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High-frequency verbs and verb diversity in the spontaneous speech of school-age children with specific language impairment

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Abstract

Low verb diversity and heavy reliance on a small set of high-frequency 'general all purpose (GAP)' verbs have been reported to characterize specific language impairment (SLI) in preschool children. However, discrepancies exist about the severity of this deficit, particularly in whether these children's verb diversity is commensurate with their MLU level and whether verb diversity is more severely affected than general lexical diversity. Conflicting findings have been reported regarding the use of GAP verbs. This relatively large ($n = 100$) study extended the investigation of lexical diversity and high-frequency verb use to school-age children with SLI and NL peers and examined a particular hypothesis concerning the role of high-frequency verbs in language development. No differences were found between groups in general lexical diversity or verb diversity in samples of a set number of tokens. The results did not suggest that verb diversity constitutes an area of specific deficit in spontaneous production for children with SLI. SLI and NL groups were indistinguishable in high-frequency verb use. Extensive use of high-frequency verbs by both groups indicates that their use is part of normal development. Results are reported that support the hypothesis that high-frequency verbs act as prototypes for major meaning categories, permitting semantic and syntactic simplification with minimal losses in information value.

Keywords: specific language impairment, lexicon, verb use, school-age.

Introduction

In recent years, the investigation of language development in children with specific

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language impairment (SLI) has shifted to an increased focus on verb learning and verb use motivated largely by theoretical considerations (Rice 1991). Verbs may be expected to be more difficult than nouns conceptually given their relational meanings that require the language user to take into account several people or objects at the same time (Gentner 1982). Second, verbs play a central role in sentence structure (e.g. Haegeman 1994). Poor mastery of verbs would, therefore, have the potential of having far-reaching consequences in language development. Investigations of verb learning and use by children with SLI have uncovered deficits in a number of areas including semantic, syntactic and morphological aspects, which support the claim that inordinate difficulties with verbs are characteristic of SLI (Johnston *et al.* 1981, Watkins and Rice 1991, King and Fletcher 1993, Rice and Bode 1993, Watkins *et al.* 1993, Kelly and Rice 1994, Rice *et al.* 1994, Oetting *et al.* 1995, Loeb *et al.* 1996, 1998, 1997a, b, Conti-Ramsden and Jones 1997, Fletcher *et al.* 1997, Grela and Leonard 1997, Kelly 1997, Hadley 1998a). Among the reported verb limitations in preschool children with SLI are a small verb lexicon and, related to this restricted verb diversity, a tendency of children with SLI to rely on a small set of verbs with non-specific meanings, referred to as general all purpose (GAP) verbs (Rice and Bode 1993, Watkins *et al.* 1993). In addition, investigation of lexical learning processes has indicated that children with SLI demonstrate particular difficulty with verb learning in a naturalistic context (Quick Incidental Learning) compared with children with normal language development (NL) (Oetting *et al.* 1995), and that, although initial learning of verbs can be enhanced by increasing the input frequency, children with SLI demonstrate poor retention of verbs, suggesting a limited ability to transfer them to long-term memory (Rice *et al.* 1994). Over time, these limitations should have the effect of limiting the verb lexicons of children with SLI. Nevertheless, attempts to replicate the findings of Rice and Bode (1993) and Watkins *et al.* (1993) have been inconsistent (Conti-Ramsden and Jones 1997, Kelly 1997, Loeb *et al.* 1997a, b). In particular, it remains unclear whether children with SLI are deficient in verb diversity only when compared with NL children matched on chronological age (CA) or also when compared with NL children matched on mean length of utterance (MLU). Second, the question whether a verb-specific deficit exists that exceeds a more general lexical deficit has not been resolved (Watkins *et al.* 1993, Conti-Ramsden and Jones 1997, Grela and Leonard 1997, Loeb *et al.* 1997a, b). Although possible reasons for heavy reliance on GAP verbs are speculative at this point, some researchers have suggested that frequent GAP verb use may reflect a lexical problem (Rice and Bode 1993, Loeb *et al.* 1997a, b, Olswang *et al.* 1998), and that GAP verbs may represent a coping mechanism that helps compensate for a limited verb diversity (e.g. Rice and Bode 1993). Recently, Olswang *et al.* (1998) recommended that production of GAP verbs be used clinically as a red flag to help differentiate toddlers with language impairment requiring intervention from those for whom a wait and see approach might be advisable. However, failure to find significant differences in GAP verb use between children with SLI and peers with NL has led others to question that children with SLI demonstrate unusual reliance on these verbs (Conti-Ramsden and Jones 1997, Kelly 1997).

Verb diversity

Watkins *et al.* (1993) conducted a study of verb use by preschoolers with SLI as well as NL controls from which they concluded that preschoolers with SLI

demonstrated striking limitations in verb diversity. The children with SLI were similar to control groups of NL children matched on CA and MLU in terms of overall type-token ratio (TTR), which was taken as an indication of similar general lexical diversity. However, when the TTR measure was restricted to verbs only (vTTR, verb types/verb tokens), a significant difference emerged between the SLI children and both control groups, with lower vTTR in the SLI group. Watkins *et al.* concluded that the preschoolers with SLI had a verb-specific lexical deficit and that this deficit was more severe than would have been predicted based on these children's MLU. They further pointed out that the low vTTR might indicate problems in learning verbs or with verb retrieval during production.

Subsequent investigations have not consistently replicated evidence that verb limitations in SLI exceed expectations based on MLU or that the deficit is verb-specific, that is exceeding more general lexical limitations. Conti-Ramsden and Jones (1997) investigated the verb use of three young children with SLI videotaped in mother–child interactions over 2 years and compared the results with an existing database of NL children matched on MLU. The children with SLI used fewer verbs (total number of verbs, NV), fewer different verbs (total number of different verbs, NDV) and more nouns than the NL controls. In terms of vTTR, however, half the children with SLI were within the normal range or above. Loeb *et al.* (1997a, b) used the MacArthur parent report checklist (Fenson *et al.* 1993) to examine verb vocabulary among preschool children. Children with SLI used fewer words and fewer action words than CA-matched NL children. When compared with MLU-matched NL children, however, the children with SLI did not differ in the overall number of words but actually used more action words. These findings indicate a general rather than a verb-specific lexical deficit. Furthermore, this deficit does not exceed expectations based on MLU. Grela and Leonard (1997) computed vTTR from spontaneous language samples of preschool children with SLI as well as groups of NL children matched on age and MLU and found no group differences in verb diversity as indexed by vTTR.

The disparity in verb diversity findings is related in large part to differences in the metrics used, involving both the items used for diversity counts: types, tokens or their ratio, and sample size. These are factors that critically influence the results and their interpretation, making direct comparisons across studies difficult. Both Watkins *et al.* (1993) and Grela and Leonard (1997) used vTTR, whereas Conti-Ramsden and Jones (1997) used number of types and tokens, while also reporting the ratio of these, and Loeb *et al.* (1997 a, b) used verb types only. Most of the studies defined their sample sizes in terms of number of utterances, but the actual number varied across studies from 80 to 185 utterances (Conti-Ramsden and Jones: 80 and 100 utterances depending on MLU level; Grela and Leonard: 185; Watkins *et al.* 1995: 50 and 100; Watkins *et al.* 1993: 100). Watkins *et al.* (1995) also reported samples equated in terms of 100 and 200 word tokens. The sample size in Loeb *et al.* is determined by the number of verb types on the MacArthur parent report checklist, which is 103 'action words'.

