



LEXICAL COMPREHENSION AND GRAMMATICAL DEFICITS IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT

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Several accounts of specific language impairment (SLI) in children have appeared in the recent literature. One of the most explicit is that of Locke. The purpose of the present investigation was to evaluate some of the details of Locke's proposal. In the first of two studies, it was found that children with SLI who were limited to single-word utterances showed deficits in their lexical comprehension. In the second study, a number of children with SLI who had reached the grammatical stage of development showed age-appropriate levels of lexical comprehension. Although the first of these findings was in keeping with Locke's account, the second was not. Additional provisions for this proposal are suggested.

INTRODUCTION

Children with specific language impairment (SLI) exhibit significant deficits in language ability, but only minor problems in other areas of development. The hearing acuity of these children is normal, there are no traceable emotional disorders, and the children are free from gross neurological impairment. These children also score at age-appropriate levels on nonverbal tests of intelligence, although close inspection of the literature reveals that some children with SLI perform below age level on experimental tasks of cognitive ability (Johnston, 1992). English-speaking children with SLI display particular difficulty in their use of phonology and grammar. However, problems with vocabulary are also found (Johnston, 1988; Leonard, 1982; Rice, 1991).

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In recent years, there have been several attempts to account for SLI (see Bishop, 1992 for a recent review). Among the more persuasive accounts is one proposed by Locke (1992, 1993, 1994). Locke argues that children who exhibit SLI are affected by a neuromaturational delay which leads to the late emergence of words in comprehension as well as production. According to Locke, a certain amount of lexical material must be acquired by the child before a presumably time-locked grammatical analysis mechanism is activated. The optimal period of functioning of this mechanism is approximately 20 to 36 months of age, with a decline in functioning thereafter. If children are late in acquiring the requisite amount of lexical material, activation of this mechanism will be postponed, and as a result there will be a reduced period of optimal functioning of the mechanism. Grammatical analysis of the language input will be incomplete at the end of the optimal period; therefore, less efficient, compensatory mechanisms will be pressed into service for additional grammatical learning. Because these mechanisms are ill-equipped for such learning, the development of grammar in these children will remain seriously impaired.

Unlike the case for grammar, Locke assumes that lexical acquisition is normal, apart from the delay in the emergence of word comprehension. Once lexical items begin to be comprehended, lexical development proceeds at a near-normal rate. This means that children with SLI will not fall further behind their peers in lexical ability across time. On the other hand, because lexical development (following the initial delay in emergence) is approximately normal, there is no basis for expecting these children to catch up to their peers in lexical ability, at least during the early childhood years when vocabulary continues to accumulate at a rapid rate.

The purpose of this investigation was to examine the feasibility of Locke's proposal. The language profiles of two groups of children with SLI were examined. The first group exhibited speech limited to single-word utterances (SWUs) and therefore had not yet reached the grammatical stage of language development, at least in production. The second group of children primarily produced multi-word utterances (MWUs) and had clearly entered the grammatical stage of development.

STUDY 1

According to Locke, children limited to SWUs have not yet attained sufficient lexical material to permit activation of the grammatical analysis mechanism. Thus, the receptive vocabulary abilities of children with SLI who are limited to SWUs should be found to be below age level, given that these children's chronological ages (CAs) have exceeded the point at which grammatical development usually begins. Study 1 examined this assumption.

Subjects

Ten children diagnosed as specifically language-impaired served as subjects in the study. These children had participated as subjects in one of two studies of early phonological abilities of children with SLI conducted by Leonard, Schwartz, Swanson, and Loeb (1987) and Leonard, Schwartz, Allen, Swanson, and Loeb (1989). The children ranged in age from 3:0 to 3:9. There were two females and eight males. All of the children were Caucasian. The children's nonverbal IQs on the Arthur Adaptation of the Leiter International Performance Scale (Arthur, 1952) ranged from 92 to 143 ($M = 119$). All displayed normal hearing and oral motor abilities; none exhibited evidence of gross neurological impairment, nor signs of emotional disturbance.

Each of the children's speech was limited to single-word utterances according to parental report and a 100-utterance sample of spontaneous speech. The basis for their selection as subjects in the Leonard et al. (1987) and Leonard et al. (1989) investigations was their limited expressive language; receptive language ability was allowed to vary.

