relationships in DP to interpret:
   a) demonstrative-possessor plural agreement;
   b) adjectives that modify possessors;
   c) Case assignment?
3) Do children with SLI and their normally developing peers obey principled DP constraints to allow:
   a) binding;
   b) wh- extraction?

The answers to these questions will allow comparison of the NP/DP structures available for each group of subjects. They will also provide evidence as to whether the nominal system is affected in children with SLI. Spontaneous language production will also be analyzed to determine whether it can provide conflicting or converging evidence for the status of the DP in children with SLI.
CHAPTER 3

METHODS

To test the general hypothesis that children with SLI have a limited Noun Phrase structure available to them as compared to their normally developing peers, three experiments were designed to test the following 3 hypotheses.

Hypothesis 1: Children with SLI show more difficulty than their peers distinguishing between specific and non-specific determiners.

Hypothesis 2: Children with SLI show more difficulty than their peers understanding Noun Phrases that rely on rich hierarchical relationships.

Hypothesis 3: Children with SLI show more difficulty than their peers obeying principles of binding relations and wh-extraction that rely on Noun Phrase structure.

Subjects

Three groups of 10 subjects each participated in this study: One group of subjects with Specific Language Impairment (SLI group), one group of Language Matches (LM group) composed of subjects developing language normally and at a language development stage comparable to the SLI subjects as measured by Mean Length of Utterance (MLU), and...
one group of Age Matches (AM group) composed of subjects developing language normally and matched to the SLI subjects by age. All subjects came from monolingual standard American English speaking families. All SLI subjects were recruited from a large integrated public pre-school program in Western Massachusetts. LM and AM subjects were recruited from the same pre-school program and from a private pre-school program in the same region. SLI subjects ranged in age from 4;9 to 5;5 (mean = 5;0).

All of the SLI subjects had been previously identified by the school's speech and language pathologists as language impaired and met the following criteria:

a) Passed a hearing screening at 25 dB HL in the frequencies 500, 1000, 2000, and 4000 Hz.

b) Received a passing score on the Articulation subtest of the Test of Language Development-2 -Primary (TOLD2-P) (Newcomer and Hammill, 1988).

c) Obtained a non-verbal IQ score of at least 90 on the Columbia Mental Maturity scale (CMMS) (Burgemeister, Blum, and Lorge, 1972).

d) Obtained a z score of at least -1.14 on the Syntax Quotient composite of the Test of Language Development-2 - Primary (TOLD2-P) (Newcomer and Hammill, 1988). This composite score is obtained from 3 subtests of the TOLD2-P; Grammatic
Understanding, Grammatic Completion, and Sentence Imitation; and it is also called the Grammar Composite by Tomblin et al. (1996).

e) Had no history of frank neurological deficits as reported by teachers and in school records.

f) Had no history of behavioral/emotional difficulties as reported by teachers and in school records.

The LM subjects ranged in age from 3;8 to 4;5 (mean = 3;11) and also met criteria a) b) c) e) and f) above. The TOLD-2P was also administered, but standard scores could not be obtained for children under 4 years of age, all children 4 years old and above scored within 1 standard deviation from the mean in the Syntax Quotient score. Additionally, all LM children passed a school wide speech and language screening administered by the school's speech and language pathologists, which consisted of a short informal assessment of conversational speech and administration of the Fluharty Speech and Language Screening (Fluharty, 1978).

A spontaneous language sample containing at least 140 utterances was obtained from each SLI and LM subject to determine their Mean Length of Utterance in morphemes (MLU), and for analysis of language production. All language samples consisted of an informal interview with the examiner and a narrative production obtained with two picture books from the frog series, "A Boy a Dog and a Frog" (Mayer, 1967) and
"Frog Where Are you?" (Mayer, 1969). Language samples were video and audio recorded and later transcribed by the examiner into CHAT format, the standard transcription system of the Child Language Data Exchange System (CHILDES; MacWhinney, 1995; MacWhinney & Snow, 1990), for MLU computation and analysis of grammatical morphemes. Each subject in the LM group was matched to a child in the SLI group with an MLU of + or - 0.2.

AM subjects ranged in age from 4;7 to 5;7 (mean = 5;2) and each subject was matched to an SLI subject with an age of + or - 2 months. No standardized tests were administered to AM subjects. Subjects included were described by their teachers as having no language or academic delays. Table 3.1 summarizes each subject's profile.

<table>
<thead>
<tr>
<th>Subj</th>
<th>Sex</th>
<th>Age</th>
<th>MLU</th>
<th>Syntax Z Score</th>
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<td>99</td>
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<td>F</td>
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<td>4.5</td>
<td>103</td>
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<td>AM1</td>
<td>F</td>
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<td>AM2</td>
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Table 3.1. Subjects profile.
Experiment 1 was designed to test the first question, namely, whether subjects can make the specific/non-specific distinction between definite/indefinite articles. Maratsos (1976) established that normally developing children can make this distinction as early as age 3. However, there is no data on the acquisition of this distinction in children with SLI. This experiment only tests a very narrow contrast between definite and indefinite articles, which is established by contrasting one item that is part of a set with one that was previously mentioned. This task was not intended to provide a thorough description of how well children with SLI and their peers understand articles. It was assumed that children who have limited NP structure would have difficulty with this distinction, but not that such limited structure would be the sole cause of this difficulty nor that this would be the only distinction affected.

Maratsos' (1976) tasks were replicated with minor changes in the stories to accommodate objects available to this experimenter (e.g., plastic objects were used instead of wooden ones, but there was no need to change any of the stories used). Subjects were given toys to act out the stories as they were told. Each subject listened to 3 stories containing a total of 2 definite articles and 2 indefinite articles. The use of the definite article "the" and the indefinite article "a" was alternated for each child in the underlined positions in the stories below, so that half the children were presented with the sequence, "the, a, the, a" and the other half with the sequence "a, the, a, the."
Story 1. The Table Story: Four dogs, a boy, a plastic table, and 4 plastic chairs were used. Subjects were instructed to "listen to the story carefully and we will move the toys just as the story says. You move the dogs and chairs and I'll move the boy." The four chairs were set around the plastic table and the dogs were lined up in front of the subject.

"This boy came and sat down in one of the chairs. And just as he sat down, suddenly [a, the] chair fell over. Now one of the dogs jumped onto the table. The boy looked at him, but he just barked, 'woof, woof'. And now [the, a] dog ran under the table."

Story 2. Dogs and Cars: Four cars, a boat, 4 boys, 1 dog, and a plastic ramp were used. The four cars and the boat were laid out in a line with a boy beside each car, and the plastic ramp was set up nearby. Subjects were told, "now I'll move the dog and you will move everything else."

"One of the boys got into a car. He drove up the hill and he drove down again. Then he came back. Good. Now [he, one] got into the boat." After each boy is placed in one car, the story continues. "Now, this little dog came along. He went up and started talking to one of the boys. See them talking? Well, they talked and talked, and now, while they were talking, suddenly [a, the] boy drove away."

Story 3. elephant, zebra, and tigers: A plastic elephant, a plastic zebra, and four plastic tigers were used. Subjects were told, "now you move the tigers and I'll move the elephant and zebra." The tigers were lined up in front of the subjects and the elephant and zebra in front of the experimenter.
"The elephant and zebra saw the tigers, and they walked up to them. One of the tigers went over to the zebra. He said hello to the zebra. Now [a, the] tiger went over to the elephant. He said Hello to him."

Individual responses were scored as correct (selecting the previously mentioned item when given "the" and one of the other 3 items when given "a") or incorrect and analyzed with chi-square tables.

**Experiment 2**

The tasks of Experiment 2 were designed to test hypothesis 2, namely, whether subjects have full hierarchical representations necessary to understand demonstrative-possessor agreement, adjectives that modify possessors, and Case assignment.

**Task 2a**

This task was based on Abney's (1987) assertion that determiners and possessives are mutually exclusive in a DP. Therefore in the phrase "that bear's balloon", the determiner "that" refers to "bear" and not "balloon", because the possessive "bear's" renders the head D unavailable for a determiner. Thus, its adult tree representation would be:
and the bracketing paradigm for this phrase would be: [[that bear]'s balloon]. This paradigm can be verified by playing with number agreement on the demonstrative and each of the nouns. The phrase "those bears' balloon" is grammatical if more than one bear own the same balloon, in the same way that "that bear's balloons" is grammatical if one bear owns more than one balloon. However, "those bear's balloons" is ungrammatical, because it would require the demonstrative to agree in number with the head noun of the second DP, "bear's balloons", instead of its complement "bear" (unless "bear's balloons" is interpreted as a compound). This contrast in grammaticality can be more easily observed when a noun that requires irregular plural is used. For example, "those men's balloon" and "that man's balloons" are grammatical, but "those man's balloons" is not, unless "man's balloons" is a compound. An adult interpretation of such phrases requires that 2 DP's be projected and that there is a clear distinction between head and specifier positions.

A child who cannot distinguish between these positions and how they relate to one another hierarchically may randomly allow agreement between demonstrative and possessor or possessee, or require that the
demonstrative agree with both. Because "bear" requires a regular plural, the "'s" renders "bear's" indistinguishable from its plural counterpart "bears'" auditorily, which can be used to explore whether children allow the demonstrative to agree with the possessed object. An adult hearer can give grammatical interpretations to the following four forms:

a) that bear's balloon
b) that bear's balloons
c) those bears' balloon
d) those bears' balloons

Before testing for comprehension of these phrases, subjects were given a comprehension task to ensure understanding of plural vs. singular demonstratives, i.e., "that" and "those". For this pre-test, subjects were presented with 4 sets of two pictures and asked to "show me which picture goes with what I say". Each set had one picture with one subject and one picture with two subjects performing the same act. Verbs starting with "s" consonant clusters were selected to disguise plural marking on the subject. Each subject received two plural and two singular demonstratives in random order. Items presented were:

1) that/those girl(s) swinging;
2) that/those boy(s) skating;
3) that/those girl(s) sledding;
4) that/those guy(s) skiing.
After passing at least 3 of the 4 pre-test items, subjects were presented with the following task:

Task: "bear's house"; a set of 4 plastic boards in the shape of houses with peel-off objects was presented to subjects, each house had the following:

- house 1: One bear with one object of each kind;
- house 2: One bear with two objects of each kind;
- house 3: Two bears with one object of each kind;
- house 4: Two bears with two objects of each kind.

Figures 3.1 to 3.4 illustrate each house with an example stimulus phrase.
Figure 3.1. House one. 
  e.g., "that bear's balloon"

Figure 3.2. House two. 
  e.g., "that bear's balloons"

Figure 3.3. House three. 
  e.g., "those bears' balloon"

Figure 3.4. House four. 
  e.g., "those bears' balloons"
Each house was introduced to the subject and the number of bears and objects was pointed out (e.g., "this bear lives in a house by himself and he has two balloons, two umbrellas, two flowers, two cakes, two icecream cones, two trees, two rackets, and two footballs, he has two of everything"). After the subject was familiarized with each of the four houses, a fifth house was introduced which had a girl-bear and no objects. Subjects were given the following instruction:

"This girl-bear needs some things for her house, the other bears will give her anything she wants, but she can only get things from one house at a time. Listen carefully to what she says so you know which house she is talking about. You show me which house she's talking about and I'll help you pick up the stickers and put them in the girl-bear's house."