Several researchers have discussed the problems associated with the use of various lexical diversity measures in samples whose length is based on a set number of utterances (e.g. Richards 1987, Klee 1992, Richards and Malvern 1997). Traditionally, NW, NDW and TTR are computed from such samples, typically including 50 or 100 utterances (e.g. Miller 1991). This practice has persisted despite warnings of their problematic nature. Concerns have been raised repeatedly about

the shortcomings of TTR, including its insensitivity to developmental change and potential for misleading results (e.g. Richards 1987, Klee 1992, Watkins *et al.* 1995, Richards and Malvern 1997). The problem with using samples of a set number of utterances is that although each sample has the same number of utterances, the mean length of the utterances within each sample varies. This introduces a confound, whereby samples with longer utterances (higher MLU) will have a higher number of tokens and higher number of types. However, the ratio of the type and token counts varies with sample size because words tend to be repeated more often in longer samples. Any differences in lexical diversity are thus related to differences in MLU. Or, conversely, a lack of difference may be expected if groups are matched on MLU. TTR is also susceptible to this confound and has been shown to vary as a function of utterance length. In addition, TTR has the potential for misinterpretation stemming from the fact that either an unusual numerator or denominator can influence the ratio. Traditionally, TTR is viewed as a measure of lexical diversity, where a higher TTR is considered to indicate more diversity. However, Richards and Malvern (1997) pointed out that language development can result in the opposite scenario. As lexical diversity increases, so does MLU, resulting in a large denominator that overshadows a more modest increase in the numerator. This also makes predictions about the direction of any differences between children with normal language and language impairment difficult.

To come back to the studies of lexical diversity reviewed earlier, all those studies using language samples equated the samples based on number of utterances and are thus all subject to the confound of utterance length. In addition, the actual number of utterances included varied across studies, further complicating meaningful comparisons that would clarify the conflicting findings. Some examples from these studies illustrate how the resulting picture can change depending on what measure is applied to the same data. Watkins *et al.* (1995) reported significant group differences in NDW between preschoolers with SLI and peers with NL where, for these same groups, no group difference was evident in TTR. Watkins *et al.* pointed out this discrepancy and concluded that the component measures, NW and NDW, were more informative than TTR and should be used instead. Conti-Ramsden and Jones (1997) found that half of their children with SLI fell within the normal range when their data were expressed in terms of vTTR. However, the normal-range TTR masked the fact that these children used both fewer verbs and fewer different verbs than did the NL control children. Further, Watkins *et al.* (1993) interpreted the significantly lower vTTR of their group of children with SLI as compared with the MLU-matched group of children with SLI as evidence of strikingly low verb diversity. However, inspection of the component measures, which were also reported, reveals that the groups were almost identical in terms of NDV (23 versus 24), whereas the SLI group had a larger number of verb-tokens (55 versus 48), and, hence, a lower vTTR. The fact that the children with SLI had the same number of different verbs as the children with NL with a higher number of tokens indicates that they had a greater tendency to repeat verbs in their samples. However, this result points to a less severe deficit than would be the case if both component measures were depressed.

One of the procedures that has been proposed as an alternative that would control the influence of MLU on lexical diversity measures is the use of the component measures, NW and NDW instead of combining them in a ratio measure. Miller (1991) showed that both component measures increased linearly with age

(which is why TTR remains constant, as previously inferred from Templin 1957). However, he also showed that each component contributed significantly to age prediction, suggesting that each measures a different aspect of language development and that the two components should therefore be analysed separately. Richards (1987) pointed out the influence on TTR of the number of tokens used in its computation and advocated that it be based on a standard number of tokens. Similarly, Watkins *et al.* (1995) preferred the component measures to TTR because they showed TTR to be misleading, as discussed above. Furthermore, they demonstrated that, for their sample of children, NDW produced the same pattern of group differences for samples of 50 and 100 utterances, and for samples of 100 and 200 tokens. They concluded that NDW is more robust than TTR to variations in sample size. Klee (1992) advocated the use of NDW based on its ability to differentiate groups of children with normal language and children with language impairment. However, although NW and NDW avoid the problems inherent in the ratio measure, they are still sensitive to the influence of length of utterance when samples are equated based on number of utterances (see discussion in Richards and Malvern 1997). The absolute number of words and different words is, of course, greater in longer samples. Another alternative is to equate samples based on number of tokens rather than on utterance length. Richards and Malvern (1997) discussed this procedure as one viable alternative in the measurement of lexical diversity without confounding the measure with utterance length. Both Klee (1992) and Watkins *et al.* (1995) included this measure. Watkins *et al.* found that the same pattern of group differences held in samples of 100 and 200 utterances. Klee computed TTR based on 100 and 200 word tokens (TTR100 and TTR200). He concluded that these were, unlike their counterpart computed from 50 utterances, sensitive to development, but did not find them to have diagnostic value. Thus, age-matched groups of children with SLI and NL were readily distinguished by NDW from 50 utterances, but not by TTR once the influence of their different MLU had been removed by basing the sample size on a set number of tokens.

In summary, interpretation of previous studies of lexical diversity and verb diversity among preschool children is complicated by methodological differences and by the failure of these studies to control for the influence of MLU on lexical diversity counts. At this time, therefore, claims of a verb-specific lexical deficit among preschoolers with SLI must be viewed as open to question. Conflicting findings also exist among studies that used samples equated on number of tokens with one study finding significant group differences in general lexical diversity (Watkins *et al.* 1995), and another study concluding that the measure did not differentiate the groups (Klee 1992). These two studies also differed in the statistical procedures used to evaluate group differences. Another factor that may explain some of the differences in the findings of previous studies of vocabulary diversity in children with SLI is the sampling context. Watkins *et al.* (1993) and Grela and Leonard (1997) used conversational samples collected in free play interaction with the examiner. Conti-Ramsden and Jones (1997) examined language production in mother–child interaction, whereas Loeb *et al.* (1997a, b) used a parent report checklist measure. Substantial differences have been found between language samples of different sampling contexts (see discussion in Hadley 1998b). Although parent report measures are a reliable source of information on the language use of young children and correlate highly with language sample measures (Dale 1991, Elin Thordardottir and Ellis Weismer 1996), it is recognized that they provide different information

than language samples. Because the parent observes the child over a long period and in different contexts, the parent report reflects what the child knows rather than what the child uses in a given situation (Bates *et al.* 1988). In addition, a parent report checklist addresses only the number of verb types, not verb-tokens. It is clear from the above discussion of lexical diversity measures that differences in the computation method can produce dramatic differences in results which may upon closer inspection be related to factors other than lexical diversity *per se*. Equating samples based on number of tokens rather than in terms of number of utterances provides a way of separating lexical diversity from utterance length.

General all purpose (GAP) verbs

The suggestion that preschool children with SLI may use GAP verbs more frequently than NL children was first made by Rice and Bode (1993) who examined verb use by three preschoolers with SLI. Examination of verb frequencies in these samples uncovered a small set of verbs that were used frequently by each of the children. Comparison with a normative database (Huttenlocher *et al.* 1983) suggested that preschoolers with SLI might rely on this set of verbs to an unusual extent for their age, and that they resembled younger NL children in this respect. The set of high-frequency verbs, referred to as GAP verbs, included verbs such as *go*, *make*, *do* and *look*. It was noted that among the shared characteristics of these verbs is a non-specific meaning. It was further suggested that these verbs appeared to be similar in some respects to 'light verbs' described by Pinker (1989). Whereas Rice and Bode examined longitudinal data, Watkins *et al.* (1993) investigated GAP verb use in a cross-sectional sample of children with SLI and control groups of NL children matched on age and on MLU. The two studies yielded very similar GAP verb lists. However, Watkins *et al.* did not find significant group differences in the use of these verbs. Subsequent attempts to confirm that GAP verbs are used more by SLI children than NL children have also not found significant group differences, with the exception of Loeb *et al.* (1997b), who reported that children with SLI, as documented by parent report checklist, produced fewer GAP verbs (types) than CA-matched peers, but did not differ from MLU-matched peers in this respect. Conti-Ramsden and Jones (1997) reported that GAP verbs made up a similar proportion of the total verb use for their three preschool participants with SLI and for the NL controls matched on MLU. Kelly (1997) found that preschoolers with SLI were similar to CA-matched NL peers in GAP verb use in an elicitation task. Both of these groups made more use of specific verbs and less use of GAP verbs than the younger MLU-matched children. It is interesting to note that, in Loeb *et al.*'s investigation, children with SLI had fewer rather than more GAP verbs than CA-matched NL children. A similar pattern is seen in Watkins *et al.*'s study. Although between-group differences in number of GAP verb types are small and not significant, the GAP verb set of the SLI children was slightly smaller than those of the other two groups (15 verbs for the SLI group versus 19 and 22 for the MLU- and CA-matched NL groups respectively). This suggests that children of a more advanced language stage actually have a larger repertoire of GAP verbs, which is contrary to the prediction based on the assumption that GAP verb use reflects immature language development.

