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Fast mapping of verbs by children with specific language impairment

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Abstract

Two studies examined preschoolers' ability to assign verb interpretations to nonsense words encountered in conjunction with novel actions. Experiment 1 examined the ability of children with specific language impairment (SLI) and younger, normally developing peers to glean a verb interpretation when the name of the figure performing the novel action was already known. The two groups of children performed in a similar, accurate fashion. Experiment 2 required preschoolers to rely exclusively on morphosyntactic information to determine whether the novel word represented an object or action. When provided with redundant morphosyntactic cues, children with SLI and language- and age-matched peers succeeded in identifying the novel words that referred to objects but not those that referred to actions. Only the age-matched normal peers were above chance levels when a noun interpretation depended on a single grammatical morpheme (e.g., 'We want the *koob*' versus 'We want to *koob*'). The findings suggest that preschoolers, whether or not they have language impairment, have difficulty using morphosyntactic information to bootstrap verbs. Furthermore, redundant but not single morphosyntactic cues facilitate the bootstrapping of nouns.

Keywords: fast mapping, verb learning, specific language impairment.

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Introduction

Children with specific language impairment (SLI) exhibit problems in a number of areas of language (see reviews in Johnston, 1988; Bishop, 1992; Leonard, 1998). One of these areas appears to be the lexicon (Rice, 1991; Leonard, 1998). Since the earliest studies of children with SLI, it has been known that first words appear late in these children's speech, and subsequent lexical development is protracted (e.g., Nice, 1925; Bender, 1940; Werner, 1945; Morley, Court, Miller and Garside, 1955). When otherwise-normal children who are slow in their lexical development at 24–30 months are followed across time, up to half are diagnosed as SLI (e.g., Rescorla and Schwartz, 1990). One factor that helps to distinguish late talkers who do and do not eventually develop language normally is their receptive vocabulary (Thal, Tobias and Morrison, 1991).

The lexical diversity reflected in the speech of children with SLI is well below age-matched peers during the late preschool period (Watkins, Kelly, Harbers and Hollis, 1995), and subtle lexical deficits remain into the school years. Importantly, even when children with SLI appear to use or comprehend particular lexical items, they do not always show a complete mastery of these words (McGregor and Leonard, 1995). For example, school-age children with SLI often show slower-than-normal response times in naming pictures and poorer recall on memory tasks even when the words used in these tasks are those that they could readily identify on simple picture pointing tasks (Kail and Leonard, 1986).

Many of the more recent lexical studies of children with SLI have examined 'fast mapping' ability, that is, the ability to form an initial association between a word and its referent after only one or two exposures of the word. Dollaghan (1987) examined the fast mapping abilities of a group of children with SLI who exhibited expressive deficits of grammar. These children were found to be comparable to a group of age-matched controls in correctly associating the nonsense name *koob* with an unfamiliar object on a comprehension task; however, the children with SLI performed below the level of the age controls in their production of this word.

Rice, Buhr, and Nemeth (1990) employed a task in which several unfamiliar names of objects, action, attributes and affective states were presented to children with SLI in a television format. The children with SLI showed poorer overall mapping ability on a comprehension task than both age controls and a group of normally-developing children matched to the children with SLI according to mean length of utterance (MLU). The names of actions were especially difficult for each of the groups of children. In a study involving names of objects and attributes only, Rice, Buhr and Oetting (1992) found that children with SLI were more limited than age-matched controls in associating these words with their referents on a comprehension measure. Furthermore, Rice, Oetting, Marquis, Bode and Pae (1994) observed that children with SLI showed no evidence of learning a set of new object and action names after only three exposures of each word. Learning was apparent for words presented ten times each. The purpose of the present study was to extend the available findings on the fast mapping abilities of children with SLI. Specifically, we examined the ability of children with SLI to form an initial association between newly presented verbs and their referents.

There are several good reasons to study verb learning in children with SLI. First, actions are more transient and have fuzzier boundaries than objects; thus, they might stretch the limits of children's attentional and representational capacities

(Tomasello and Kruger, 1992). This may be especially crucial in children with SLI who have been shown to exhibit a range of mild attentional and representational deficits (Johnston, 1992). Second, studies of the grammatical profiles of children with SLI suggest that the most serious grammatical difficulties experienced by these children are those that centre on verbs in general including knowledge of each verb's argument structure (Fletcher and Peters, 1984; Fletcher, 1992; King and Fletcher, 1993). Third, verb learning may involve extra obstacles that are especially difficult for children with SLI to overcome. Gleitman and her colleagues (e.g., Gleitman, 1990; Gleitman and Gleitman, 1992; Lederer, Gleitman, and Gleitman, 1995) have demonstrated that the meaning of many verbs cannot be learned on the basis of simple exposure to events and the verbs that describe them. Rather, it appears that the learner must also be provided with the syntactic frames in which the verbs appear. Through such 'syntactic bootstrapping', the child can refine the meaning of the verb, eliminating other plausible interpretations.