Procedure

At the time of their participation in the Leonard et al. (1987) or Leonard et al. (1989) study, the children were administered the Sequenced Inventory of Communication Development- Revised (SICD-R) (Hedrick, Prather, & Tobin, 1984). This test permits the computation of both an Expressive Communication Age (ECA) and Receptive Communication Age (RCA). Because the SICD-R is not limited to vocabulary items, it provides only a rough estimate of a child's accumulation of lexical material. However, for the developmental periods of 16 months and above, the receptive items deal principally with vocabulary. Locke (1994, p. 612) himself has invoked SICD test data in support of his position.

Results

Table 1 provides the ECA and RCA of each child. It can be seen that all of the children's ECAs were below their CAs. In fact, only one child's ECA was within six months of his CA.

Of particular interest were the children's RCAs. It can be noted from Table 1 that all 10 children's RCAs fell below their CAs. For two children, the gap was smaller than six months. Reference to the SICD-R norms reveals that these two children's RCAs were within 1 SD of the mean for their CA. The remaining children's scores were more than 1 SD below the mean.

Although most of the receptive items beginning at the 16-month level dealt with vocabulary (e.g., names of common objects and body parts; at-

Table 1. Chronological Age (CA), Expressive Communication Age (ECA), and Receptive Communication Age (RCA) on the Sequenced Inventory of Communication Development-Revised of Ten Children with Specific Language Impairment

Child	CA	ECA	RCA
1	3:5	3:0	3:0
2	3:3	2:4	2:8
3	3:0	1:8	2:4
4	3:6	1:8	1:8
5	3:2	2:0	3:0
6	3:6	2:0	2:4
7	3:4	2:0	2:8
8	3:9	2:4	2:8
9	3:5	2:4	2:8
10	3:4	2:0	2:8

tribute terms of size and color), it was possible to gain an impression of the children's grammatical comprehension. Two of the children passed a sufficient number of earlier administered items classified by Hedrick et al. (1984) as syntactic. Neither of the children performed correctly on these items. Seven of the children were administered receptive items that required comprehension of the relational terms *in*, *on*, *under*, and *beside*. These items were not regarded by Hedrick et al. as syntactic, presumably because no grammatical understanding was required for correct performance. All of these items involved the examiner handing the child a block and asking the child to place it in some spatial relationship relative to a box (e.g., in the box). No child performed correctly on more than two of the four items of this type.

Interpretation

Given that the children had been selected as subjects on the basis of their limited expressive language, they could in principle have displayed RCAs that approximated or even exceeded their CAs. However, only two children's RCAs approached CA level. These findings seem to lend support to the view that delays in the acquisition of grammar might be related to limitations in receptive language, including vocabulary.

Study 2

Study 2 was concerned with another aspect of Locke's proposal, namely, that following the delay in the onset of lexical comprehension, the subse-

quent lexical development of children with SLI proceeds at a near-normal rate. One consequence of such a state of affairs is that through the early childhood years, children with SLI should neither fall further behind nor catch up to their peers in their receptive vocabulary. Study 2 was concerned with the latter issue. Specifically, the study was aimed at the question of whether children with SLI who had clearly reached the grammatical stage of development would in fact show limitations in their lexical comprehension.

Subjects

The data for this study came from eight of the children with SLI whose spontaneous speech samples constitute the "Leonard corpus" in the Child Language Data Exchange System (CHILDES) Database (MacWhinney, 1995). All of the children in the Leonard corpus showed MLUs and composite scores on standardized language tests that fell more than 1 SD below the mean for their CA. The eight children selected from the corpus for the present study were singled out because they had been administered the Test of Language Development- Primary (TOLD-P) (Newcomer & Hammill, 1982), a comprehensive test of language that includes subtests of receptive language skills (see below).

The children ranged in age from 4:2 to 5:3. Three of the children were female, five were male. All of the children were Caucasian. The children's nonverbal IQs on the Arthur Adaption of the Leiter International Performance Scale ranged from 86 to 127 ($M = 105$). The children displayed normal hearing and oral motor abilities. No signs of frank neurological impairment or emotional difficulties were evident.

The children's mean length of utterances (MLUs) in morphemes ranged from 2.4 to 4.2 based on the counting conventions of Systematic Analysis of Language Transcripts (SALT) (Miller & Chapman, 1991) applied to a 100-utterance sample of spontaneous speech. These MLU values placed all of the children more than 1 SD below the mean for their CA. In addition, an examination of each child's use of grammatical morphemes revealed that all children used at least one morpheme with lower percentages in obligatory contexts than would be expected for their MLU according to the data of de Villiers and de Villiers (1973). Table 2 provides a summary of these spontaneous speech sample data.