Possible reasons for use of GAP verbs

It has been proposed that reliance on GAP verbs may be an adaptive strategy in the presence of difficulty with more specific verbs. This may be the case for both children with SLI and NL children. However, exactly how the use of these verbs simplifies the task is a matter of speculation. Rice and Bode (1993), in their discussion of this issue, noted that their GAP verbs did not form a cohesive group grammatically. Among the shared characteristics that were noted was the fact that all the GAP verbs were monosyllabic, but, perhaps most important, were shared semantic characteristics, namely that the GAP verbs were all non-specific in meaning. Rice and Bode suggested that GAP verbs might be used as substitutes for more specific verbs that might not be available in the child's lexicon or that the child might not be able to retrieve under discourse pressure. In the present study, it is proposed that additional insights into the possible role of GAP verbs may be gained from a look at a classification of verbs that takes into account the close relationship and interdependence between meaning and syntactic behaviour.

A great deal of research has been devoted to the investigation of how subtle differences in verb meaning call for variations in the syntactic expression of the verb's arguments, or, conversely, how shared meaning calls for similarities in syntactic behaviour. Based on a compilation of a substantial body of research into this matter, Levin (1993) has grouped a large number of English verbs according to their shared meaning and syntactic behaviour. This resulted in 49 verb classes each of which comprises verbs similar in syntactic and semantic characteristics and may thus be said to be both syntactic and semantic near-synonyms. The GAP verbs reported by Rice and Bode (1993) and Watkins *et al.* (1993) constitute a total of 13 verbs, nine of which overlap between the two studies. When these verbs are grouped using Levin's verb groups, they can each be shown to fall into separate semantic/syntactic groups, with the exception of the verbs *want* and *need*, which are both members of the group *verbs of desire*, and *come* and *go*, which are members of *verbs of motion*. Each of Levin's 49 verb groups is further subdivided into subgroups. In some cases, GAP verbs are members of a subgroup that is more limited in possible syntactic variations than other subgroups. For example, *look* is a member of a subgroup of *search verbs* that allows only one type of alternation, whereas many of the other subgroups allow two or three different alternations. To explain further, verbs that alternate allow their arguments to be expressed in more than one way syntactically. The arguments of *search verbs* are the agent, the entity sought, and the location where the search is carried out (Levin 1993). The subgroup of *hunt verbs* allows three types of alternations: (1) Ida hunted the woods for deer, (2) Ida hunted for deer in the woods and (3) Ida hunted deer in the woods (Levin 1993: 70). Only the second of these options is allowed by the verb *look*. The distribution of GAP verbs among verb categories indicates that GAP verbs may serve as prototypes for major meaning categories of verbs. Their use would allow children to limit the number of verbs that they need to memorize and retrieve. At the same time, GAP verb use would allow children to avoid the syntactic variations that would be entailed by verbs with more specific meanings. GAP verb use would thus permit simplification in both the semantic and syntactic domains with relatively little effect on meaning.

The GAP verb lists reported by Rice and Bode (1993) and Watkins *et al.* (1993) were based on language samples of preschool children. In this study, which focused

on school-age children, it was anticipated that if GAP verbs were still used once children reached school age, the composition of this high-frequency verb repertoire would have changed. Based on the hypothesized role of GAP verbs as prototypes of meaning categories, it was predicted that new high-frequency verbs would represent semantic/syntactic categories not previously represented by the preschool GAP verbs, thus adding to the repertoire of meaning categories represented.

Purpose of the study

The purpose of this study was to investigate verb diversity and high-frequency verbs in school-age children with SLI and NL. Given previous findings on preschool children and young school age children, the specific questions addressed were as follows. First, it was asked whether verb diversity is an area of particular difficulty for school age children with SLI. This involves investigation of whether limitations in verb diversity are more severe than general lexical deficits and whether they exceed expectations based on MLU. Second, it was asked whether school age children with SLI use high-frequency verbs to a greater extent than NL controls. Third, the present authors evaluated a particular hypothesis regarding the role of high-frequency verbs in normal development, namely, that they serve as prototypes of major semantic/syntactic verb categories.

Methods

Participants

The participants in this study were 100 school-age children, including 50 children with SLI with a mean age of 7 years 9 months (SD 12 months) and 50 children with NL matched on CA with a mean age of 7 years 8 months (12 months). In addition, subsets of 25 children from each group were matched on MLU. The 50 children with SLI included 26 boys and 24 girls. The racial/ethnic composition of the SLI group was: 36 white, nine African American, three Asian children, one Hispanic and one Native American child. The NL group included 24 boys and 26 girls; 48 white and two African American children. Maternal education, which was used as an index of socio-economic status (SES), was 13.84 years (SD 2.45) for the SLI group and 16.14 years (2.43) for the NL group. All children were monolingual speakers of American English. The data used for this investigation were collected as part of several studies (Ellis Weismer and Hesketh 1996, 1998, Ellis Weismer *et al.* 1999); a detailed description of selection criteria is provided in these published reports.

All children in this investigation had normal physical, motor, cognitive and emotional development based on parent report and school records. NL children had no history of academic difficulty or problems with language development. Children with SLI had been diagnosed by a certified speech-language pathologist and were receiving language intervention in their schools in the Madison Metropolitan School District (Wisconsin) or had recently been identified by a multidisciplinary team as requiring clinical services. In addition to receiving speech-language services, 21 of 50 children in the SLI group had also been identified as having a learning disability or were receiving special programming for reading difficulties. At the time they participated in the original studies, all children passed a pure tone screening of hearing sensitivity (20 dBHL at 0.5, 1, 2 and 4 kHz),

tympanometric screening and a visual acuity screening. A screening measure adapted from that of Robbins and Klee (1987) was used to establish that structure and function of the oral mechanism was within normal limits for all children. Phonological skills were evaluated from spontaneous language samples, using an informal assessment protocol to inventory each child's phonetic repertoire, word shapes and phonological processes (cf. Smit 1994). None of the children exhibited phonological simplification processes or other phonological deficits that compromised their overall speech intelligibility or ability to produce morphological markers.