Unfortunately, the process of interpreting meanings based on syntactic frames plays into one of the major weaknesses seen in children with SLI. Relative to normally developing children with comparable MLUs, children with SLI seem to have greater difficulty with a range of grammatical inflections and free-standing closed-class morphemes (e.g., Johnston and Schery, 1976; Steckol and Leonard, 1979), and syntactic operations such as complementation and auxiliary movement (e.g., Johnston and Kamhi, 1984). Given the morphosyntactic difficulties of these children, it is not clear that they can take advantage of syntactic information to interpret a new word as a verb with a particular meaning. As put so well by Rice (1991):

> The end result would be the opposite of bootstrapping. Instead of using one area of language to build another, SLI children would be left without a solid strap to hang onto. (p. 455)

In fact, the evidence to date is conflicting regarding the ability of children with SLI to make use of morphosyntactic information to learn new words. A number of studies have recently looked at the ability of children with SLI to interpret a novel verb's meaning based on the number and locations of accompanying noun phrases (e.g., a transitive vs. intransitive sentence frame). In some cases the children with SLI perform at levels commensurate with their normally developing peers in the initial mapping of verbs (Hoff-Ginsberg, Kelly and Buhr, 1996; Oetting, 1999). Yet in somewhat similar investigations, children with SLI are less skilled in using the sentence frame to map an initial verb meaning (van der Lely, 1994; O'Hara and Johnston, 1997; Hoff, Kelly, and Sullivan, 2000).

Furthermore, Rice *et al.* (1994) observed that the gains made by a group of children with SLI in learning verbs presented ten times each were not retained. The verbs showing a drop in retention had been presented in contexts requiring the past tense inflection. Rice *et al.* speculated that the children might have had difficulties recalling the verbs because features such as tense were not adequately stored and thus the representation of these words in memory was insufficiently elaborate. Similarly, Oetting (1999) found novel verb retention to be poor in children with SLI as compared to language- and age-matched peers. Finally, in a study of Haynes (1982) in which novel words were presented in sentences containing a range of grammatical morphemes, the children with SLI performed more poorly than the control children.

In this paper, we report on the results of two experiments. The goal of the first experiment was to determine the extent to which children with SLI could learn an association between a novel verb and its referent when morphosyntactic cues could assist the children, but were not necessary. In the second experiment, we attempted to determine whether children with SLI could distinguish novel nouns and verbs when this association depended crucially on morphosyntactic information, an especially rigorous test of syntactic bootstrapping skills.

Experiment 1

The literature on normal language development makes clear that from a quite early age children are capable of fast mapping a novel verb, even when a noun interpretation is plausible. However, this ability seems to depend on the presence of semantic and/or nonlinguistic cues, such as the element's novelty to the discourse or the adult's readying of the action apparatus, along with grammatical information (Tomasello and Akhtar, 1995). Experiment 1 examines whether children with SLI show evidence of making these action associations at levels commensurate with their language-matched peers.

Method

Participants

Two groups of eight children participated in Experiment 1. Each of the children in the first group had been diagnosed as exhibiting SLI by a speech-language pathologist and was either enrolled in an intervention programme or was on a waiting list for such a programme. The children ranged in age from 42 to 64 months (M = 50.63, SD = 7.73). Six of the children were boys; two were girls. The children's MLUs, based on a 100-utterance spontaneous speech sample, ranged from 1.60 to 2.88 (M = 2.25, SD = 0.42), placing them more than 1 SD below the mean for their age (Miller and Chapman, 1981). The children were also administered the *Test of Early Language Development-2* (*TELD-2*) (Hresko, Reid and Hammill, 1991), a test that contains both comprehension and production items. Two of the children's scores were well within 1 SD of the mean. The remaining children's scores were more than 1 SD below the mean.

Each of the eight children with SLI displayed normal hearing and an oral mechanism adequate for speech production purposes. None showed evidence of neurological impairment or disturbance in their interactions with others. The children's nonverbal IQs ranged from 86 to 123 (M = 106, SD = 12.02) on the *Arthur Adaptation of the Leiter International Performance Scale* (Arthur, 1952).