Two training items were presented to each subject before testing began. In addition to objects related to the test items, house 1 had one star, house 2 had 2 stars, house 2 had one cloud, and house 4 had 2 clouds. These items were used to test for plural comprehension and also to familiarize the subjects with the task of inspecting each house before responding. Immediately after the instructions above, subjects were told:

a) First she wants the star.

b) Now she wants the clouds.

Then, the following test items were presented in random order (each child gets either a, b, c, or d, for a total of 8 trials, 2 of each form):

"Now she wants:"
i)  a) that bear's tree
   b) that bear's trees
   c) those bears' tree
   d) those bears' trees

ii) a) that bear's football
    b) that bear's footballs
    c) those bears' football
    d) those bears' footballs

iii) a) that bear's cake
     b) that bear's cakes
     c) those bears' cake
     d) those bears' cakes

iv) a) that bear's umbrella
    b) that bear's umbrellas
    c) those bears' umbrella
    d) those bears' umbrellas

v)  a) that bear's racket
    b) that bear's rackets
    c) those bears' racket
    d) those bears' rackets
vi)  a) that bear's flower  
     b) that bear's flowers  
     c) those bears' flower  
     d) those bears' flowers  

vii) a) that bear's balloon  
     b) that bear's balloons  
     c) those bears' balloon  
     d) those bears' balloons  

viii) a) that bear's ice-cream cone  
       d) that bear's ice-cream cones  
       b) those bears' ice-cream cone  
       c) those bears' ice-cream cones  

Items a) are critical because a child might interpret them as, "that bears' balloon", by selecting the two bears who own one car, thus allowing the determiner to agree with the head noun. Items d) are also critical, because likewise a child might interpret them to mean "those bear's cars" by selecting one bear that owns two cars, again allowing the determiner to agree with the head noun, or interpreting it as a compound and allowing the demonstrative to agree with the head of the compound. Items b) and c) functioned as controls, because they could only be interpreted incorrectly if the child was not paying attention or did not understand plural agreement at all. If that is the case, random responses would be expected for all phrase types. Each child's response was clearly marked and
analyzed with Chi-square tables. Incorrect responses were also analyzed for trends in error patterns.

**Task 2b**

The same hierarchical relationships observed in determiner-possessor constructions can be obtained in adjective-possessor constructions. In the phrase "the yellow horse's signs," yellow modifies horses and not signs giving the following bracketing paradigm [[the yellow horse]'s signs]. Though there are different proposals for the structures of AP (e.g. Mandelbaum, 1994), the adjective seems to modify the noun in the DP specifier and not in the NP head.

```
DP
  /   \ 
 D'   
  /   \ 
 D    DP
the  /   \ 
  /   \ 
 AP   D'
  /   \ 
 yellow horse  /   \ 
    /   \ 
   D    NP
   's   /   \ 
    signs
```

A child who does not observe this hierarchical relationship might interpret such phrases with the following bracketing paradigms: [[the yellow [horse]'s [signs]], thus requiring yellow to modify
"horse" and "signs" (e.g., "yellow horses and signs"), or [the yellow [horse's] signs]), thus allowing the adjective to modify "signs" only.

As described in the Literature Review chapter, de Villiers et al. (1996) tested this same contrast using phrases such as "the two bears' signs." Because it was felt that using numerals might add processing load to this task by having children count the objects, adjectives were used in this adaptation of their Lions/Bears task:

First set-up: One red horse and one yellow horse. Each has the following in front of his house:

4 signs (2 red, 2 yellow)
4 feathers (2 red, 2 yellow)
4 chairs (2 red, 2 yellow)

Subjects were presented with Miss Piggy in a toy car and they were told, "Miss Piggy is not a very good driver. She keeps running into things when she drives, I'm gonna tell you what she runs into and you make her do it". Subjects were given Miss Piggy's car and asked to make her do what the examiner said.

Pre-test for instructions and plural understanding:
Miss Piggy knocked over the red chairs
Miss Piggy knocked over the signs

Test items:
1) Miss Piggy knocked over the red horse's chairs
ii) Miss Piggy knocked over the yellow horse's sign

iii) Miss Piggy knocked over the red horse's feathers

Second set-up: One big duck and one small duck. Each had the following in front of his house:

4 trees (2 big, 2 small)
4 horns (2 big, 2 small)
4 mailboxes (2 big, 2 small)

Test items:

i) Miss Piggy knocked over the big duck's trees

ii) Miss Piggy knocked over the little duck's horns

iii) Miss Piggy knocked over the big duck's mailboxes

Subjects' responses were marked according to whether the adjective was assigned to the possessor, to the object possessed, to both, or any other response. Results were analyzed with paired t-test comparisons.

Task 2c

This task was designed to determine whether subjects are sensitive to Case assignment requirements. The first part of this task assumes that possessors must be case marked with "'s" by agreement features in D, therefore two-noun strings must be interpreted as compounds by adults. A child who is not sensitive to
case assignment will randomly interpret two-noun strings as either compounds or possessor constructions whether or not the "'s" is present:

Part 1: Compound versus possessive

Subjects were presented with 2 contrasting pictures and were asked to "point to the picture that goes with what I say." Each subject received either a) or b) forms in random order for a total of 8 items (four of each form). As pictures of compound items of the form "N1 N2" (e.g., "flower dress") were presented, they were accompanied by a verbal description of the form "this is a N2 that looks like a N1" (e.g., "this is a dress that looks like a flower"). Likewise, as pictures of possessive items of the form "N1's N2" (e.g., "flower's dress") were presented, they were accompanied by a verbal description of the form "this is a N1 that has a N2" (e.g., "this is a flower that has a dress").

After each pair was thus presented, the examiner said, "show me the...:

i) a)flower dress b)flower's dress
ii) a)cat mug b)cat's mug
iii) a)bear pillow b)bear's pillow
iv) a)bunny cookie b)bunny's cookie
v) a)girl bottle b)girl's bottle
vi) a)monkey mask b)monkey's mask
vii) a)dog mitten b)dog's mitten
viii) a)duck brush b)duck's brush

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The second part of this task was designed to determine whether subjects are sensitive to the dummy "of" preposition, whose only function in a phrase is to assign Case. It is commonly inserted in "container expressions" and its absence forces a compound interpretation in adults.

Part 2: Compound versus container

Subjects were presented with 2 contrasting pictures and were asked to "point to the picture that goes with what I say." Each subject received either a) or b) forms in random order for a total of 8 items (4 of each form). As pictures of compound items of the form "N1 N2" (e.g., "box shoes") were presented, they were accompanied by a verbal description of the form "here are some N2s that look like N1s" (e.g., "here are some shoes that look like boxes"). Likewise, as pictures of container items of the form "N1 of N2s" (e.g., "box of shoes") were presented, they were accompanied by a verbal description of the form "here is a N1 with some N2s in it" (e.g., "here is a box with some shoes in it").

After each pair was thus presented, the examiner said, "show me the..."

i) a) box of shoes  b) box-shoes
ii) a) pail of hats  b) pail-hats
iii) a) bag of dresses b) bag-dresses
iv) a) tub of cars  b) tub-cars
v) a) can of earrings b) can-earrings
vi) a) basket of beds b) basket-beds
vii) a) bowl of glasses b) bowl-glasses
viii) a) pitcher of pencils b) pitcher-pencils

Subjects' responses for both parts of task 2c were marked as correct or incorrect and analyzed with chi-square tables.

Experiment 3

This final set of tasks was designed to test hypothesis 3, namely, to determine whether subjects obey principled rules expected for adult DP's in binding and wh-extraction. These experiments were based on Roeper's (1995) assertion that the DP constitutes a binding domain and a barrier for wh-extraction.

Task 3a

This task examined constructions where adults provide distinct interpretations of pronouns depending on whether a DP is present or not. This task was originally devised by de Villiers and Roeper (1995). In this study, the authors argued that when DP's are posited, they create a binding domain, so co-reference is allowed between pronoun and subject in test items a) and b) below (Principle B is not violated). When only NP's are posited, such as in items c) and d) below, co-reference between pronoun and subject is not allowed (Principle B is violated).
To test whether subjects obey this principle, they were presented with the objects described within the instructions below followed by a target sentence and a probing question. Verbal and/or pointing responses were recorded on the test forms.

Instructions:
"Look, here are some people from Sesame Street: Bert, Cookie and Elmo. Here is a little pretend razor. I'm going to tell you something and I want you to imagine what happens:"

a) "Bert liked the decision to shave him. Who got shaved?"

"Now, here is a bathtub:"

b) "Cookie overheard permission to bathe him. Who got bathed?"

"Now, we have Elmo and Bert. And a feather! Show me what happens when I say:

c) "Bert made a plan to tickle him. Who got tickled?"

"Now, we have Cookie and Elmo, and a plate and a spoon! Listen carefully:

d) Grover had an idea to feed him. Who got fed?"
Subjects' responses were marked as "allowed co-reference" when they answered by pointing to or naming the subject of the sentence, and "did not allow co-reference" when they pointed to or named a second or third character.

Task 3b

As argued in section 2a. of chapter II, languages such as Portuguese that denote inalienable possession with the definite article "the", may have this article occupying the spec of NP position, so that it may be bound to the sentence's subject to get its possessor interpretation. A child who has not acquired the DP, which would prevent such binding, might allow the definite article in English to function just as its counterpart in Romance languages. The following act-out task was devised to test this hypothesis:

Subjects had control of "Mrs. Potato Head" and were instructed to make her act out events as they were described: "I'm going to tell you a story and you are going to make Mrs. Potato Head do the things that happen in the story, ok?"

Training: "Look, here I have Mrs. Potato Head. Let's look at everything she has. Tell me, does she have a nose? ok, can you make her touch it?"
Does she have eyes? Can you make her touch them?

" " shoes? " " " " " ?
" " an ear? " " " " it?
" " an arm? " " " " ?
" " a bag? " " " " ?
" " a hat? " " " " ?"

"Yes, she is very proud, because she thinks that she has a better looking nose, mouth, eyes, ears, arm, bag, hat, and shoes than anybody else! Then she saw this box (show child a Mrs. Potato Head box) and she was very surprised at the things she saw coming out of the box.

(take each item out of the box at a time and hold it in front of Mrs. Potato Head at her arm's length) First, look at what she saw (subject is shown a nose exactly like Mrs. Potato Head's.)

Wow, 1) she just touched [the/ her] nose, then look at what she saw,

(each object is shown one at a time and presentation of 'the' or 'her' was randomized for a total of 4 presentations of each type.):

2) (eyes): she just touched [the/ her] eyes, then look at what she saw,

3) (shoes): she just touched [the/ her] shoes, then look at what she saw,

4) (ear): she just touched [the/ her] ear, then look at what she saw,

5) (arm): she just touched [the/ her] bag, then look at what she saw,

6) (bag): she just touched [the/ her] arm, then look at what she saw,

7) (mouth): she just touched [the/ her] mouth, then look at what she saw,

8) (hat): she just touched [the/ her] hat.
Wow, Mrs. Potato Head thought, well I guess there will be someone else who will be pretty good looking too!