Tables 1 and 2 summarize the performance of the CA- and MLU-matched groups of children on language and cognitive assessment measures administered as part of the test protocol of the original studies in which the children participated. All of the children in this study exhibited normal range non-verbal cognitive skills as assessed by the Columbia Mental Maturity Scale (CMMS; Burgemeister *et al.* 1972), though the mean score for the NL children was significantly higher than that for children with SLI. Children in the NL group scored within normal range on each of the language measures (better than − 1 SD), whereas children with SLI scored below − 1 SD on one or more of the language measures. Measures used to assess receptive language abilities included Subtest V of the Token Test for Children (DiSimoni 1978) and either the Peabody Picture Vocabulary Test—Revised (Dunn and Dunn 1985) or the Grammatical Morphemes subtest of the Test of Auditory Comprehension of Language—Revised (TACL-R, Carrow-Woolfolk 1985) (60 children received the PPVT-R and 40 children were administered the TACL-R). Productive language abilities were assessed from narrative language samples that were analysed using Systematic Analysis of Language Transcripts (SALT; Miller and Chapman 1993). Indices included MLU in morphemes and selected productive language features based on the SALT analyses (omitted words, omitted bound morphemes, word and utterance errors, utterances with mazes, number of different

Table 1. Background characteristics of groups of children with SLI and NL matched on chronological age (means and SD)

Variable	SLI ($n = 50$)	NL ($n = 50$)
Age	93.62	92.96
(months)	SD 12.51	12.15
MLU*	7.18	9.32
	2.24	1.94
PPVT-R*	94.56	117.85
Standard score	10.94	17.07
TACL-R*	41.00	52.85
Standard score	7.93	8.17
TTC*	494.32	501.46
Standard score	6.33	3.80
CMMS*	103.50	113.38
Age deviation score	9.81	11.16

MLU, Mean Length of Utterance in Morphemes, Narrative sample; PPVT-R, Peabody Picture Vocabulary Test—Revised; TACL-R, Test of Auditory Comprehension of Language—Revised; TTC, Token Test for Children; CMMS, Columbia Mental Maturity Scale.
*$p < 0.001$.

Table 2. Background characteristics of groups of children with SLI and NL matched on mean length of utterance (means and SD)

Variable	SLI ($n = 25$)	NL ($n = 25$)
Age***	100.28	84.04
(months)	SD 9.18	8.52
MLU	8.62	8.61
	1.86	1.80
PPVT-R*	89.20	99.08
Raw score	8.40	15.10
TACL-R	32.93	37.80
Raw score	5.30	15.74
TTC**	14.12	17.20
Raw score	3.86	2.18
CMMS**	102.88	114.20
Age deviation score	10.51	12.39

MLU, Mean Length of Utterance in Morphemes, Narrative sample; PPVT-R, Peabody Picture Vocabulary Test—Revised; TACL-R, Test of Auditory Comprehension of Language—Revised; TTC, Token Test for Children; CMMS, Columbia Mental Maturity Scale.
*$p < 0.05$; **$p = 0.001$; ***$p < 0.001$.

word roots). MLU and the other productive language features were compared with Reference Database norms collected on Madison area children using SALT Profiler. Results of *t*-test analyses indicated that the group with SLI performed significantly ($p < 0.001$) worse on each of the language measures than the CA matched controls (table 1). The subsets of children matched on MLU did not constitute an overall language match, as these groups differed significantly on certain other areas of language functioning (table 2).

Procedure

Analysis of verb diversity and high-frequency verb use was based on spontaneous language samples, which were all collected by a single examiner during 15-minute interactions with each child. Children were asked to describe a book, movie, school activity or other topic of special interest to them. The samples were transcribed orthographically according to SALT conventions in conjunction with the studies for which they were originally collected. The average length of the samples was 117 child utterances (minimum 75, maximum 189). MLU, used for matching of participants, was based on the first 100 complete and intelligible utterances of each sample, except in nine cases in which fewer than 100 such utterances were collected (of these, five samples had over 90 complete and intelligible utterances). The analysis involved the middle utterances of each sample and included complete utterances as well as partially unintelligible, revised and abandoned utterances. Utterances with mazes were included, but words within mazes were not analysed. Analysis of high-frequency verbs included the 50 middle utterances, whereas verb diversity counts involved as many utterances as required to obtain a set number of verb and word tokens. Selection of the 50 middle child utterances was based on requirements for an analysis of argument structure use that was also carried out for these same

samples (Elin Thordardottir and Ellis Weismer 1999). The analysis of verb use included a total of over 5000 child utterances.

Analysis of verb diversity and high-frequency verbs included all lexical verbs, phrasal verbs and copulas (linking verbs). Excluded were verbs that have mainly a grammatical function, that is, auxiliary verbs, semi-auxiliaries such as *have to*, *going to*, and *use to* and modal verbs. Previous verb diversity studies (Rice and Bode 1993, Watkins *et al.* 1993, Conti-Ramsden and Jones 1997) have typically excluded auxiliaries, semi-auxiliaries and copula forms. In this study, copulas were included. As noted above, many previous studies of verb diversity in SLI have excluded copulas, presumably because they are viewed as non-content verbs. Whereas the copula *be* can be adequately viewed as a relatively low-content form, English has a fairly large number of other copulas that differ substantially from each other in meaning. Among those encountered in this study were copulas such as *feel*, *get*, *look like* and *seem*. The verbs *be*, *have* and *do* were included when they were main verbs, but excluded when they were auxiliaries.

General lexical diversity and verb diversity were measured by counting the number of different words and verbs in samples whose size was based on number of tokens in order to avoid the influence of sample size on token counts inherent when samples are equated based on a standard number of utterances. The sample size based on number of tokens is limited by the maximum number of tokens available in the smallest sample in the corpus. The sample size was 315 word tokens for general lexical diversity and 80 verb-tokens for verb diversity (although three of the 50 children with SLI turned out not to meet this criterion, resulting in a mean number of verb-tokens of 79.16, SD 3.84). The resulting measures are the number of different verbs in 80 verb tokens (NDV80) and the number of different words in 315 word tokens (NDW315). The number of utterances required to obtain these numbers of verb-tokens (UTT80V) and word tokens (UTT315W) is also reported. In addition, the number of words contained in the 80-verb-token segment is reported as well as vTTR for 80 verb tokens. To allow comparison with previous studies and to highlight the differences in results obtained when samples are equated based on a standard number of utterances versus on number of tokens, the authors also computed the conventional TTR, computed from 50 utterances, as well as the component measures, types and tokens for 50 utterances.

In this study, a specific criterion was set of a frequency of twice or more the average verb frequency for the identification of 'high-frequency verbs'. The average verb frequency was determined for each group of children. Verb lists from individual children in the group were pooled, and from this pooled list the frequency of use of each verb for the group as a whole was determined. The computation of the average verb frequency excluded the copula *be* because its frequency far exceeded that of any other verb in all the samples and it was felt that its inclusion would unduly inflate the average verb frequency. Subsequent examination revealed that the resulting list of high-frequency verbs was unaffected by whether the copula *be* was included in the calculation of the mean verb frequency. The group analyses were confirmed by analysis of individual data for a subset of participants. Evaluation of high-frequency verbs involved the middle 50 utterances of each sample and involved the relative frequency of different verb types within these utterances.

Reliability

The accuracy of the orthographic transcription and coding of bound morphemes was verified as part of the studies for which the samples were originally collected

revealing a morpheme to morpheme inter-rater agreement of 97.5%. Subsequent analyses involving lexical diversity and number of utterances were computer-generated using the SALT program. Coding of verbs for analysis of verb diversity and frequency was done by hand. Reliability was ensured by recoding of 10 randomly selected samples (10%) by an independent scorer. Five of the recoded samples were from children with SLI and five from NL children. Inter-rater agreement was 97.7%.