The remaining eight participants were younger, normally developing (YND) children. These children ranged in age from 27–31 months (M = 28.88, SD = 1.25). Six of the children were boys and two were girls. All scored at age-appropriate levels in the Cognitive Domain of the *Battelle Developmental Inventory* (Newborg, Stock, Wnek, Guidubaldi, and Svinicki, 1984). Standard scores ranged from 98 to 123 (M = 112.75, SD = 7.57). Each of the children passed a hearing screening and was reported to be developing normally by their parents.

Spontaneous speech samples of 100 utterances were obtained from each of the YND children, and MLUs were computed. In addition, each child was administered the *TELD-2*. On these two measures, the YND children and children with SLI were comparable. The mean raw scores on the *TELD-2* for the children with SLI and YND were 31.25 ($SD=5.31$) and 29.63 ($SD=3.43$), respectively, $t\ (14)=0.68$, $p>0.05$. The two groups' means for MLU were, respectively, 2.25 ($SD=0.42$) and 2.17 ($SD=0.45$), $t\ (14)=0.35$, $p>0.05$.

Procedure

Each child participated in four sessions, scheduled 2–3 days apart. In each session, the child heard and was tested on a nonsense word that referred to a novel action. The nonsense words and actions were different for each session. At the beginning of each session, the experimenter and child played with a set of toys. After several minutes, the experimenter introduced six different items, one at a time, with approximately two minutes separating the presentation of each item. The order of the six items was randomized. Two of the items were novel objects. For these items, the experimenter held up the object and said 'Oh, look at this' or 'look what I have'. The objects were never named. A third item was a familiar object whose name the child had produced during the spontaneous sample obtained at the outset of the study. This object was held up and named by the experimenter, using the sentence frame 'Here's a ______' (e.g., 'Here's a truck').

The remaining items were three different animate figures (dolls and stuffed animals) with moveable body parts that were made to perform three distinct actions. The animate characters selected were those whose names the children had shown evidence of using in their speech sample (e.g., *baby*, *dolly*, *teddy*). One of the actions performed was a familiar action whose name was previously observed in the child's speech. As the experimenter had the animate figure perform the action, she named the action, using the utterance 'See, it's ______ing' (e.g., 'See, it's jumping').

The remaining two actions were novel actions. Some examples of the novel actions used were: a doll moving one of its arms in a propeller motion; a doll extending one of its legs backward; and a stuffed bear bouncing up and down on one arm. One of the two novel actions was brought to the child's attention, but was not actually named by the experimenter. Instead, she used the sentence 'Oh, look what it's doing'.

The remaining novel action was named by the experimenter, using a one syllable nonsense word consisting of a consonant+ vowel+ consonant (CVC) sequence (e.g., *tiv*, *koob*, *pone*, *neen*). The nonsense word was produced three times in succession, in three different sentence frames. The first sentence was produced when the doll was about to perform the action. The second was produced during the action, and the third immediately after the action was completed.

Two different sets of three sentence frames were employed, depending on the presentation condition to which the nonsense word was assigned (see below). One set of sentence frames was regarded as the 'syntax' condition. These sentences provided a syntactic structure that supported a verb interpretation. They were, in order of presentation: 'Watch this one ______' (e.g., 'Watch this one *tiv*'), 'Let this one ______', and 'I saw it ______'.

The second set of three sentence frames also provided a syntactic structure for a verb. It differed from the first set in the presence of non-thematic closed-class morphemes (verb inflections, the infinitival complement *to*) that further supported a verb interpretation. This condition was considered the 'syntax and morphology' condition. The three sentence frames, in order of presentation, were: 'It likes to ______' (e.g., 'It likes to *pone*'), 'Everyday it ______s', and 'It just ______ed'.

After the experimenter produced the nonsense word in the three sentence frames, she removed the doll and drew the child's attention to several toys. Following 5 minutes of play, the child's comprehension of the nonsense word was assessed. Six items were placed in a row in front of the child, in random position. The items were those that had been exposed a few minutes earlier: the two un-named novel objects; the familiar object that had been named; the animate figure that had performed a familiar action that was named; the animate figure that had performed the novel action that was not named; and the animate figure that had performed the novel action that was the appropriate referent for the nonsense word. The child was asked to respond to three requests. The first two were requests to identify the familiar, named object and the familiar, named action, with the order of these two requests randomized. The request frame was 'Show me ______' (e.g., 'Show me truck', 'Show me jump'). The third request was to respond to the nonsense word, using the same frame (e.g., 'Show me *neen*'). It was expected that the first two requests would present no difficulty for the children; they were included simply to ensure that the children knew that both action and object responses were options during the testing activity. Following the child's response to the third request, the six items were removed and the child and experimenter resumed play with a set of toys. Table 1 summarizes the procedures for Experiment 1.