Subjects responded by either making Mrs. Potato Head touch her own body part/possession (considered a correct response given the pronoun “her”) or by making her touch the object taken out of the box (considered a correct response given the article “the”). Each response was marked as correct or incorrect for scoring purposes.

**Task 3c**

This experiment was designed to test whether subjects build DP’s by examining whether they disallow long distance wh- movement when such movement would be prevented by the barrier created by the DP. A subset of the pictured stories developed by de Villiers and Roeper (1995) were used. In their original study, de Villiers and Roeper contrasted questions containing NP only (where long distance movement is allowed) with questions containing a DP. Since they already established a clear distinction in wh- movement in both cases, only the questions containing DP were used here to test whether subjects would disallow long distance movement for these questions. Each story was told as a set of 3 accompanying sequential pictures was shown. At the end of each story, subjects were asked one question, and their responses were recorded on the test form verbatim and later coded according to whether they provided a long distance (LD) response (non-adult), a short distance (SD) response (adult) or others:
"These little girls really wanted to go on a trip on their bikes, but the older girls didn't want them to come. This little girl found a note in the trash about a plan the big girls had to leave for the beach early in the morning! So the little girls got up early and surprised them!"

Question: "Where did they discover_ the plan to ride_?"

Expected answers:

"in the trash" = SD (adult)

"the beach" = LD (non adult)

"These kids were going to run in a race but the teacher said it was too muddy because of the rain. But later on, the sun came out and the teacher decided it would be okay as long as they ran in their bare feet. So she gave permission through the microphone that they could run in their bare feet."

Question: "How did they hear_ the permission to run_?"

Expected answers:

"through the microphone" = SD (adult)

"in their bare feet" = LD (non-adult)

"All these people were really bored and they couldn't think of anything to do the next day. But at night they all called each other and shared their ideas. One person suggested that they paint pictures, and that was what they chose. Here they are painting the next day."

Question: "When did they choose_ the idea to paint _?"

Expected answers:

"at night" = SD (adult)

"the next day" = LD (non-adult)

The following stories were devised to test subjects' sensitivity to the DP barrier in verb nominalizations. The same procedure as
above was used, but at the end of the stories each subject answered one of the two alternative questions:

"Susy and Billy decided to have a race on their bikes. Susy liked to race very fast, but Billy wanted to be careful. Susy hit a hole and fell off her bike. She was very sad."

a) "How did Susy like racing?" LD/SD = adult = "very fast"/"didn't like it"

b) "How did Susy like the racing?" SD = adult = "didn't like it"

"Kathy wanted to decorate her Christmas tree with red balls, so she brought the tree in the house to get started. She had a lot of fun decorating it. When she was finished, she thought the tree was very beautiful."

a) "How did Kathy like decorating?" LD/SD = adult = "with red balls/liked it"

b) "How did Kathy like the decorating?" SD = adult = "liked it"

"Annie liked baking cookies wearing her yellow apron. So she put on her apron and got to work. She made very nice gingerbread men. She was so proud of her baking that she called her friend Jimmy to have some cookies with her."

a) "How did Annie like baking?" LD/SD = adult = "with yellow apron"/"liked it"

b) "How did Annie like the baking?" SD = adult = "liked it, proud"

Subjects' responses were transcribed verbatim and later classified as long or short distance for analysis. Presentation of
the 6 stories contained in task 3c took no longer than 10 minutes per subject.
CHAPTER 4

RESULTS

Experiment 1

Experiment 1 investigated whether SLI children can accurately distinguish between specific and non-specific determiners (definite/indefinite articles). Each subject responded to two instances of the article "the", and 2 instances of "a" for a total of 20 responses for each article per group. Table 4.1 shows proportion of correct responses for each article per group. For scoring purposes, a correct response for "the" means that the child selected the previously mentioned object, and a correct response for "a" means that the child selected one of the other 3 items available and not previously mentioned. The number of correct responses provided by each subject can be found in the Appendix, table A1.

<table>
<thead>
<tr>
<th></th>
<th>SLI</th>
<th>LM</th>
<th>AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE</td>
<td>0.85</td>
<td>0.95</td>
<td>0.85</td>
</tr>
<tr>
<td>A</td>
<td>0.35</td>
<td>0.75</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Table 4.1. Proportion of correct responses for comprehension of articles.
All 3 groups performed at high levels for comprehension of “the”. Because subjects could only respond by moving either a specific or a non-specific object, it is possible that the telling of the stories created a pragmatic preference for selecting the specific objects (those already mentioned and manipulated). Therefore, high levels of accuracy for “the” can only lead to the conclusion that the distinction between the articles is fully acquired if there is a concurrent high level of accuracy for comprehension of “a”. SLI subjects were much less accurate for comprehension of the article “a”. Chi-square comparisons found significant differences for comprehension of “a” between SLI and LM subjects (chi-square = 4.91, p < .05) and between SLI and AM (chi-square = 12.91, p < .05). Though AM subjects performed at higher levels than LM subjects, that difference did not reach significance (chi-square = 2.50, p = .114). These results confirm hypothesis one, which states that SLI children lag behind both their language matches and their age matches, and do not fully differentiate between definite and indefinite articles.

**Experiment 2**

This experiment was designed to examine if SLI children and their peers show evidence of fully elaborated Noun Phrases by testing their comprehension of constructions that are dependent on specific hierarchical relationships. Task 2a examined their comprehension of demonstrative-possessor plural agreement; task 2b examined their comprehension of adjectives that modify possessors; and task 2c
examined their sensitivity to Case marking requirements in possessive phrases and container phrases.

**task 2a**

For this task, subjects were presented with 4 types of phrases (2 of each for a total of 8 phrases per subject) that varied according to possessor number (singular or plural), and object number (singular or plural). The demonstratives "that" or "those" were used to agree with possessor number. Table 4.2 shows examples of each phrase type and the proportion of correct responses per group (chance performance is .25, above chance performance is .50 and up). The number of correct responses each individual subject provided can be found in the Appendix table A 2.

<table>
<thead>
<tr>
<th>PHRASE TYPE</th>
<th>SLI</th>
<th>LM</th>
<th>AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 possessor/1 object (1P/10)</td>
<td>.20</td>
<td>.40</td>
<td>.60</td>
</tr>
<tr>
<td>e.g. &quot;That bear's balloon&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 possessor/2 objects (1P/20)</td>
<td>.10</td>
<td>.50</td>
<td>.65</td>
</tr>
<tr>
<td>e.g. &quot;That bear's balloons&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 possessors/1 object (2P/10)</td>
<td>.25</td>
<td>.30</td>
<td>.75</td>
</tr>
<tr>
<td>e.g. &quot;Those bears' balloon&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 possessors/2 objects (2P/20)</td>
<td>.35</td>
<td>.60</td>
<td>.95</td>
</tr>
<tr>
<td>e.g. &quot;Those bears' balloons&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2. Proportion of correct responses for each demonstrative-possessor phrase type.

As can be seen in table 4.2, SLI subjects performed at chance levels in all phrase types, suggesting that they could not rely on any strategy to interpret these constructions. It cannot be said that
they do not distinguish between plural and singular, because they passed the pre-test items that tested comprehension of plural "s" and of "that" versus "those". The added complexity of these phrase types seems to have caused them to ignore their previous knowledge and select items at random. LM subjects performed at chance level in phrase types 1P/10 and 2P/10, while AM subjects performed at above chance levels in all phrase types. Chi-square comparisons showed significant differences in the performance of SLI and LM subjects only for phrase type 1P/20, and between SLI and AM for all phrase types. Table 4.3 shows chi-square values and probabilities for each comparison. Significant results are marked with an asterisk. Note also that LM subjects' performance was significantly worse than AM subjects' for phrase types 2P/10 and 2P/20.

<table>
<thead>
<tr>
<th>PHRASE TYPE</th>
<th>CHI-SQUARE COMPARISONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SLI - LM</td>
</tr>
<tr>
<td>1 possessor/1 object (1P/10)</td>
<td>1.90</td>
</tr>
<tr>
<td>e.g. &quot;That bear's balloon&quot;</td>
<td>P=.16</td>
</tr>
<tr>
<td>1 possessor/2 objects (1P/20)</td>
<td>7.61*</td>
</tr>
<tr>
<td>e.g. &quot;That bear's balloons&quot;</td>
<td>P=.006</td>
</tr>
<tr>
<td>2 possessors/1 object (2P/10)</td>
<td>.12</td>
</tr>
<tr>
<td>e.g. &quot;Those bears' balloon&quot;</td>
<td>P=.72</td>
</tr>
<tr>
<td>2 possessors/2 objects (2P/20)</td>
<td>1.60</td>
</tr>
<tr>
<td>e.g. &quot;Those bears' balloons&quot;</td>
<td>P=.20</td>
</tr>
</tbody>
</table>

Table 4.3. Chi-square group comparisons for each phrase type (values and probabilities).
Figure 4.1 shows the number of subjects in each group who responded correctly to both items presented (100% accuracy) in each phrase type, and figure 4.2 shows the number of subjects in each group who responded correctly to at least 1 of the 2 items presented (50% accuracy or better) in each phrase type. Both figures indicate an increasing number of children providing correct responses as we move from SLI to LM to AM. One exception to this rule seems to be phrase type 2P/10 (those bears' balloon) where LM subjects did as poorly as SLI subjects.
Number of Subjects with 2 correct responses

Fig 4.1. Number of subjects with 2 correct responses in each phrase type.

Number of Subjects With at Least 1 Correct Response

Figure 4.2. Number of subjects with at least 1 correct response in each phrase type.
Figures 4.3 through 4.6 show for each phrase type the number of times subjects selected items from each of the 4 houses. For example, when given the stimulus 1P/10, shown in figure 4.3, a correct response is to select items from house 1P/10 (underlined in the X axis). Figure 4.3 confirms the pattern of random responses given by SLI subjects, as they seemed equally likely to select items from any of the 4 houses given the stimulus “that bear’s balloon” (1P/10), i.e., they showed no preference for one specific interpretation when given this phrase.

Their error patterns seem less random for phrase types with a plural object (“that bear’s balloons” and “those bears’ balloons”), where they were less likely to select the house with one bear and one balloon, though they were still willing to select the house with two bears and 1 balloon. They seemed sensitive to the plural marker on the object and used it as an extra clue, but their pattern of responses was not clear enough to warrant a clear interpretation of this fact.

LM subjects’ error responses were less random than SLI subjects’, except for phrase type 2P/10, where they clearly had more difficulty. For phrase type 1P/10 where they performed at chance level, their errors were not random, as they preferred to select the house with 2 bears and 1 balloon more often than the other two houses with 2 balloons, suggesting as hypothesized that they were allowing the demonstrative to agree with the object. For phrase types 1P/20 and 2P/20, LM subjects almost never selected houses with only 1 object.