Results

Verb diversity

Measures of general lexical diversity and verb diversity in sample segments based on number of word and verb tokens are presented in table 3. Group differences for these measures were evaluated by one-way ANOVA ($\alpha = 0.01$). Effect sizes are reported in terms of η^2. As is evident from table 3, no significant group differences were found in the number of different verbs or words for either CA- or MLU-matched groups of children. However, CA-matched groups differed significantly in the number of utterances required to produce the standard number of verb and word tokens. The group of children with SLI required a mean of 70.88 utterances to produce 80 verb tokens, whereas the group of children with NL required only 56.44 utterances ($F(1, 98)$ 12.56, $p = 0.001$, $\eta^2 = 0.11$). For 315 word tokens, the number of utterances was 52.76 (SD 16.34) for children with SLI and 39.78 (9.52) for children with NL ($F(1, 98) = 23.56$, $p = 0.000$, $\eta^2 = 0.19$). The groups, whether

Table 3. Measures of lexical diversity: general and verb-specific. Sample size equated on number of verb and work tokens

		CA-matched groups		MLU-matched groups	
		SLI	NL	SLI	NL
Verb-specific measures (sample size 80 verb tokens[a])					
NDV	Mean	33.30	34.08	34.56	34.08
	SD	5.16	4.77	5.23	4.59
vTTR	Mean	0.42	0.43	0.43	0.43
	SD	0.006	0.006	0.007	0.006
Number of utterances	mean	70.88*	56.44*	56.80	59.32
	SD	25.03	14.26	11.63	12.40
	η^2	0.11			
NW (80 verb segments)	mean	429.90	450.46	429.12	447.76
	SD	49.14	39.00	32.17	32.17
General lexical measures (sample size 315 word tokens)					
NDW	mean	133.460	134.64	134.00	135.32
	SD	13.47	10.28	14.62	10.77
TTR	mean	0.42	0.43	0.42	0.43
	SD	0.004	0.003	0.005	0.004
Number of utterances	mean	52.76*	39.78*	42.40	42.28
	SD	16.34	9.52	7.79	8.10
	η^2	0.19			

[a] Three of the younger children with SLI did not have 80 verbs in their samples. The number of verb tokens for these children was 74, 68 and 56. As a result, the mean NV for the CA-matched group with SLI is 79.16 (SD 3.84). All other groups have mean of 80 (0). Note that if this significantly affected the results, it should enhance any group differences.

matched on CA or MLU, did not differ significantly in the number of words contained within the 80 verb token segment. For CA-matched groups, the group with SLI had a mean of 429.90 words compared with 450.46 for the group with NL ($p = 0.023$). For the MLU-matched groups, the corresponding numbers were 429.12 words for the SLI group and 447.76 for the NL group ($p = 0.046$).

For comparative purposes, the number of types, tokens and their ratio, TTR, for the middle 50 utterances was also computed. These measures yielded no significant group differences for the MLU-matched groups, but did for the CA-matched groups. Only the results for the CA-matched groups are reported. The NDV in 50 utterances was 27.24 (SD 7.89) for children with SLI and 31.10 (SD 7.31) for children with NL. The difference was not statistically significant ($F(1, 98)$ 6.44, $p = 0.013$). NV was 61.78 (SD 20.53) for children with SLI and 73.14 (SD 15.92) for children with NL. The group difference was significant ($F(1, 98) = 9.56$, $p = 0.003$, $\eta^2 = 0.09$). vTTR obtained from these measures was 0.46 and 0.43 for groups with SLI and NL respectively (SD 0.09 and 0.07). The group difference was not significant ($F(1, 98)$ 2.47, $p = 0.12$). Measures of general lexical diversity in 50 utterances were as follows: NDW was 135.1 (SD 32.1) for children with SLI and significantly higher for children with NL, or 161.60 (SD 25.1) ($F(1, 98)$ 21.19, $p = 0.000$, $\eta^2 = 0.18$). Group differences were also significant for NW: 324.8 (SD 100.3) for the group with SLI and 411.9 (SD 85.9) for the group with NL ($F(1, 98) = 21.76$, $p = 0.000$, $\eta^2 = 0.18$). Finally, TTR was significantly higher for the group with SLI (0.43, SD 0.06) than for the group with NL (0.40, SD 0.04) ($F(1, 98) = 8.43$, $p = 0.005$, $\eta^2 = 0.08$).

Verbs with higher than average frequency

The average verb frequencies for each group of children are shown in table 4. For the CA-matched groups, each verb was used on average 7.7 times (2467 tokens/320 types) by the children with SLI, and 7.96 times (2936 tokens/369 types) by the NL children. For the MLU-matched groups, the average frequency of verbs was 5.62 for the SLI group (1462 tokens/260 types) and 5.66 for the NL group (1346 tokens/238 types). Using the criterion of two times or more the average verb frequency, 33 verbs were designated as high-frequency verbs for the CA-matched NL group and 28 for the CA-matched SLI group. For the MLU-matched groups, the NL children had 23 high-frequency verbs and the SLI children had 24. Table 5 lists the high-frequency verbs used by each group of children as well as the frequency of each verb expressed as a multiple of the average verb frequency. As shown in table 5, the mean frequency of use of the high-frequency verbs by children with

Table 4. Number of high-frequency verbs and frequency of use by group of children

	CA-matched groups		MLU-matched groups	
	SLI	NL	SLI	NL
Number of high-frequency verbs*	28	33	24	23
Average verb frequency (all verbs)	7.70	7.96	5.62	5.66

*High-frequency verbs are those that occurred with a frequency twice or more the average verb frequency.

Table 5. High-frequency verbs

CA-matched groups				MLU-matched groups			
SLI		NL		SLI		NL	
Verb	Frequency	Verb	Frequency	Verb	Frequency	Verb	Frequency
go*	33.0	**go***	34.1	**go***	28.8	**go***	23.7
have	24.3	**have**	27.0	**have**	20.5	**have**	16.6
get*	16.0	**do***	22.6	**get***	10.0	**do***	16.1
know	15.4	**get***	20.2	**know**	8.4	**get***	14.3
do*	12.7	**play***	11.4	**see***	8.2	**know**	8.8
see*	10.3	**know**	11.3	**do***	8.2	**play***	8.0
play*	8.7	**get (Motion)**	8.3	**say**	7.7	**get (Motion)**	5.8
say	8.3	**make***	8.0	**put***	6.6	**see***	5.8
put*	7.8	**see***	7.8	**play***	6.4	**make***	5.5
come*	7.0	**say**	7.6	**come***	6.1	**think**	4.4
like	6.8	**come***	7.3	**get (COP)**	5.9	**say**	4.1
get (Motion)	6.2	**take**	7.3	**like**	5.3	**come***	3.9
get (COP)	6.1	**put***	6.9	**get (Motion)**	5.2	**take**	3.7
think	5.2	**think**	6.8	want*	4.8	**get (COP)**	3.5
want*	5.2	**try**	6.3	**think**	4.3	**put***	3.4
take	4.7	**like**	5.0	**take**	3.9	bring	3.0
forget	4.3	**get (COP)**	4.8	forget	3.6	**eat**	2.8
let	3.4	find	4.3	**eat**	3.6	**like**	2.7
eat	3.2	read	3.9	fall	3.0	find	2.7
try	3.1	want*	3.9	**try**	3.0	let	2.3
make*	3.0	**eat**	3.3	**make***	2.7	**try**	2.3
watch	2.6	let	3.3	live	2.7	read	2.3
live	2.5	give	3.1	run	2.3	give	2.1
fall	2.4	remember	2.9	remember	2.3		
hit	2.0	run	2.9				
die	2.0	start	2.8				
read	2.0	catch	2.6				
run	2.0	tell	2.6				
		ride	2.6				
		bring	2.5				
		stay	2.5				
		use	2.4				
		talk	2.0				
Mean	7.51		7.58		6.80		6.42
SD	7.22		7.62		6.04		5.76
Range	2–34		2–33		2–29		2–24

Frequencies are multiples of the average frequency of verbs for the group as a whole.
Verbs in **bold** are high-frequency verbs for all four groups of children.
Verbs marked with an asterisk (*) were on the GAP verbs lists in Rice and Bode (1993) and/or Watkins *et al*. (1993).