Across the four sessions, the child heard and was tested on four different nonsense words that referred to novel actions. Two of these were heard in sentence frames with a syntactic structure that supported a verb interpretation, and two were heard in sentence frames with both a syntactic structure and accompanying closed-class morphemes that promoted a verb interpretation.

Table 1. *Experiment 1 procedures summarized*

I. Exposure to the following six items in random sequence.
  A. Familiar object: 'I want this baby. Now I have one baby'.
  B. Unnamed novel object: 'Oh, look at this.' Or 'Look what I have'.
  C. Additional unnamed novel object: 'Oh, look at this.' Or 'Look what I have'.
  D. Unnamed novel action: 'Oh, look what it's doing'.
  E. Familiar action: either the syntax frames or the syntax and morphology frames.
    Syntax frames: 'Watch! I saw it fall. Now watch this fall. Ok, let this one fall'.
    Syntax and morphology frames: 'Watch! It just jumped. Watch! It likes to jump. Everyday it jumps'.
  F. Named novel Action: either the syntax frames or the syntax or morphology frames.
    Syntax frames: 'Watch! I saw it tiv. Now watch this tiv. Ok, let this one tiv'.
    Syntax and morphology frames: 'Watch! It just koobed. Watch! It likes to koob. Everyday it koobs'.
II. Ten minutes of play with new toys or another activity.
III. Comprehension Testing, using an array of the six items listed above.
  A. 'Show me (familiar named object)'.
  B. 'Show me (familiar named action)'.
  C. 'Show me (named novel action)'.

Note. This procedure was followed once per session over four sessions. Two sessions employed the syntax frames and two used the syntax and morphology frames. Frame type was consistent within each session across familiar and novel action presentations. Frame type was systematically varied across sessions.

The order in which the two types of sentence frames were presented was randomized. Across children, the particular CVC sequences constituting the nonsense words were used an equal number of times in each type of sentence frame.

Scoring

Responses to the familiar object names were scored as correct if the children pointed to the appropriate object, held up the object, or handed the object to the experimenter. Responses to the familiar and nonsense word action names were regarded as correct if the children selected the animate figure and manipulated it to perform the appropriate action with no intervening pointing or displaying gesture. If the appropriate action was performed with an animate figure that was not the original figure performing the action, then the children were credited with a correct response. Incorrect responses were recorded if the children responded to a verb item with a noun response, made the animate figure perform the wrong action, or failed to respond altogether.

The comprehension responses of four children were scored independently by a second individual to assess interjudge reliability. Both the experimenter and independent judge scored the same 11 responses as correct. The remaining five responses were judged by both as errors; however, one of these was classified differently by the two individuals. The experimenter scored the response as the child selecting the appropriate animate figure but performing a familiar action on it, whereas the independent judge recorded only that the appropriate animate figure was selected but the appropriate (novel) action was not performed.

The children's responses were also scored relative to chance. Because children were asked to respond to the familiar noun and the familiar verb before being asked to respond to the nonsense word, chance for the latter was taken to be 33%. That is, the reasonable responses remaining were the selection of one of the two novel objects, or the manipulation of one of the two animate figures to perform one of the two novel actions. Of these six possible responses, two of them—making either of the two animate figures perform the appropriate action—were regarded as correct.

Results

The children's levels of accuracy relative to that expected by chance (33%) on the four nonsense words were examined through chi-square analysis. Performance across all children was well above chance; this finding held when each subject group was considered separately. For the YND children, χ^2 (1) = 12.60, $p < 0.001$; for the children with SLI, χ^2 (1) = 33.69, $p < 0.001$. Overall percentages correct for the YND children and the children with SLI were 63 and 81, respectively.

The mean number of correct responses according to subject group and type of sentence frame can be seen in table 2. In 24 of the 26 correct responses made by the children with SLI, the appropriate action was performed by the animate figure originally associated with that action. For the YND children, 16 of the 20 correct responses were of this type. Correct actions were performed with the other animate figure by only two children with SLI and three YND children. The children responded without error when asked to identify the familiar named object and to perform the familiar named action.