All eight children showed composite scores on the TOLD-P that fell more than 1 SD below the mean for their CA. These scores, referred to as Spoken Language quotients, are based on the child's performance across both comprehension and production subtests. The TOLD-P also has provisions for computing Listening quotients and Speaking quotients, reflecting scores

Table 2. Chronological Ages (CAs), Mean Lengths of Utterance (MLUs) in Morphemes and Words, and Number of Grammatical Morphemes Used with Percentages Below MLU Expectations by Eight Children with Specific Language Impairment

Child	CA	MLU in morphemes	MLU in words	Number of grammatical morphemes below MLU ^a
1	4:3	2.83	2.73	5
2	5:3	4.02	3.78	1
3	5:0	4.81	4.21	4
4	4:6	4.41	3.98	2
5	4:11	3.81	3.75	5
6	5:7	2.55	2.40	4
7	5:0	3.28	2.99	4
8	4:4	3.96	3.59	4

^a Based on de Villiers and de Villiers (1973).

across the comprehension and production subtests, respectively. Because the selection of the children as part of the Leonard corpus was based on their composite scores, the Listening and Speaking quotients were free to vary within the limits permitted by the requirements of a composite score greater than 1 SD below the mean.

As can be seen in Table 3, all eight children showed Listening quotients that were higher than their Speaking quotients. However, for certain children these differences were minimal. It is noteworthy that five of the children displayed Listening quotients of 85 or higher, placing them within 1 SD of the mean for their CA.

Of special interest in the present study was the children's performance

Table 3. Spoken Language (Composite), Listening, and Speaking Quotients of Eight Children with Specific Language Impairment on the Test of Language Development-Primary

Child	Spoken Language	Listening	Speaking
1	79	91	76
2	76	85	76
3	72	85	70
4	72	82	72
5	79	85	81
6	62	70	68
7	67	79	68
8	72	88	68

Table 4. Standard Scores of Eight Children with Specific Language Impairment on the Receptive Vocabulary and Grammatical Understanding Subtests of the Test of Language Development-Primary

Child	Picture Vocabulary	Grammatical Understanding
1	8	9
2	12	3
3	9	6
4	9	5
5	9	6
6	7	3
7	4	9
8	9	7

on one of the two Listening subtests, Picture Vocabulary, for this subtest provided an estimate of the children's lexical comprehension. Appearing in Table 4 is a breakdown of the children's performance into the two Listening subtests, Picture Vocabulary and Grammatical Understanding.

The scores provided in Table 4 are standard scores. Scores between 7 and 13 fall within 1 SD of the mean for the children's CA. As can be seen, only one child scored more than 1 SD below the mean on the Picture Vocabulary subtest. Five of the children earned standard scores of 9 or higher.

The Picture Vocabulary subtest of the TOLD-P consists of 25 items, each involving the identification of the target from an array of four pictures. Testing is discontinued after five consecutive failures. In the age range of 4:0 to 4:11, children identifying as few as 6 items correctly earn a score within 1 SD of the mean; for children age 5:0 to 5:11, only 8 items must be identified correctly. This raises the possibility that the Picture Vocabulary subtest overestimated the children's true level of lexical comprehension. The Picture Vocabulary subtest in the latest revision of the test, the TOLD-P:2 (Newcomer & Hammill, 1988) contains 35 items. Several of the original items in three other subtests were also modified for the revised version.

Examination of the children's clinical records revealed that three children had been administered the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) within three months of the date of the TOLD-P administration. These three children—Child 1, 2, and 3—were among those that scored within 1 SD of the mean for their CA on the Picture Vocabulary subtest of the TOLD-P. Their standard scores on the PPVT-R were likewise within normal limits; Child 1, 2, and 3 earned standard scores of 89, 96, and 91, respectively. Thus, there was no clear indication that the children's receptive vocabulary ability was artificially inflated by the Picture Vocabulary Test of the TOLD-P.

Interpretation

The results of this study do not appear to support the notion that the development of lexical comprehension in children with SLI proceeds at near-normal rates after the initial delay in emergence. The majority of children in this study showed receptive vocabulary abilities that were in the age-appropriate range. Such a finding suggests that, if these children did experience a delay in emergence of lexical comprehension, subsequent development was faster than normal, allowing the children to catch up to their peers in this area.