Likewise, AM subjects were very sensitive to the plural marker on the object. Their incorrect responses were almost always towards the
house that had the correct number of objects. All results from this task are discussed in more detail in the Discussion chapter.
Given 1P/10 (that bear's balloon)

selected items from:

![Diagram showing response patterns for phrase type 1P/10]

Figure 4.3. Response patterns for phrase type 1P/10

Given 1P/20 (that bear's balloons)

selected items from:

![Diagram showing response patterns for phrase type 1P/20]

Figure 4.4. Response patterns for phrase type 1P/20
Given 2P/10 (those bears' balloon)
selected items from:

```
20 18 16 14 12 10 8 6 4 2 0
```

```
   | SLI | LM  | AM |
---|-----|-----|----|
1P/10 |     |     |    |
1P/20 |     |     |    |
2P/10 |     |     |    |
2P/20 |     |     |    |
```

Figure 4.5. Response patterns for phrase type 2P/10

Given 2P/20 (those bears' balloons)
selected items from:

```
20 18 16 14 12 10 8 6 4 2 0
```

```
   | SLI | LM  | AM |
---|-----|-----|----|
1P/10 |     |     |    |
1P/20 |     |     |    |
2P/10 |     |     |    |
2P/20 |     |     |    |
```

Figure 4.6. Response patterns for phrase type 2P/20
For this task, subjects were presented with the stimulus "Miss Piggy knocked over..." followed by 6 phrases, each containing an adjective modifying a possessor phrase (e.g. "the yellow horse's signs"). Because subjects were presented with a red and a yellow horse, who each had 2 yellow signs and 2 red signs (though there were 6 different stimulus phrases, this example will be used throughout for simplicity), they could respond by: 1) assigning the adjective "yellow" to the possessor (a correct response) by knocking over all of the yellow horse's signs; 2) assigning the adjective to the objects by knocking over all the yellow signs belonging to both horses; 3) assigning the adjective to both the possessor and the object by knocking over only the yellow signs belonging to the yellow horse; and 4) other unrelated responses. Table 4.4 shows the proportion of responses in each group for each of the possibilities described above. Response 1) "possessor" is the only correct response. Individual subjects' responses are listed in the Appendix table A.3.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ASSIGNED ADJECTIVE TO:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POSSESSOR</td>
</tr>
<tr>
<td>SLI</td>
<td>.41</td>
</tr>
<tr>
<td>LM</td>
<td>.53</td>
</tr>
<tr>
<td>AM</td>
<td>.93</td>
</tr>
</tbody>
</table>

Table 4.4. Proportion of responses according to assignment of adjective per group.
Paired t-tests showed no significant differences in the number of correct responses provided by SLI and LM subjects (t = -.74, p = .23), but significant differences were found between LM and AM subjects (t = -3.27, p = .0048) and between SLI and AM subjects (t = -4.97, p = .001). As groups, SLI and LM subjects were equally likely to err by assigning the adjective to the object or to both, but a close look at individual data shows that of the 6 LM subjects who made any mistakes, 4 erred by assigning the adjective to both only, 1 erred by assigning it to the object and 1 made the two errors (this child did not get any correct responses). Of the 8 SLI subjects who made any mistakes, only four clearly split their error types (3 assigned the adjective to the object only, and one to both only). These differences will be discussed in conjunction with results for task 2c below.

**Task 2c**

In task 2c subjects were shown sets of 2 pictures and asked to select one that matched the stimulus phrase. There were 4 types of phrases and 4 phrases of each type, for a total of 16 sets presented. Table 4.5 shows the proportion of correct responses provided by each group for each sentence (chance performance is .5, above chance performance is .7 and up). Number of correct responses given by individual subjects can be seen in the Appendix, table A.4.
Table 4.5. Proportions of correct responses for each phrase type in task 2c.

Table 4.5 shows that SLI subjects always performed at chance level and AM subjects always performed at above chance level, while LM subjects only performed at above chance level in "compound 2" phrase type. It is not clear why LM subjects did so well with "compound 2" phrases and so poorly on "possession" phrases. As a group, they don't seem to have completely disregarded the possessive "'s" and always picked the "compound" interpretation, because if they did, their performance on the "possession" phrases would be below chance level. However, that seemed to be the case for at least 3 LM subjects who always selected the compound reading (i.e., scored 0 for possession and 4 for compound). For this reason, responses for contrasting pairs were collapsed and proportion of correct responses, now based on 8 responses for "container versus compound 1" and 8 responses for "possessive versus compound 2", is shown in table 4.6.
When contrasting phrases are collapsed, only AM subjects performed at above chance levels. Chi-square comparisons showed significant differences in the performance of SLI and AM subjects as well as LM and AM subjects for both types of contrasts. Table 4.7 shows chi-square values and probabilities for each comparison. Significant results are marked with an asterisk. Note also that SLI subjects' performance was significantly worse than LM subjects' in "possession versus compound 2" contrasts, even though LM subjects did not quite reach above chance performance in these contrasts.

<table>
<thead>
<tr>
<th>CONTRASTING PHRASE</th>
<th>GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SLI</td>
</tr>
<tr>
<td>CONTAINER VERSUS COMPOUND 1</td>
<td>.55</td>
</tr>
<tr>
<td>POSSESSIVE VERSUS COMPOUND 2</td>
<td>.47</td>
</tr>
</tbody>
</table>

Table 4.6. Proportion of correct responses for contrasting phrases.

<table>
<thead>
<tr>
<th>CONTRASTING PHRASE</th>
<th>CHI-SQUARE</th>
<th>COMPARISONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SLI-LM</td>
<td>SLI-AM</td>
</tr>
<tr>
<td>CONTAINER VERSUS COMPOUND 1</td>
<td>2.01</td>
<td>17.98*</td>
</tr>
<tr>
<td>e.g. &quot;box of shoes v. box-shoes&quot;</td>
<td>P=.149</td>
<td>.000</td>
</tr>
<tr>
<td>POSSESSION VERSUS COMPOUND 2</td>
<td>5.73*</td>
<td>23.30*</td>
</tr>
<tr>
<td>e.g. &quot;cat's mug v. cat-mug&quot;</td>
<td>P=.017</td>
<td>P=.000</td>
</tr>
</tbody>
</table>

Table 4.7. Chi-square comparisons for contrasting phrases in task 2c.
Though both SLI and LM subjects had difficulty with possession versus compound 2 contrasts, LM subjects produced the possessive “s” in spontaneous speech much more frequently than SLI subjects. To investigate whether individual children in each group had difficulty with this form both productively and receptively, Pearson correlations were performed on the proportion of correct responses for “possession versus compound 2” comparisons and proportion of use of possessive “s” in obligatory contexts in spontaneous speech.

SLI subjects' production rate of possessive “s” correlated highly with correct responses for "possessions versus compound 2" (r= .70, p = .023), indicating that SLI children with higher ratios of production of possessive “s” in spontaneous speech also had higher ratios for its comprehension. For LM subjects, this correlation did not quite reach significance (r=- .59, p = .07), but it was in the inverse direction of that observed in SLI subjects, i.e., LM subjects with higher ratios of production in spontaneous speech tended to have lower ratios of comprehension. Because most LM subjects produced the possessive “s” at very high rates, this observation may not be relevant, but it seems interesting that the same 3 LM subjects who always chose a compound reading for possessive phrases had 100% accuracy in their use of possessive “s” in spontaneous speech.

**Correlations between experiment 2 tasks**

To determine whether children’s performance was consistent across tasks, Pearson correlations were performed between tasks. Because AM subjects performed at high levels in all tasks, only LM and
SLI subjects' responses were analyzed. Table 4.8 shows the correlation matrix with probability levels in parenthesis.

<table>
<thead>
<tr>
<th></th>
<th>TASK 2A</th>
<th>TASK 2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK 2B</td>
<td>.17 (P=.473)</td>
<td></td>
</tr>
<tr>
<td>TASK 2C</td>
<td>.13 (P=.588)</td>
<td>.621* (P=.003)</td>
</tr>
</tbody>
</table>

Table 4.8. Correlation matrix for experiment 2 tasks.

Given the complexity of task 2a, perhaps it is not surprising that it did not correlate with any of the other 2 tasks. Tasks 2b and 2c were highly correlated, possibly because comparable phrase structures are necessary for interpretation of both tasks. These results are discussed in more detail in the Discussion chapter.

Experiment 3

Experiment 3 was designed to investigate whether children with SLI and their peers respect principled rules in assigning binding relations. Task 3a and 3b examined whether they project full DP's using two different strategies: Task 3a attempted to determine if they recognize DP as a binding domain and task 3b attempted to determine if they recognize that inalienable possessions are inconsistent with DP projection in English. Task 3c attempted to find converging evidence for recognition of DP as a barrier for long distance wh- extraction.

task 3a

In task 3a, subjects were presented with 4 leading sentences and set of props and asked 1 question after each sentence, 2 containing a
DP (e.g., "Bert liked the decision to shave him, who got shaved?")
and 2 containing no DP (e.g., "Grover made a decision to tickle him,
who got tickled?"). After each subject acted out the sentence with
the props or pointed to a character, their responses were scored as
"coreference" with the subject mentioned (appropriate only when given
DP), or "no coreference with the subject mentioned (appropriate in
both cases). Table 4.9. shows the proportion of coreference allowed
for each sentence type per group. Individual responses are listed in
the Appendix, table A.5.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ALLOWED</th>
<th>COREFERENCE</th>
<th>IN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DP</td>
<td>NP</td>
<td></td>
</tr>
<tr>
<td>SLI</td>
<td>1.0</td>
<td>.40</td>
<td></td>
</tr>
<tr>
<td>LM</td>
<td>.90</td>
<td>.40</td>
<td></td>
</tr>
<tr>
<td>AM</td>
<td>.85</td>
<td>.50</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.9. Proportion of coreference allowed in DP and NP.

Though the 3 groups incorrectly allowed coreference in NP about
50% of the time, they seemed quite sensitive to the distinction
between the two constructions as they were less likely to allow
coreference in NP than in DP constructions. A paired t-test found
this difference to be highly significant across groups (df=29, t=6.23,
p=.000). This difference, however, is not enough to show that subjects
clearly distinguish between NP’s and DP’s, because previous research
has shown that children up to 6 years of age often violate principle B
in other linguistic environments also (e.g., Chien & Wexler, 1990).