SLI was 7.51 times the average verb frequency (SD 7.22, range 2–33), versus 7.58 for the CA-matched children with NL (SD 7.62, 2–34). For the MLU-matched groups, the corresponding means were 6.80 (SD 6.04, 2–29) for the SLI group and 6.42 (SD 5.76, 2–24) for the NL group. The verbs in table 5 are arranged in order of descending frequency. Those verbs that appear on the lists of all four groups of

children are shown in bold. They include the following 18 verbs: *come*, *do*, *eat*, *get* (obtain), *get* (motion), *get* (copula), *go*, *have*, *know*, *like*, *make*, *play*, *put*, *say*, *see*, *take*, *think* and *try*. In addition, the following four verbs appeared in three of the four lists: *let*, *read*, *run* and *want*. Those verbs that also appeared on the GAP verb lists of Rice and Bode (1993) and/or Watkins *et al.* (1993) are marked with an asterisk in table 5. Of the 13 GAP verbs reported in these two previous studies, eight emerged as high-frequency verbs for all four groups of children in this study. These are the verbs *come*, *do*, *get*, *go*, *make*, *play*, *put* and *see*. The preschool GAP verb *want* appeared on three of the lists. Other preschool GAP verbs, including *look*, *need*, *open* and *work* were not used with higher than average frequency by the children in this study.

Table 6 specifies the semantic/syntactic classification (Levin 1993) of the 18 high-frequency verbs that appeared on the lists of all four groups of children. Also included in the table are the five verbs previously reported as GAP verbs (Rice and Bode 1993, Watkins *et al.* 1993) that were not among the high-frequency verbs in this study. In terms of semantic/syntactic categories, there is little overlap between the verbs in table 6. Additions to the preschool GAP verb lists, that is, high-frequency verbs not previously reported to be GAP verbs, are from categories not represented by the preschool GAP verbs. With the exception of the verbs *want*

Table 6. High-frequency verbs: semantic/syntactic classification

	Classification based on meaning and syntactic behaviour (Levin 1993)
High-frequency verb	
come*	motion/inherently directed
do*	
eat	ingesting/eat
get (motion)	
get (copula)	
get*	change of possession/obtaining/getting
go*	motion/inherently directed
have	contain verb
know	predicative complement/conjecture
like	psychological state/admire
make*	creation and transformation/build
play*	performance/social interaction
put*	putting/put
say	communication/say
see*	perception/see
take	removing/possessional deprivation/steal
think	predicative complement/declare
try	
Previously reported GAP verbs that were not high-frequency verbs in the present study	
look	perception/searching
need	desire/want
open	change of state
want	desire/want
work	

*The verb was part of the GAP verb lists of Rice and Bode (1993) and/or Watkins *et al.* (1993).
Note: some verbs are members of more than one verb group (Levin 1993). The classification here is based on the verbs' basic meaning (not extended or figurative meanings). Verbs not classified were not included in Levin's list of verbs in their basic meaning.

and *need*, both of which are from the category of *desire/want* verbs, no two verbs are from the same semantic/syntactic verb category. In some cases, two verbs are from the same general category, but represent different subgroups and, hence, nuances in meaning and variation in syntactic behaviour. In the entire list of verbs in table 6, there are two *motion verbs* depicting opposing directions of movement (*come* and *go*), two *verbs of perception* from different subgroups, *verbs of seeing* and *verbs of searching* (*see* and *look*), two verbs representing two subgroups of *verbs with predicate complements*, *conjecture verbs* and *declare verbs* (*know* and *think*). Six of the verbs, *get*, *say*, *see*, *take*, *want* and *put*, are the prototype verb of their group, with the group named after them. To give an example of the complexity of these verb groups, *verbs of putting* include several subcategories, among which are *put verbs* (e.g. arrange, immerse, install), *verbs of putting in spatial configuration* (e.g. dangle, hang) and *verbs of putting with a specified direction* (e.g. drop, lift).

Age effects

Age effects were not among planned comparisons in this study. However, given the fairly large age range of the children in the study, the present authors investigated the possibility of age effects on lexical diversity within the early school years. For this analysis, the children were divided into three age groups, each spanning one-third of the total age range covered in the study. The mean ages and group sizes for children with SLI and NL respectively were: 6 year olds: 77.85 (5.34), $n = 13$, 77.86 (2.98), $n = 14$; 7 year olds: 91.61 (5.49), $n = 18$, 91.84 (4.72), $n = 19$; 8 year olds: 106.32 (4.95), $n = 19$, 106.65 (4.47), $n = 17$. Measures of verb and general lexical diversity (NDV80 and NDW315) are presented in figure 1 as a function of age group. The number of utterances corresponding to the segment cuts (UTT80V and UTT315W) based on number of tokens is shown in figure 2. Two-way ANOVA (Group × Age) were computed for each of the four dependent variables, with α set at 0.01. The main effect of Group was significant for both UTT80V and UTT315W

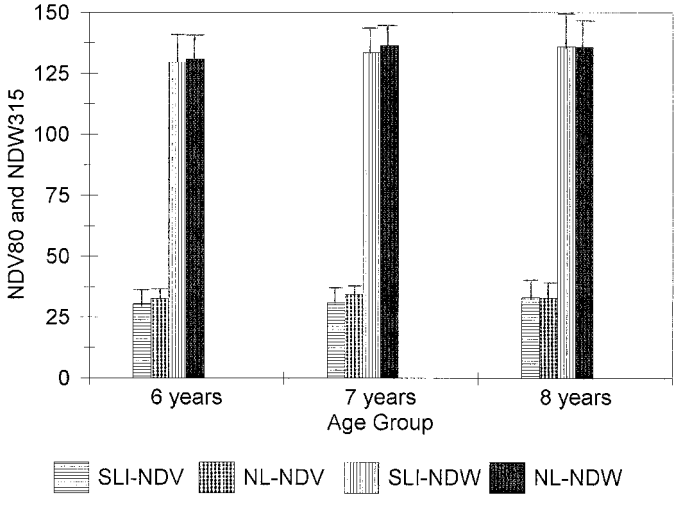

Figure 1. General lexical diversity and verb diversity by group and age group. The measures shown are NDV per 80 verb-tokens and NDW per 315 word-tokens. These are shown for CA-matched children with SLI and NL, divided into three age groups.

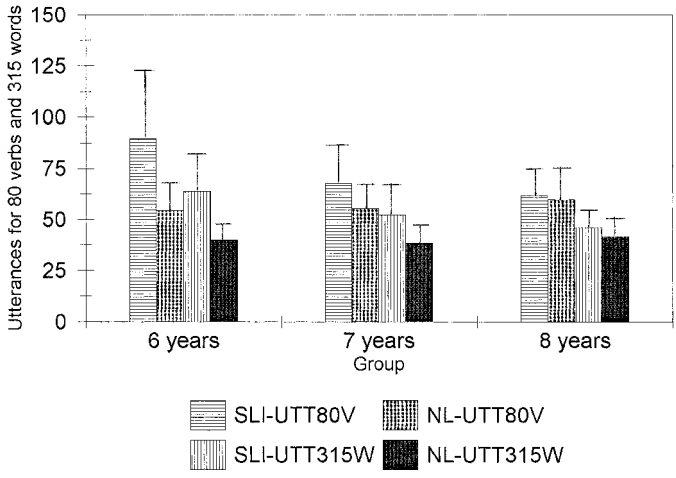

Figure 2. Number of utterances required for production of 80 verb-tokens (UTT80V) and 315 word-tokens (UTT315W). These measures are shown for CA-matched groups of children with SLI and NL, each divided into three age groups.