DISCUSSION

Before discussing the implications of these findings, two qualifications must be noted. First, of course, the studies described in this paper were not longitudinal. Consequently, it cannot be determined that the three-year-olds in Study 1 would resemble the four-year-olds in Study 2 after one year. Likewise, it cannot be taken for granted that the children in Study 2 were limited in their receptive vocabulary when they produced only single-word utterances.

A second limitation is that the tests of language administered to the two groups of children were not the same. Therefore, it is possible that the age-level receptive scores of the children in Study 2 and the below-age-level receptive scores of the children in Study 1 were due to the particular tests administered. Of course, this problem is not an easy one to overcome; few if any tests that permit separate computations for receptive and expressive language are standardized on both three- and four-year-old children.

The findings from these two studies are consistent with certain aspects of Locke's proposal, and seemingly at variance with others. Specifically, it appears from Study 1 that children with SLI who are limited to single-word utterances are also below age expectations in their respective language abilities, including lexical comprehension. This complies with Locke's assumption that before grammatical learning begins, a requisite amount of lexical material must be understood by the child. Of course, it must be acknowledged that two of the 10 children did not conform to this pattern; although their RCAs were below CA level, they fell within 1 SD of the mean.

Although Locke was probably the first to propose a minimum receptive vocabulary size before a grammatical analysis mechanism is activated, other researchers have noted the importance of receptive vocabulary in diagnosing children with SLI at an early age. Thal and her colleagues (Thal & Bates, 1988; Thal, Tobias, & Morrison, 1991) studied a group of children between age 1:6 and 2:8 who showed no productive use of word combinations and an expressive vocabulary significantly below age level. The children differed

in their receptive vocabulary skills. One year later, it was found that the children who had poor vocabulary comprehension skills at the outset of the study remained behind in their vocabulary and grammatical development, whereas the children with age-appropriate lexical comprehension skills achieved age-appropriate levels of language production after a year. Larger receptive vocabularies, then, seemed to presage the onset of a rapid period of linguistic growth.

The present study also examined a second assumption of Locke's proposal, that lexical development subsequent to the appearance of grammar would proceed at an approximately normal rate in children with SLI. This assumption was not supported by the data. In Study 2 it was seen that a clear majority of children with SLI who were well into the grammatical stage of development – and who were clearly having problems with grammar judging from their low MLUs and grammatical morpheme difficulties – were nevertheless at age-level in their receptive vocabulary ability. These findings suggest that if the children in Study 2 had experienced an initial delay in emergence of lexical comprehension, their subsequent rate of development would have to have exceeded normal expectations.

Clearly, if our findings of age-appropriate receptive vocabulary skills are accurate, some modifications in Locke's proposal will be necessary. It is true that lexical learning is attributed largely to social cognitive processes in this account, processes that rely on mechanisms that are not time-locked and hence can proceed unabated once lexical acquisition finally begins. However, a stipulation must be added to the proposal stating that subsequent lexical development in children with SLI can not only proceed at a normal rate, but can even exceed this rate. Although it is not clear why faster-than-normal rates might occur, one possibility is the fact that once these children are in a position to acquire a lexicon, their relatively advanced non-verbal mental ages and world experiences permit them to recruit additional resources that serve to facilitate the word learning process.

The drawback to such a stipulation is that the additional cognitive and experiential resources would have to be assumed to be extremely powerful. According to a number of child language researchers, learning the meaning of certain types of words requires the child to have some minimal command of grammar. Determining the meaning of verbs, especially, seems to require sensitivity to the kinds of sentence frames in which the word enters (e.g., Gleitman, 1990). For example, adults are much more accurate in determining a verb used by mothers with their young children if they are given only a sentence frame along with nonsense words substituting for the content words than if they are permitted to observe the actual events in the interaction without the benefit of grammatical information (see Gleitman & Gleitman, 1992).

Even when there is a close correspondence between the verb used and

the actual event, syntactic information is nevertheless valuable. In fact, for some events, the choice of verb is based on perspective (e.g., *give* and *receive*, *buy* and *sell*); it is not sufficient to comprehend the names of the objects and participants. Because children with SLI continue to have problems with grammar, such syntactic bootstrapping operations might be unavailable to them.

In summary, the present study identified both strengths and weaknesses in Locke's proposal. Future attempts to evaluate this proposal should include prospective longitudinal studies in which consistent measures are employed to track lexical comprehension from the single-word to the grammatical stage of development. The results of such research might reveal irreparable defects in the proposal. However, the findings of the present investigation suggest that the proposal has sufficient merit to justify the effort.

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