Theories that explain this violation range from lexical learning to
pragmatic interpretation. Results of this task will be further analyzed in conjunction with task 3c in an attempt to arrive at converging evidence for the NP/DP distinction.

task 3b

In task 3b, subjects were presented with 8 opportunities to select either an inalienable possession item (Mrs. Potato Head's own body parts/clothing items) or specific items taken out of a box that exactly matched Mrs. Potato Head inalienable possessions, after hearing the stimulus, "she just touched the (or her) item" (4 stimulus sentences contained "the" and the other four contained "her"). A correct response when presented with the article "the" would be to make Mrs. Potato Head touch the item that came out of the box, and a correct response when presented with the pronoun "her" would be to make her touch one of her own items. Table 4.10 shows proportion of correct responses for "the" and "her" per group. Individual responses are listed in the Appendix, table A.6.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>PROPORTION OF CORRECT RESPONSES FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THE</td>
</tr>
<tr>
<td>SLI</td>
<td>.47</td>
</tr>
<tr>
<td>LM</td>
<td>.70</td>
</tr>
<tr>
<td>AM</td>
<td>.77</td>
</tr>
</tbody>
</table>

Table 4.10. Proportion of correct responses for "the" and "her"
There was a problem with this task that was most evident with the LM and AM subjects. After giving consistent incorrect responses for "her", at the end of the task they were shown items previously taken out of the box and asked again if they were "hers" (Mrs. Potato Head's). All children responded "yes" and gave as reason the fact that these items were identical to Mrs. Potato Head's, so they were hers too, therefore the data for "her" could not be analyzed.

Turning to the proportion of correct responses for "the", SLI subjects seemed more willing than LM and AM subjects to allow an inalienable possession interpretation to this article. However, this preference was not found to be statistically significant when paired t-tests were performed (SLI-AM: t=-1.58, df=18, p=.065; SLI-LM: t=1.09, df=18, p=.14).

**task 3c**

Task 3c was divided into two parts, both examined whether subjects would allow wh- extraction from a barrier DP. The first part consisted of 3 sets of questions containing either a verb or a verb nominalization (e.g., "how did Susie like racing?" or "how did Susie like the racing?"). Questions containing the verb could be answered by giving either a short distance response (e.g. "She liked it a lot") or a long distance response (e.g., "she liked racing fast"). Questions with the nominalization could only be correctly answered with a short distance response, and would therefore be the relevant test items. All subjects overwhelmingly preferred to answer both questions with the short distance response, making it impossible to discern whether they recognize the DP as a barrier for extraction or
they just have a bias towards giving the short distance response. (It is possible that this bias was caused because it was easier to remember whether the character liked the activity or not than to remember how the character liked to perform the activity.)

The second part of task 3c consisted of 3 questions containing a DP barrier for long distance extraction, therefore requiring a short distance response (e.g., "where did they discover the plan to ride?"). Table 4.11 shows the number of responses of each type provided by each group, as well as uninterpretable responses. Because each child responded to 3 questions the total number of responses per group is 30. The number of subjects providing each response type is included in parenthesis. Responses provided by individual subjects are listed in the Appendix, table A.7.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>LONG DISTANCE</th>
<th>SHORT DISTANCE</th>
<th>UNINTERPRETABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLI</td>
<td>8 (6)</td>
<td>2 (2)</td>
<td>20 (10)</td>
</tr>
<tr>
<td>LM</td>
<td>9 (7)</td>
<td>2 (1)</td>
<td>19 (9)</td>
</tr>
<tr>
<td>AM</td>
<td>11 (7)</td>
<td>11 (6)</td>
<td>8 (4)</td>
</tr>
</tbody>
</table>

Table 4.11. Number of long distance, short distance and uninterpretable responses given by each group.

It is not clear why subjects provided so many uninterpretable responses. When asked questions such as "when did they choose the idea to paint?", many children answered "I don't know" even after the complete story was repeated and the question asked again. Others gave
answers such as, "because they wanted to" or "because they were bored", suggesting that they could not understand the question itself. Because there were so many uninterpretable responses, this set of data was not formally analyzed, on the assumption that there was a problem with the task. In general, when responses were interpretable, both SLI and LM subjects favored a long distance response (e.g., "where did they discover the plan to ride?: answer: "to the beach"), suggesting that in their grammar there is no barrier for this extraction. AM subjects, who unlike the other subjects provided more interpretable than uninterpretable answers, seemed to allow both kinds of extraction. Of the 6 AM subjects who provided short distance responses, 4 subjects also provided long distance responses.

This task was originally designed to be analyzed in conjunction with task 3a, because children who showed sensitivity to the DP/NP distinction in task 3a, by not allowing coreference in NP contructions (e.g., "Grover made a decision to tickle him"), should also show sensitivity to the DP in this task by not allowing long distance extraction (extraction from the DP). Given the number of uninterpretable responses provided in this task, a correlation was not attempted. On the surface, the available data do not seem to support this conclusion. Of the 2 AM subjects who always provided short distance responses, one never allowed coreference in NP and one always allowed coreference in NP. The one LM subject who provided both short distance responses for that group allowed coreference in NP in one of the 2 NP sentences presented. But given the small number of interpretable responses provided, this observation cannot be generalized. Unfortunately, none of the tasks contained in experiment
3 seemed to provide enough evidence for the NP/DP distinction, whether in isolation or when the tasks were combined.

**Analysis of Spontaneous Language**

A spontaneous language sample containing at least 140 utterances was obtained from each SLI and LM subject. Each language sample was transcribed using the CHAT format and following procedures outlined in the CHILDES manual (MacWhinney, 1995). Grammatical morphemes of interest were coded as present or absent in obligatory contexts and the FREQ program contained in the CHILDES package was used to count the number of times each morpheme was used or omitted by each subject. Table 4.12 shows the grammatical morphemes analyzed, the proportion of use in obligatory contexts by each group, and the range of proportions across subjects. Detailed information on morpheme use by each subject is listed in the Appendix, table A.8 and A.9.

<table>
<thead>
<tr>
<th>MORPHEME</th>
<th>SLI</th>
<th></th>
<th>LM</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>prop.</td>
<td>range</td>
<td>prop.</td>
<td>range</td>
</tr>
<tr>
<td>IS/ARE</td>
<td>.65</td>
<td>0.2 - 1.0</td>
<td>.94</td>
<td>0.8 - 1.0</td>
</tr>
<tr>
<td>THIRD S</td>
<td>.12</td>
<td>0.0 - 0.4</td>
<td>.94</td>
<td>0.6 - 1.0</td>
</tr>
<tr>
<td>PAST ED</td>
<td>.66</td>
<td>0.0 - 1.0</td>
<td>.92</td>
<td>0.5 - 1.0</td>
</tr>
<tr>
<td>IRREGULAR PAST</td>
<td>.65</td>
<td>0.3 - 1.0</td>
<td>.96</td>
<td>0.7 - 1.0</td>
</tr>
<tr>
<td>INF TO</td>
<td>.63</td>
<td>0.0 - 1.0</td>
<td>1.0</td>
<td>1.0 - 1.0</td>
</tr>
<tr>
<td>POSSESSIVE S</td>
<td>.48</td>
<td>0.0 - 1.0</td>
<td>.96</td>
<td>0.8 - 1.0</td>
</tr>
<tr>
<td>PLURAL S</td>
<td>.90</td>
<td>0.4 - 1.0</td>
<td>1.0</td>
<td>1.0 - 1.0</td>
</tr>
</tbody>
</table>

Table 4.12. Proportion of morphemes used in obligatory contexts.

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Except for plural "s", SLI subjects were much less accurate than their language matches in providing grammatical morphemes. LM subjects showed mastery of all morphemes examined (above 90% use in obligatory contexts), while SLI subjects only showed mastery of the plural "s". Some interesting trends to note in the production of morphemes by SLI subjects are: 1) they show very close production rates for regular and irregular past, suggesting that their difficulty with this morpheme is not related to a phonological deficit that would affect regular past differentially; 2) they show more pronounced difficulty with third person singular "s", perhaps because this morpheme encodes both tense and agreement instead of just one feature; 3) they show marked difficulty with possessive "s", even though this morpheme is part of the nominal system (NP/DP) and not the verbal system as is the case for the other affected morphemes.

Pearson correlations were performed on the proportions of morpheme use in obligatory contexts by SLI children. Table 4.13 shows the matrix of correlations with their probabilities in parenthesis, significant correlations are marked with an asterisk.

<table>
<thead>
<tr>
<th></th>
<th>PAST ED</th>
<th>IS/ARE</th>
<th>THIRD S</th>
<th>POSS S</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS/ARE</td>
<td>.003 (.99)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THIRD S</td>
<td>-.078 (.83)</td>
<td>.907* (.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POSS S</td>
<td>-.068 (.85)</td>
<td>.713* (.021)</td>
<td>.728* (.017)</td>
<td></td>
</tr>
<tr>
<td>INF TO</td>
<td>.785* (.007)</td>
<td>.038 (.91)</td>
<td>-.074 (.83)</td>
<td>-.228 (.52)</td>
</tr>
</tbody>
</table>

Table 4.13. Matrix of correlations and probabilities for production of grammatical morphemes in spontaneous language.
Significant correlations were found between possessive "s" (a nominal morpheme) and two verbal morphemes (third person "s" and "is/are"), while no significant correlations were found between these verbal morphemes and past ed (also verbal), thus suggesting that the nature of their difficulty is not in whether they are part of a verbal or nominal feature, but perhaps in the type of structural relationships they require.

Other differences noted in the spontaneous language of SLI and LM subjects were an infrequent tendency for SLI subjects to substitute a/the (27 occurrences in 5 SLI children, LM subjects never did this). Also, 9 SLI children omitted the article a total of 28 times (4.6% of total article contexts), while only 2 LM subjects did so (6 times, 1 child was responsible for 5 omissions). Clearly, SLI children show difficulty in spontaneous use of articles when compared to their language matches.
CHAPTER 5

DISCUSSION

This dissertation attempted to arrive at a description of the status of the Noun Phrase structure available for children with SLI. The overall hypothesis to be tested stated that children with SLI present with limited Noun Phrase structure when compared with their normally developing peers. Assuming that the ability to project the adult structure is at least in part input-dependent, no specific claims are made as to whether a deficit is due to a processing/perceptual problem or a representational problem, as these two problems are closely related in children.

A structural limitation in children with SLI can be described more generally as a pervasive inability to project a fully hierarchical structure, or more specifically, as an inability to project the nominal functional category, the Determiner Phrase (DP). A combination of both would also be possible. If an adult NP and no DP is proposed, the projected NP must contain a specifier, a head, and a complement:

```
1) NP
   / \
  spec N'
     / \
    head complement
```
If there is no specific difficulty with functional categories per se, but with the fully hierarchical nature of phrases, then perhaps the "spec" position is missing in all phrases, including lexical and functional categories, and children with SLI might project the following structure:

2) DP
   / \
  head NP (complement)
   / \
  head XP (complement)

If both problems are present, the higher phrase may be an unspecified lexical phrase (XP), possibly an Adjectival phrase (AP):

3) XP
   / \
  head NP (complement)
   / \ 
  head YP (complement)

The general hypothesis of limited structure was broken down into three hypotheses tested in experiments 1 through 3. Each hypothesis will be examined in light of the results obtained in each experiment and in relation to the 3 structural options presented above. The general hypothesis will be re-examined in the General Discussion section.
Hypothesis 1

Hypothesis 1 stated that children with SLI show more difficulty than their peers distinguishing between specific and non-specific determiners (definite/indefinite articles). This hypothesis is important to determine whether children with SLI can project a DP. As Roeper (1995) proposed (see also de Hoop, 1992), the DP is always specific, while the NP is non-specific, therefore a DP/NP distinction is necessary to fully comprehend the definite/indefinite distinction. This distinction is dependent not only on syntactic but also on semantic relations, as well as syntactic-semantic interdependencies, therefore the DP/NP distinction is probably only one of many factors impacting on comprehension of articles. All that can be concluded after testing comprehension of articles is that children who can fully comprehend them must have all the necessary factors in place. On the other hand, if children with SLI have difficulty with the DP/NP distinction, they must show some difficulty in their understanding of articles.