(respectively $F(1, 94) = 18.28$, $p = 0.000$, $\eta^2 = 0.16$; $F(1, 94) = 30.3$, $p = 0.000$, $\eta^2 = 0.24$), reflecting the fact that children with SLI required more utterances than children with NL to produce 80 verbs and 315 words. For UTT80V, the Group × Age interaction was significant ($F(2, 94) = 6.14$, $p = 0.003$, $\eta^2 = 0.12$). *Post-hoc* tests (Dunn–Bonferroni) revealed a significant difference between the youngest and oldest age group among children with SLI ($p = 0.003$). No significant differences were found between age groups among the children with NL. The Group × Age interaction for UTT315W just failed to reach significance ($p = 0.013$). No other age effects were significant.

Analysis of individual data

In this study, high-frequency verbs were identified for groups of children as a whole based on group verb frequencies. To ascertain the extent to which the group analyses agree with data from individual children, the authors randomly selected 10 children (five SLI, five NL) and identified high-frequency verbs in their samples. The procedure was analogous to the group analysis. The average verb frequency was determined for each individual child, and, based on this figure, verbs that occurred with a higher frequency than average were identified as high-frequency verbs. The data for these 10 children are shown in figure 3, which shows the number of verbs for each child that exceeded the average verb frequency (> AVG, a criterion used in, for example, Rice and Bode 1993) and verbs whose frequency was twice the average verb frequency (> AVG × 2, the criterion used in the group analyses). This individual analysis confirms the group results in that no significant group differences are found in the number of high-frequency verbs. The composition of the high-frequency verb lists was also similar across groups and to the lists resulting from group analysis. When these individually determined high-frequency verbs were pooled for each group, the number of verbs for the group with SLI was 28 (> AVG) and 6 (> AVG × 2). The corresponding numbers for the NL group were 18 and nine. The higher number of verbs that exceeded the average

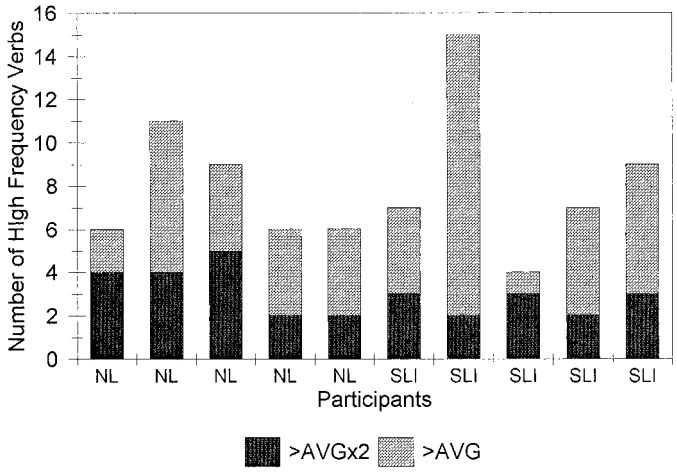

Figure 3. Analysis of verb use by individual children: number of high-frequency verbs used by each of 10 randomly selected children. Children 1–5 are from the NL group; children 6–10 are from the SLI group. > AVG denotes verbs used with greater than average frequency, > AVG × 2 denotes verbs used with twice or more the average verb frequency.

frequency at all (> AVG) for the SLI group was due to one subject who had an unusual number of verbs that fit this criterion (figure 3). Seventeen of 28 verbs of the SLI group and 15 of 18 verbs of the NL group corresponded to verbs designated as high-frequency verbs by group analysis. The most common verbs for both groups of children were *be*, *come*, *do*, *get*, *go*, *have* and *know*.

Discussion

Lexical diversity

In this study, verb diversity did not emerge as an area of particular difficulty for children with SLI. No significant group differences were found in the number of different verbs per 80 verb tokens whether groups were matched on age or MLU. The groups were also comparable in general lexical diversity measured in the same way, that is with samples equated on number of tokens. In addition, the total number of words in the 80-verb segment was somewhat lower for children with SLI than for the CA-matched NL peers. This indicates that verbs constituted a higher percentage of total words within this segment for the SLI than the NL group. These findings contradict those earlier studies that have suggested a verb-specific lexical deficit in children with SLI. As discussed above, this is likely to be related to differences in methods, where the current study effectively controlled for confounds from non-lexical factors associated with utterance length. The findings for general lexical diversity are consistent with those of Klee (1992), which were based on a sample of 200 tokens in that they find no group differences, but are in disagreement with those of Watkins *et al.* (1995). For comparison with previous studies of preschoolers, and to illustrate the effect on results of different lexical diversity metrics, NDW, NW and TTR as well as the corresponding verb-specific measures NDV, NV and vTTR computed traditionally from samples of a standard number of utterances were also reported. Even using these measures, which are

more comparable with those used in previous studies of preschool children, the authors found no evidence of a verb-specific lexical deficit, and lexical deficits did not exceed expectation based on MLU. Examination of TTR confirmed its ambiguous nature: children with SLI had a higher TTR than CA-matched children with NL. Both component measures were, however, higher for the NL children. A similar problem was found for the vTTR, which showed no group difference and masked the significant difference that existed in the component measures.

It has been advocated here, following, for example, Klee (1992) and Richards and Malvern (1997), that lexical measures computed from samples of a set number of tokens are more appropriate than the traditional measures based on a standard number of utterances because they control for the unwanted effect of factors associated with utterance length such as morphological and syntactic development. Thus, they produce a purer measure of lexical factors. However, re-evaluation of computation methods also calls for reconsideration of the meaning of these measures. It was found here that children with SLI did not differ from CA-matched (let alone MLU-matched) peers even in general lexical diversity when differences in MLU were controlled in this manner. Does this mean that the groups are comparable in lexical knowledge or lexical use? One would argue that such a conclusion is not warranted. The lexical deficits of children with SLI have been documented in some studies, including late emergence of first words and subsequent slow vocabulary development (e.g. Leonard 1988). Klee (1992) suggested that NDW based on a set number of tokens might be viewed as a measure of lexical knowledge, but that NDW based on a set number of utterances might be viewed as a measure of lexical density. Watkins *et al.* (1995) reached a similar conclusion from their comparison of the measures. What Klee referred to as lexical density results, in part, from syntactic proficiency, or the ability to produce increasingly complex and long utterances (hence, the MLU confound discussed above). But, contributing to this ability are also lexical production factors such as the ability to retrieve words during sentence formulation, when other task demands compete for the available resources.

Using samples based on number of tokens is one viable means of separating lexical factors from syntactic and production factors of this sort. However, the effect of these factors may now be seen by examining the number of utterances required to produce the set number of tokens. The results of this study showed that groups matched on CA differed significantly in this respect, with children with SLI requiring significantly more utterances than children with NL. Furthermore, this was the only factor for which an age effect was evident. A significant interaction effect between age and group was found for verbs and a similar trend was observed for words. This effect involved, for the SLI group only, a systematic decrease from age 6 to 8 in the number of utterances required to produce the set number of tokens. The children with NL, in contrast, evidenced stability in this respect over this age range. The children with SLI showed clear development in the number of utterances required, with the oldest children approximating the performance of the NL children. The fact that the effect was significant only for verbs suggests that the development of verbs may be somewhat more delayed than that of the general lexicon for children with SLI. However, it should be noted that a similar age trend was observed for the general lexicon.

With regard to the interpretation of the measures used in this study, it must also be emphasized that this discussion has been concerned with only one area of

verb use, that is, verb diversity. Other aspects of verb use that have been reported to be particularly problematic for children with SLI such as verb inflections and verb complementation were not investigated in this study. Also, this investigation inferred verb diversity from spontaneous language samples. The fact that children with SLI can use a variety of verbs does not guarantee that their knowledge of these verbs' meaning is as developed as that of their NL peers. Kelly (1997) reported no significant group differences between children with SLI and NL children matched on age or MLU in the number of verbs or the number of different verbs produced in an elicitation task. However, children with SLI made more semantic errors, which may reflect incomplete or partial learning of the verbs they used. Reports of poor quick incidental learning of verbs and poor verb retention by children with SLI (Rice *et al.* 1994, Oetting *et al.* 1995) also support the conclusion that language sample measures provide an incomplete picture of children's lexical development.