Experiment 1 tested one aspect of the specific/non-specific distinction, the one-of-a-set versus the already mentioned object. Even though there are many other aspects to this distinction, it was not the intention of this experiment to provide a full account of how well children with SLI understand it. As mentioned in the paragraph above, it was expected that they would show difficulty with at least one aspect of this distinction if they have difficulty with the DP/NP distinction.

Results of experiment 1 showed that children with SLI were significantly less accurate than their age and language matches in
comprehending "the" versus "a" in the context tested. These results are not enough to show that their difficulty lies in the DP/NP distinction, but they suggest that this distinction (or lack of it) may play a role in this difficulty and set the stage for further testing.

**Hypothesis 2**

Hypothesis 2 stated that children with SLI show more difficulty than their peers understanding Noun Phrases that rely on rich hierarchical relationships. This hypothesis tests the general hypothesis directly and represents the bulk of this dissertation. Experiment 2 was divided into 3 tasks that tested subjects' comprehension of constructions that are dependent on specific hierarchical relationships. Task 2a examined their comprehension of demonstrative-possessor plural agreement; task 2b examined their comprehension of adjectives that modify possessors; and task 2c examined their sensitivity to Case marking requirements in possessive phrases and container phrases.

**task 2a**

For this task, subjects were presented with 4 types of phrases exemplified here:

a) that bear's balloon
b) that bear's balloons
c) those bears' balloon
d) those bears' balloons

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According to current linguistic theory, DP's must be projected when interpreting these phrases. The demonstrative occupies the head of the higher DP, and the NP "bear" occupies the specifier of the second DP to receive genitive case from abstract Agreement features in the head of the DP:

\[
\begin{array}{c}
\text{I)} \quad \text{DP} \\
\quad / \quad \backslash \\
\quad (\text{spec}) \quad D' \\
\quad / \\
\quad (\text{head}) \quad / \quad \backslash \\
\quad \text{that} \quad \text{DP} \\
\quad (\text{head}) \quad / \\
\quad \text{NP} \quad D' \\
\quad (\text{spec}) \quad / \\
\quad \mid \\
\quad N \quad (\text{Agr}) \quad \text{NP} \\
\quad \text{bear} \quad (\text{head}) \quad / \\
\quad (\text{head}) \quad \text{balloon} \\
\end{array}
\]

The demonstrative "that" agrees in number with the noun "bear", which constitutes a case of "head-to-head" agreement. This type of agreement differs from the agreement found between a subject and a verb, which constitutes specifier-to-head agreement (the subject occupies the specifier of IP and agreement features occupy the head of IP). A specifier-head relationship similar to the one found in the IP is obtained between the NP "bear's" (occupying the specifier of DP) and the Agreement features in the head of the DP.

As discussed in chapter 2, Rice and Oetting (1993) found that children with SLI show no difficulty producing demonstrative-noun agreement in phrases such as "that bear" and "those bears". Because children with SLI show difficulty with subject-verb agreement, they
concluded that these children's difficulty lies only in the verbal system and is not specific to agreement relations. However, they failed to note that demonstrative-noun agreement constitutes head-to-head agreement as opposed to specifier-head agreement. Though the feature agreement may be similar in both cases, the hierarchical relationships obtained are quite different.

Munn (1999) distinguished between specifier-head agreement and agreement under government (head-to-head agreement). He observed that verbal head-to-head agreement can occur in some cases when conjunct subjects appear. Though more common in other languages, it also appears in "there" constructions in English, such as in "there is a man and a woman in the room" (but *"a man and a woman is in the room"), where the verb "is" agrees with the first head of the conjunct "a man and a woman". He noted that this type of agreement is in some sense "automatic" because it appears in very restricted contexts and it cannot look beyond the first head of the conjunct. This automaticity can also be thought of as "easier" or more primitive (Munn, 1998 p.c). Therefore, the head-to-head agreement observed in demonstrative-noun number agreement cannot be equated with subject-verb agreement.

A child with limited NP structure is likely to have various difficulties with phrases a) through d). If she lacks the ability to project DP's, she might project an AP for the demonstrative, and project a single NP for the possessor phrase, so that the possessor "bear's" occupies the specifier of the NP and the noun "balloon" occupies its head, such as in ii), or "bear's balloon" becomes a compound noun such as in iii):
Note that because all the specifier positions in iii) are empty, there would be very little change in it if the child is unable to project specifier positions, such as in iv):

iv) AP
   / \nn that NP
   / \nn bear's balloon

Another possibility for the child who cannot project specifier positions would be to project another AP for "bear's" and thus not treat "bear's balloon" as a compound:
Note that in ii), iii), and iv), to obtain head-to-head agreement, the demonstrative would always agree with “balloon”, the head of “bear’s balloon” whether it is an NP or a compound. In v), head-to-head agreement can be obtained with either “bear’s” or “balloon” each one the head of its phrase. Though in this phrase both the possessor and the object are singular, a child who allows the demonstrative to agree with the object, might interpret “bear’s” as the plural “bears”, and thus select a single balloon that belongs to 2 bears.

Results of task 2a showed that SLI children’s performance was significantly worse than that of their age matches in all 4 phrase types, and significantly worse than language matches only in one phrase type (1P/20 as in “that bear’s balloons”). SLI children showed chance performance (less than 50% accuracy in a 4 option forced choice task) in all phrase types, while LM children showed chance performance for phrase types 1P/10 (that bear’s balloon) and 2P/10 (those bears’ balloon). Error responses for phrase types where children showed chance performance were further examined to determine whether they were employing a consistent strategy to interpret these phrases, thus
showing a preference in their type of responses. It was assumed that when error responses followed a random pattern (i.e., no preference for any response type), children were not able to give an interpretation to the phrases and just selected any response randomly.

When presented with phrase types IP/10 (that bear's balloon) and 2P/10 (those bears' balloon), SLI children and their language matches performed at chance levels, however their error responses showed different patterns. SLI children were equally likely to select items from each of the 4 houses (random responses) when presented with either phrase type. Given phrase type 1P/10, LM children preferred to select items from the house with 2 bears and 1 balloon, thus apparently allowing the demonstrative to agree with the object as hypothesized. Likewise, given phrase type 2P/10, LM subjects preferred to select items from the house with 2 bears and 2 objects, forcing the plural marker on the demonstrative "those" onto the object "balloon" which was not marked for plural.

SLI subjects' error responses to phrase types IP/20 (that bear's balloons) and 2P/20 (those bears' balloons) were less random. Both phrase types have the plural marker on the object. Though SLI children seemed quite sensitive to this plural marker they did not seem to restrict it to the object. Given phrase type 2P/20, they never selected the house with 1 bear and 1 balloon, but they did select the house with 1 bear and 2 balloons and the house with 2 bears and 1 balloon. Given phrase type 1P/20, they preferred to select the two houses with two bears. Because of this inconsistency in the type of responses provided, SLI children's responses do not seem to match
any of the structural options provided. It is likely that they had extreme difficulty interpreting these phrases, thus the pattern of random error responses for phrase types 1P/10 and 2P/10. The plural marker on the object in phrase types 1P/20 and 2P/20 gave them an extra clue, but it was still not enough to resolve their difficulty as they seemed to randomly assign the plural to either the possessor or the object and disregard the number information on the demonstrative.

Results from task 2a suggest that 4-year-old normally developing children optionally interpret possessive phrases such as “bear’s balloon(s)” as noun compounds, as shown by their willingness to let the demonstrative agree in number with “balloon(s).” Though normally developing 5-year-olds still showed some difficulty interpreting the rather complex phrases presented, they were able to perform at above chance levels, suggesting they can give them adult-like interpretation. Five-year old SLI children, however, did not seem able to interpret these phrases at all and responded at chance levels. Their error responses did not show a clear enough pattern to allow any conclusions about the type of structure into which they might be trying to fit the phrases. They may have gotten “garden pathed” with the phrases and unable to fit them into a consistent structure. Tasks 2b and 2c provided more insights into the nature of their difficulty.

**Task 2b**

In this task the same hierarchical relationships presented in structure 1) apply, but instead of a demonstrative that agrees with a possessor, the phrases had an adjective that modified the possessor, such as in “yellow horse’s signs”. There is less processing load in
these phrases because number agreement is eliminated, but the 
hierarchical relationship still holds, so that "yellow" should modify 
"horse" and not "signs." The adult structure for this phrase is 
presented in vi):

vi) AP
   / \
  (spec) A'
  / \ 
yellow DP
(head) / \ 
   NP D'
(spec) / \ 
   | 
 N (Agr) NP
horse (head) / \ 
(head) signs

The normally developing 5-year-old children (age matches) were 
quite accurate in assigning the adjective to the possessor only (93% 
accuracy), suggesting that they already have adult-like 
interpretation. Both SLI and LM subjects were significantly less 
accurate (41 and 53% respectively). Both groups erred by either 
assigning the adjective to the object (e.g., "the horses' yellow 
signs", as if "horse's signs" were a compound) or to both the 
possessor and the object (e.g., "the yellow horse's yellow signs" as 
if they had heard "the yellow horse's and signs'" and allowed "yellow" 
to spread to "horse" and "signs"). These interpretations are likely 
to have the following general structures:
Because the spec positions in structures vii) and viii) are empty, they could be absent from these structures. Structure viii) does not reflect the spreading effect, because it is not clear whether children obtained this effect syntactically or via some other non-syntactic mechanism. It only tries to establish a crude structure that allows for the adjective to modify both nouns.

It is also possible to have an ambiguous structure where either interpretation can be given by adding an adjunct AP thus allowing the first adjective to modify either of the following heads or both:

SLI children did not show a clear preference for one interpretation or the other. Eight SLI children provided error responses, of these, 4 gave both types of responses, suggesting that they may interpret this phrase to be ambiguous and give it a structure
such as ix). Of the other 4 children who provided error responses, 3 assigned the adjective to the object only (as in vii) and one assigned it to both (as in viii). Of the 6 LM children who provided error responses, 4 assigned the adjective to both only (as in viii), 1 assigned it to the object only (as in vii) and 1 child who did not provide any correct answers gave both interpretation (as in ix). This difference in error response pattern suggests that SLI children may favor a structure where adjunct phrases are added to fit the lexical items (structure ix). However, individual differences are clearly present, with more individual variation in the SLI group than in the LM group. Structure ix) seemed to apply to only one of the LM children, and as a whole the LM group’s responses were more consistent with structure viii).

Task 2c

Task 2c attempted to narrow the structural options available to the SLI children and their peers from a different angle. Case theory states that NP’s must be assigned Case. Individual nouns contained within a noun compound do not receive Case. Therefore, we can say “box-shoes” to describe a certain kind of shoes as a compound, i.e., the two bare nouns “box” and “shoes” are combined to form one single NP that in a sentence will receive Case from the VP or a PP. In contrast, we must say “box of shoes” to describe a box that contains shoes. The preposition “of” is only present to assign case to the separate NP “shoes”. Likewise, in the phrase “the cat’s mug”, “cat” is in a separate Noun Phrase and must receive Case, which is realized in the possessive “s”. When the possessive “s” is absent, i.e., “the
cat mug", "cat" must be interpreted as part of the compound NP "cat-mug". These contrasts are useful to determine whether children with SLI and their peers interpret possessive phrases as containing two separate NP's or as compounds. If they interpret them as two separate NP's, the first NP must occupy the specifier of a DP to receive Case.

In developing this task, it was assumed that because Case theory is part of UG, all children respect its principles, whether or not Case assignment is reflected in the surface form. So, for example, if a child hears "box-shoes" and points to the box of shoes, it cannot be claimed that "shoes" is a Caseless NP, as this is an impossibility in UG. An alternative explanation is that the Case assigner "of" is silent in this child's grammar. However, when the child hears "box of shoes" and points to the box-shoes, we must conclude that she is interpreting the phrase as a compound and does not recognize "of" as a Case assigner. The same argument is true when compounds and possessives are contrasted. A child may interpret "the cat-mug" as "the cat's mug" if she allows a silent Case marker on the NP "the cat." But only failure to recognize "'s" as a Case marker can lead to a compound interpretation upon hearing "the cat's mug."

Results obtained in task 2c showed that normally developing 5-year olds (age matches) were very accurate in discriminating between possessives and containers and their contrasting compounds. SLI subjects and their language matched peers performed at chance levels when presented with the contrasting pairs. LM subjects were significantly better than SLI subjects in discriminating between possessives and compounds, but they were still allowing a compound interpretation to possessives at high levels. Therefore, both groups
of subjects seemed to optionally accept silent Case markers/assigners as well as ignore their presence. This result is surprising because LM subjects used possessive "s" in spontaneous speech with high accuracy (present in 96% of obligatory contexts), while SLI subjects only used it in 48% of obligatory contexts. For SLI subjects, performance on comprehension of the possessive was highly correlated with its spontaneous use, while no correlation was found for LM subjects. Unfortunately, there were not enough instances of spontaneous use of compounds and container phrases to compare with their comprehension. But it seems clear that even though LM subjects showed mastery of possessives in spontaneous speech, they still had difficulty recognizing the possessive marker on a comprehension task, suggesting that their knowledge of this form is still incomplete. It also seems that both groups were able to fit two-noun strings in separate NP’s and not only in compound NP’s, as they allowed container and possessive interpretations roughly as often as compound interpretations. Such ability would suggest that both groups can project full DP’s so that no NP would remain Caseless.

An alternative explanation for these results is that both groups of subjects were interpreting the phrases presented as conjoined NP’s. Just as presented in structure viii) for "yellow horses and signs", subjects may have interpreted both "cat-mug" and "cat’s mug" as "cat and mug". Because the "cat-mug" is both a cat and a mug and the picture corresponding to the "cat’s mug" contained a cat holding a mug, either picture would match their interpretation thus leading to chance performance. The same is true for container versus compound contrasts, i.e., a picture of a box of shoes has a box and shoes, and
box-shoes are both boxes and shoes. Another possibility is that they interpreted the first noun in the 2-noun strings as an adjective and projected an AP for it, just as in structure ix) above, also leading to chance performance.

It is not possible to decide on one structure over the other based on these results alone. But when results of all 3 tasks were subjected to Pearson correlations, task 2b and 2c were highly correlated. It was argued in task 2b that there were individual differences in preference for one structure over the other, with SLI subjects showing more marked preference for an adjunct structure. Given that performance on these 2 tasks were highly correlated, it is likely that results of task 2c also reflected these individual differences in structural preference.

Can it be said that structure viii) is in some sense superior or more complex than structure ix) or vice-versa? Perhaps structure viii) is more conducive to development of more complex structures than structure ix) for 2 reasons: 1) it leads to more restricted interpretations, so that in task 2b "yellow horses and signs" specifies the color of the horses and the signs, while in structure ix) the adjective "yellow" can be applied to either noun; and 2) it has two NP’s dominated by a higher NP, which may lead to earlier recognition that each phrase has additional structural positions (i.e., specifier) that can be occupied by maximal projections, while in adjunct constructions higher phrases are independently added thus preventing the recognition of structural dependencies between the specifier and head of the same phrase.
Hypothesis 3 stated that children with SLI show more difficulty than their peers obeying principles of binding and wh-extraction that rely on Noun Phrase structure. As discussed in the Results chapter, there were methodological difficulties with the tasks contained in experiment 3 that prevented unequivocal conclusions about this hypothesis.

Task 3a examined subjects' ability to project full DP's, by testing whether they recognize the DP as a binding domain, thus allowing pronoun coreference when a DP barrier is present as in "Bert liked the decision to shave him" and disallowing coreference when only an NP is present, such as in "Bert made a decision to tickle him". All 3 groups of subjects were significantly more willing to allow coreference when a DP was present than when only an NP was present, thus suggesting that they all recognize the DP as a barrier and that they are able to project DP's. However, they were also willing to allow coreference in NP environments about 50% of the time. Because violations of principle B such as this have been observed in normally developing children of up to 6 years of age in other linguistic environments as well, results of this task could only be conclusive when examined in conjunction with results of task 3c.

Task 3c examined subjects' ability to recognize the DP as a barrier for wh-extraction, so that when confronted with the question "where did they discover the plan to ride", the DP "the plan" would prevent them from answering the question "where ride" (long distance movement) and force them to answer the short distance question "where discover." Unfortunately most children showed an unexpected

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difficulty with this task and provided answers that could not be interpreted as either short or long term movement. Many children responded to these questions with "I don't know" and many others seemed to have difficulty understanding "where" and "when" questions, and answered as if they had been asked "why." The number of interpretable responses was not enough to be analyzed in conjunction with responses to task 3a, and no conclusion could be drawn.

Task 3b also used binding principles to attempt to determine whether subjects allow the determiner "the" in inalienable possession constructions. Because in English "the arm" is a DP, adult English speakers do not allow it to be bound to the subject in a sentence such as "she raised the arm" and do not give it an inalienable possession interpretation, thus requiring a possessive pronoun such as in "she raised her arm." It was hypothesized that children who do not project DP's might allow this interpretation when the definite article is present. SLI children accepted the inalienable possession interpretation when given the definite article more often than their language and age matches, but this difference was not statistically significant. As discussed in the Results chapter, there was a methodological problem with this task also. Some children were confused by the fact that both items presented (items meant to be specific and items attached to Mrs. Potato Head) were identical and assumed that both belonged to Mrs. Potato Head.

Though results of experiment 3 are not conclusive, they suggest that all the subjects tested were able to project DP's at least some of the time, thus confirming results from the other tasks that the
difficulty children with SLI show cannot be described as a complete inability to project functional categories.

**Similarities and differences between comprehension and spontaneous production**

The most striking difference between comprehension and production was for possessive "s" in the language matched normally developing 4-year-olds. They used the possessive marker in spontaneous speech in obligatory contexts with close to perfect accuracy, while they showed chance performance recognizing possessives when contrasted with compounds in task 2c. SLI subjects were very consistent in their production and comprehension performances with close to 50% accuracy in both.

It is possible that the LM subjects are at a transitional point where they are using different structures in production and comprehension. Their production skills seem to point to an ability to use adult NP structure (with a fully specified DP), but they may revert to an earlier structure in a comprehension task where they are forced to pair the two structures together. If such a transition stage exists, it is also possible that the SLI subjects projected fully specified DP's in about 50% of their productions, suggesting that they are one step behind their language matched peers who only showed this optionality in the comprehension task.

More consistent performance in comprehension versus spontaneous production was found for the definite/indefinite article distinction. LM subjects were significantly more accurate than SLI subjects in
comprehending this distinction in experiment 1 and they never omitted articles in spontaneous production. Only 2 LM subjects ever used the indefinite article "a" when the definite article would be more appropriate (5 out of 6 substitutions were produced by one child, LM 9, who was the youngest LM subject and had the shortest MLU). In contrast, 9 SLI children omitted articles a total of 28 times (4.6% of total article contexts). SLI children also used the indefinite article where the definite article was more appropriate (a/the substitution) a total of 27 times (4% of all article contexts). These numbers seem small when compared with the total number of articles used (551 used by the SLI group, and 480 used by LM subjects), but when they are examined in conjunction with results from experiment 1, where SLI subjects were only 35% accurate comprehending the distinction between the definite and indefinite articles, they suggest that the spontaneous production data are only telling a partial story. Even though evidence of article difficulty in spontaneous production is scarce, they suggest a marked difficulty with articles. As discussed before, it cannot be concluded that this difficulty with articles is only due to a difficulty with the DP/NP distinction, but results from the other experiments in this study suggest that the DP/NP distinction (or lack of it) is at least in part responsible for inconsistencies in the use of articles.

Looking at the spontaneous production data alone, it was confirmed that SLI subjects show no difficulty marking the plural "s" in obligatory contexts, while they showed marked difficulty with all the other morphemes analyzed (is/are, third s, past ed, irregular past, infinitival to, and possessive s). All but one of these
morphemes (possessive s) are part of the verbal system, which has led researchers to believe that the verbal system is the most affected in SLI. However, the number of verbal morphemes affected is greater simply because English has more verbal than nominal morphemes. SLI subjects' use of possessive "s" correlated highly with their use of "is/are" and third "s". These three morphemes are dependent on agreement relations between specifier and head positions (of IP in the case of is/are and third s, and of DP in the case of possessive s). Their use of past tense "ed" only correlated with infinitival "to", both of which depend on the head of IP position; "to" occupies this position when the verb is infinitive, or tense features occupy this position when the verb is finite. So it is possible that the omission of verb-related morphemes are related to two distinct deficits in children with SLI; one that affects a particular position, head of IP, thus causing tense related difficulties, and another that affects specifier-head relationships, thus affecting agreement relations. SLI subjects showed a marked difficulty with third person "s" as compared to the other morphemes, possibly because this morpheme encodes both tense and agreement relations and is therefore doubly affected. However, "is/are" also encode both tense and agreement relations and are not affected to the same degree as third "s". It is possible that this difference is due to differences in movement requirements for main verbs versus copula and auxiliaries, but it is not within the scope of this dissertation to discuss these differences.

Two important conclusions are possible based on the results of experimental testing as compared to spontaneous production data: 1) production data alone can lead us to overestimate the grammatical
abilities of children, such as was the case for LM subjects’ production and comprehension of possessive “s”; and 2) Symptoms that are seemingly related, such as the omission of tense and agreement markers may be due to different underlying difficulties.