High-frequency verbs

Lists of high-frequency verbs were generated for each group of children (CA- and MLU-matched SLI and NL groups) by including any verb used with twice or more the average verb frequency of the group. In examining the verb lists, the most striking finding is the similarity across groups of children. The number of verbs on these lists is similar across SLI and NL groups, but CA-matched groups have longer lists than do MLU-matched groups (28 versus 33 verbs for CA-matched SLI and NL respectively; 24 and 23 for the MLU-matched groups). Even more noteworthy is the composition of the lists with 18 verbs overlapping across all four lists and an additional four verbs appearing in three out of the four lists. Although some differences were noted in the rank order of verbs in the lists from most to least frequent, the most frequent verbs were consistently *go*, *have*, *get*, *do* and *know*. The groups were also highly comparable in the extent to which the children relied on the high-frequency verbs relative to other verbs. The degree of reliance on high-frequency verbs was evaluated by expressing their frequency as a multiple of the average verb frequency. The CA-matched groups relied somewhat more on high-frequency verbs than did the MLU-matched groups (with means ~7.5 and 6.6 times the average frequency respectively). Within both CA- and MLU-matched comparison groups, SLI and NL groups had similar means, SD and ranges. These results clearly indicate that high-frequency or 'GAP' verbs continue to be used in the school years by both SLI and NL children. Of the 18 verbs that appeared on the lists of all four groups, eight had appeared on the GAP verb lists in Rice and Bode (1993) or Watkins *et al.* (1993), or both, for preschool children. Five GAP verbs in these two studies did not emerge as high-frequency verbs in this study. This indicates that there is continuity in the children's use of GAP verbs from the preschool years into school years with some evolution in the GAP verb repertoire including both additions and deletions. The data in the present study offer very little support for the notion that children with SLI rely more heavily on high-frequency verbs than do NL children. These results are based on a group analysis, but were confirmed by analysis of individual data of a randomly selected subset of children.

The results of Watkins *et al.* (1993) for preschoolers are remarkably similar to those of this study of school-age children, particularly in terms of the group similarities in GAP verb use. From the present study and studies on preschoolers

(Rice and Bode 1993, Watkins *et al.* 1993, Conti-Ramsden and Jones 1997, Kelly 1997, Loeb *et al.* 1997b), the picture that emerges is that frequent use of GAP verbs is a characteristic of the language of preschoolers, including both children evidencing normal language acquisition and children with language disorders, and that it continues to be a prominent feature in school age for both groups of children. In light of this, frequent GAP verb use may be more appropriately viewed as a sign of linguistic skill and maturity than as an indication of language deficit. Olswang *et al.* (1998) suggested that verb diversity and frequent GAP verb use might be useful clinically as indicators of good candidacy for intervention among preschoolers with language impairment. If GAP verb use has predictive value such that children who use them heavily have better outcomes in therapy, it might be speculated that GAP verbs have a facilitative effect on language development. The fact that several studies, including the present one, have found children with SLI to have slightly smaller GAP verb repertoires than CA-matched NL peers (Watkins *et al.* 1993, Loeb *et al.* 1997b, present study) may be interpreted to mean that children with SLI are, in fact, somewhat less proficient than age-matched peers in the acquisition and/or retrieval of these verbs. Until further research is undertaken, these suggestions are, of course, only speculative.

The reason why children resort to frequent use of a small set of verbs has been the subject of considerable speculation. Researchers have suggested that GAP verb use simplifies the task of verb learning or verb use in some way for children by allowing them to circumvent complexity in one or more domains of language. Attempts to clarify this issue have involved a search for common characteristics among the GAP verbs, but this has produced few conclusive results. A separate set of analyses of the language samples used in this study has indicated that the high-frequency verbs have a variety of argument structures (Thordardottir and Ellis Weismer 1999). This finding concurs with Rice and Bode's (1993) comment that GAP verbs are not set apart from other verbs by common syntactic characteristics. In this study, the authors hypothesized that an important factor that makes GAP verbs ideally qualified for a high frequency of use might be found in a combination of their semantic and syntactic properties. Specifically, it was noted that the set of GAP verbs reported to be used by preschool children (Rice and Bode 1993, Watkins *et al.* 1993) are distributed among different semantic/syntactic verb groups as classified by Levin (1993). The present authors proposed that these verbs might, in fact, serve as prototypes for the meaning categories of which they are members. Given the present observation about the verb group distribution of the preschool GAP verbs, it is predicted that developments in the GAP verb repertoire from preschool to school age would involve addition of verbs from previously unrepresented semantic/syntactic verb groups. The advantage of relying on GAP verbs would then allow both semantic and syntactic simplification. Verbs with more specific meanings not only would call for greater lexical diversity and retrieval, but also requires attention to variations in syntactic behaviour associated with nuances in meaning. This prediction was borne out in the present study. The repertoire of high-frequency verbs had grown in size; it included many of the verbs previously reported to be GAP verbs, but new verbs had been added as well. The additions were, as predicted, members of verb groups that did not already have a GAP verb representative. The 18 verbs used with higher than average frequency by all four groups of school-age children in the present study represent 12 major verb groups, and different subgroups within one of these major verb groups (table 6). Taken

together, the 18 high-frequency verbs used by the school-age children in this study and the five preschool GAP verbs that were not high-frequency verbs in the samples of the school-age children constitute a list of 23 verbs that fall into 18 verb groups, including 15 different major verb categories and subgroups within three of these. Six of 23 verbs were considered to be the most representative members of their group as shown by the fact that their group is named after them. This distribution of high-frequency verbs into semantic/syntactic verb groups lends support to the claim that high-frequency verbs serve as prototypes for major meaning categories. This claim would be strengthened if it were shown that high-frequency verbs were learned before more specific verbs with similar meanings or that learning of more specific verbs could be facilitated by pairing them with high-frequency verbs of a similar meaning and argument structure. The non-specific meaning of GAP verbs makes them flexible as substitutes for a number of more specific verbs whose use would require variations in syntactic behaviour. GAP verbs may be one of the mechanisms available to English-speaking children (and adults) to reduce the overall processing load associated with language production. These verbs are ideal candidates for this purpose because their use allows semantic and syntactic simplification with relatively minor sacrifices in information value. Fletcher *et al.* (1997) reported that children with SLI are more likely to include obligatory verb arguments when using GAP verbs than when using more specific verbs in an elicitation task. More recently, a similar trade-off effect was reported in spontaneous speech (Hauerwas 1999). These findings support the idea that GAP verb use might be a way to gain automaticity that leads to better use of processing resources for sentence formation.

This study offered very little convincing evidence that verb diversity is an area of particular difficulty for school-age children with SLI. As previous studies indicate, however, differences may exist in the extent of the children's knowledge of the verbs that are not apparent in the mere diversity of verbs used in spontaneous production. The use of high-frequency verbs was common among both children with SLI and NL children. The pattern of high-frequency verb use indicates that these verbs play a role in normal development and, more specifically, that their role may be to act as semantic and syntactic prototypes, thus allowing simplification at little cost to the information value of the message. The use of a set of high-frequency verbs is now a well-documented characteristic of the language of English-speaking children. Whether the role of such verbs is assumed by verbs or other structures in other languages is an interesting question for future research. An investigation of verb frequency in language samples of Icelandic children is currently in process.

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