General Discussion

Combined results of experimental tasks and spontaneous language production warrant the conclusion that SLI children show limited Noun Phrase structure when compared with their language-matched and age-matched peers. Differences between SLI children and their age-matched peers were more evident because age-matches achieved above chance performance in all tasks, which suggests near adult interpretation of the stimuli tested (except for tasks in experiment 3 where methodological difficulties interfered with their performance and prevented statistical testing). Language matched subjects did not always perform significantly better than the SLI subjects, but the response patterns obtained from each group suggest important differences in the Noun Phrase structure available to them.

Language-matched subjects showed significantly better understanding of the distinction between definite and indefinite articles as well as greater accuracy in production of these articles in spontaneous language. This difference suggests that SLI children have not mastered the NP/DP distinction necessary for a full understanding of these articles.

In attempting to describe what types of NP structures are available for SLI children and their Language Matched peers, results
of the three tasks of experiment 2 led to 3 possibilities, which will be summarized here as the "adjunct structure", the "compound structure" and the "conjunct structure". Though there were individual differences present in both groups, the SLI group as a whole tended to prefer an adjunct structure, repeated here as structure x):

\[
x) \quad \begin{array}{c}
  \text{AP} \\
  / \\
  \text{(head)} \quad \text{AP (complement)} \\
  / \\
  \text{(head)} \quad \text{NP (complement)} \\
  / \\
  \text{(head)}
\end{array}
\]

The LM group seemed to prefer a compound structure (structure xi) in task 2a and a conjunct structure (structure xii) in tasks 2b and 2c:

\[
\begin{array}{c}
  \text{AP} \\
  / \\
  \text{(head)} \quad \text{NP} \\
  / \\
  N
\end{array}
\quad \begin{array}{c}
  \text{AP} \\
  / \\
  \text{(head)} \quad \text{NP} \\
  / \\
  N
\end{array}
\]

Specifier positions were purposefully omitted from these structures because of lack of lexical evidence that they exist. LM subjects may have also used a non-syntactic strategy to interpret phrases in task 2b, thus allowing a spreading effect in their conjunct
structure. No claims are made here as to how such spreading occurred. It is possible that the highly restricted environment in which the task was presented led them to look beyond syntax to resolve their difficulty with the phrases presented.

Additionally, it is not argued here that SLI children and their language matches cannot project DP's and specifier positions, but rather that they are not always projected. Evidence from task 3a, where both SLI and LM subjects seemed to recognize DP as a barrier for binding, and from the use of possessive "s" in spontaneous language production, suggest that a DP structure is available inconsistently for both SLI and LM subjects. When a DP is projected, it is also assumed that a specifier position is present as this position is essential for placement of a maximal projection and for Case assignment requirements. LM subjects seemed to project a DP more frequently than the SLI subjects, as evidenced in their spontaneous language production and their understanding of definite and indefinite articles. It was argued that SLI subjects' tendency to prefer an adjunct structure such as x) may prevent their development of specifier-head relationships that are essential in functional categories such as DP and IP.

Evidence gathered from spontaneous language use confirmed that apparent mastery of language forms in spontaneous production can be misleading. Such was the case for LM subjects' accuracy in spontaneous use of possessive "s" at the same time as they did not show mastery in comprehending this form when it was paired with compound structures. Correlations between agreement dependent morphemes such as, third "s", "is/are", and possessive "s", and their
lack of correlation with tense dependent morphemes, such as past “ed”, and infinitival “to”, suggest that SLI children’s difficulties with all these forms stem from different underlying structural difficulties that cross verbal versus nominal boundaries. Agreement dependent morphemes may be affected by an absence of specifier positions necessary for obtaining specifier-head agreement, while tense dependent morphemes may be affected by an absence or underspecification of the head of IP position. Regardless of the specific mechanisms responsible for these difficulties, it is clear from the results that SLI children show as much difficulty with the nominal system as they do with the verbal system, even though this nominal system deficit may be less obvious in language production.

Limitations of this Study and Implications for Further Study

The subject pool available for this study was limited in several ways. As is the case with most studies of children with SLI, the number of children diagnosed with this condition and available for participating in a research study is severely limited, therefore results obtained here may not reflect the broader population of children with SLI. Most of the SLI children included in this study presented with a relatively mild delay in receptive and expressive language skills as measured by the TOLD2-P and MLU. This limitation would suggest that results obtained here were more conservative than what would be expected of children with more severe delays, i.e., more pronounced differences may be found between SLI subjects and their
language-matched peers if a group of severely affected SLI subjects is
used.

There were also limitations in the selection of language-matches and age-matches. Age-matches were selected to match the SLI subjects’ age + or - 2 months. It turned out that age-matches available for this study were on average 2 months older than the SLI children. Though the + or - 2 months range is generally accepted as appropriate, because the difference was more often to the plus side, it may be argued that this group of children were not "true" age-matches. Because this dissertation places more focus on the differences between SLI subjects and their language-matches, this limitation should not significantly affect the conclusions drawn here.

The selection of subjects that match SLI subjects in language ability has long been plagued in this line of research. MLU matching is overwhelmingly preferred by researchers, but its limitations are quite obvious. SLI children’s defining feature is their frequent omission of grammatical morphemes in spontaneous language. When we calculate their MLU and attempt to match this number to MLU’s obtained from normally developing children who are not omitting these morphemes, it is clear that MLU is measuring different abilities in each group, i.e., higher MLU’s in normally developing children reflect a high rate of bound morpheme usage, while comparable MLU’s in children with SLI reflect their use of sentences containing more lexical items. Until more sensitive means of measuring language ability can be used, this limitation will be a constant in studies of children with SLI.
Another important limitation of this study is related to the methodology. Most of the comprehension tasks were newly devised and, therefore, subject to flaws. This limitation was most obvious in the tasks devised for experiment 3, where no conclusive evidence could be gathered due to problems with the tasks' design. In spite of this limitation, important data were still gathered with these tasks and they suggest that a refinement in the tasks in the future may lead to important findings.

The limitations presented here suggest several future directions for research in this area of specific language impairment. Including subjects with more severe delays and more carefully matched peers would make the results obtained here more robust. In addition, refinement of the tasks that had flaws in design would make results more easily interpretable and also more robust. But more importantly, it would be extremely helpful to devise tasks that can test the same structures both in comprehension and production, so that a more direct comparison between comprehension and production of specific forms can be made.

There are several other implications for future research that are unrelated to the limitations of this study. A thorough account of children with SLI's comprehension of Noun Phrase structures and how they relate to their production of these same Noun Phrases will provide a clearer picture of the structural representations available to these children. There are many simple and complex Noun Phrases not studied here that can provide converging evidence for a marked difficulty with these structures in children with SLI. Comparison studies of subjects exposed to a variety of languages would also
strengthen our understanding of this difficulty and at the same time provide directions for studying the nominal system in English speaking children with SLI.

It is also important to determine whether in spite of a marked difficulty with the nominal system, children with SLI show more difficulty with the verbal system. Such asymmetry might prove useful in devising treatment procedures for children with SLI. It may be more effective to focus treatment on the system that is least affected to provide a solid basis on which to build more complex structures. Though it is highly desirable to achieve a parsimonious account for specific language impairment, it is equally important to achieve one that does not ignore subtle deficits just for the sake of simplicity.
### APPENDIX

#### TABLES

**EXPERIMENT 1**

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Table A.1. Experiment 1, number of correct responses per subject given 2 trials for "the" and 2 trials for "a".
### EXPERIMENT 2 - TASK 2A

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Table A.2. Task 2a, number of correct responses per subject given 2 trials of each type.
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Table A.3. Task 2b, number of times each subject gave each response. (total of 6 items, correct response = "poss")
Table A.4. Task 2c, number of correct responses per subject for each phrase type.  
(OF = container; NO OF = compound 1; 'S = possessive; NO 'S = compound 2)
**EXPERIMENT 3 - TASK 3A**

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**TABLE A.5.** Task 3a, number of times each subject allowed coreference in DP and NP.
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**TOTAL**

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**RATIO**

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Table A.6. Task 3b, number of correct responses per subject for "the" and "her".
EXPERIMENT 3 - TASK 3C

WH-EXTRACTION

Question: “Where did they discover the plan to ride?”

Responses:

Don’t know: SL1, SL15
in the trash: SL14
the beach: SL14
they wanted to go to the beach: SL10, SL16
They wanted to ride: SL18, SL11, SL12
they thought about it:
the little girls: SL17
on the sand: SL19
in the morning: SL13

Question: “How did they hear the permission to run?”

Responses:

Don’t know: SL1, SL15, SL16
bare feet: SL10, SL17, SL13, SL14
from the teacher: SL19
microphone: SL19
wanted to: SL11, SL12
all muddy:
RUN!

Table A.7. Task 3c, Individual responses. (Continued next page)
Question: “When did they choose the idea to paint?”

Responses:

Don’t know: SL14, SL15

Last night/yesterday: SL17

they called each other: SL14, SL16

Saturday/Monday: SL10

next day: SL13

They wanted to: SL11

they didn’t like the colors: LM5

bored: SL18

on the painting: SL17

Make a picture: SL12

When they find idea: AM5

at school: LM10

that day (pointing to first picture) AM7

Question: “How did Susie like...”

“Racing?”

Don’t know: SL17, SL19, SL14

sad/not good: SL15

liket it: SL12

fast: SL18, SL13

careful: SL16

she wanted to: LM10

to the friend’s house: LM1

“The racing?”

Fast: AM1, AM10

sad/not good: SL11

good/liked it: SL110

she crashed: LM2

Table A.7 continued (Continued next page)
"How did Kathy like..."  
"Decorating?"
Don't know:
good/liked it:
red balls:
beautiful:

"The decorating?"
Don't know:
good/likes to:
Christmas:
bringing it in:

"How did Annie like..."  
"baking?"
Don't know:
liked it/good:
beautiful:
she wanted to cook:
wanted to eat it:
cooking:
fun:

goat her friend:
yellow apron:
don't know:

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<td>SL18</td>
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| SL15, SL110, SL11, SL13 | LM4 | AM10, AM9, AM6, AM3, AM4, AM2, AM7, AM8 |
| LM9, LM10 | AM6 |      |
| SL17 | LM7 |      |
| SL12 | LM6 |      |
| SL16 | LM2 |      |

| SL18, SL19, SL14 | LM8, LM5 | AM5  |
| LM1 | AM1  |      |
| LM3 |      |      |

Table A.7 continued
### SPONTANEOUS PRODUCTION

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<th>plural s</th>
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| LM  | 334    | 354.94  | 0.94   | 1.00     | 45.00   | 0.96     | 163.00 | 1.00   | 1.00   |

Table A.8. Individual use of grammatical morphemes in spontaneous speech.
### SPONTANEOUS PRODUCTION

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% of total articles | 4 % | 4.6%

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Table A.9. Total number of relevant morphemes used per subject.
REFERENCES


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