The errors committed by the children with SLI were equally divided among selecting one of the novel objects (33% of the errors), having an animate figure

Table 2. *Mean number of correct responses with standard deviations in Experiment 1 according to subject group and type of sentence frame*

Sentence frame	SLI	YND
Syntax	1.50 ± 0.53	1.38 ± 0.74
Syntax and morphology	1.75 ± 0.46	1.13 ± 0.64

Note. Maximum = 2.00. SLI = Children with specific language impairment. YND = Younger, normally developing children.

perform the wrong novel action (33%), and failing to respond altogether (33%). For the YND children, failures to respond constituted 50% of the errors, whereas selecting a novel object represented 25%. The remaining errors were equally divided among having the wrong novel action performed, having a familiar action performed, and choosing a familiar object.

The children's correct responses were further examined by means of a mixed model analysis of variance (ANOVA) with subject group (SLI, YND) as a between-subjects variable and type of sentence frame (syntax, syntax and morphology) as a within-subjects variable. No differences were observed. The main effects for subject group, $F\,(1, 14) = 2.33$, $p > 0.05$, type of sentence frame, $F\,(1, 14) < 1.00$, $p > 0.05$, and their interaction, $F\,(1, 14) = 2.04$, $p > 0.05$, were all nonsignificant.

Discussion

The children with SLI, like their younger, normally-developing peers, performed rather well on the experimental task. It is possible that this performance was due to the children's ability to identify action names based on the syntactic information contained in the presentation sentences. However, it can be recalled that the names of the animate figures made to perform these actions were already known to the children; therefore, it seems just as likely that the children simply interpreted the new words as referring to some aspect of the event and, by process of elimination, concluded that these words represented the names of the actions. This type of interpretation does not require much of an understanding of grammar. The goal of Experiment 2 was to determine whether children with SLI could interpret a new word as the name of an unfamiliar action when morphosyntax served as the sole cue.

Experiment 2

At least since the pioneering work of Brown (1957), investigators have appreciated the important role that grammatical cues can play in helping the child learn the meaning of new words. For example, young normally-developing children seem able to register the presence or absence of a preceding article to help them determine whether a new word is a count noun or a mass noun (Brown, 1957), or a common name or a proper name (Katz, Baker and Macnamara, 1974; Macnamara, 1982; Gelman and Taylor, 1984). They also take note of whether a new word that follows an article is in turn followed by a nominal form, thus suggesting an adjective interpretation (Gelman and Markman, 1985; Taylor and Gelman, 1988). Finally, young children seem to interpret the presence of an inflection such as *–ing* as evidence that a new word is a verb (Brown, 1957).

An especially rigorous test of children's ability to use grammatical information during fast mapping is seen in the work of Golinkoff, Diznoff, and Yasik (1992). These investigators performed a novel action with a novel object and provided a sentence frame compatible with either a noun interpretation or a verb interpretation. Children between two and three years of age were significantly above the level of chance in interpreting these cues correctly. In Experiment 2, we employed a similar technique to examine the abilities of children with SLI.

Method

Participants

The participants in this study included eight children classified as specifically language impaired (SLI). None had participated in the earlier study. They ranged in age from 42 to 66 months (M = 51.13, SD = 7.95) and demonstrated expressive and receptive language scores at least one standard deviation below the mean on both verbal comprehension and expressive language components of the *Reynell Developmental Language Scales* (*RDLS*) (Reynell and Gruber, 1990) and on the *Peabody Picture Vocabulary Test-Revised* (*PPVT-R*) (Dunn and Dunn, 1981). In an effort to equate receptive vocabulary learning, age equivalent scores from the *PPVT-R* were used to match these children to younger normally, developing peers as described below. Within the SLI group these scores ranged from 33–45 months (M = 37.10, SD = 3.90). Based on 100-utterance language samples, MLUs ranged from 2.84 to 4.34 (M = 3.47, SD = 0.60). Five of these children were girls and three were boys. Each child was described by his or her parent as a monolingual speaker of English. In addition, the children passed a hearing screening at 25dB for 500, 1000, 2000 and 4000 Hz, were judged to have an oral mechanism adequate for speech production purposes, and demonstrated age appropriate nonverbal cognitive ability on the *Arthur Adaptation of the Leiter International Performance Scale* (Arthur, 1952). None of the children evidenced neurological impairment or disturbance in their interactions with others.

A group of normally developing children matched to the children with SLI to within two months of age served as controls (hereafter, the 'older normally-developing' or OND children). Comparisons between the SLI and OND groups showed no significant age difference, $t\,(14) = 0.210$, $p > 0.05$. The OND participants' ages extended from 40–64 months (M = 50.25, SD = 7.68). Children in this group met inclusion criteria identical to those of the SLI group with the exception that all language scores were within normal limits. The OND group included five boys and three girls.

A third group of eight younger normally-developing (YND) children was selected to match the children with SLI on two standardized measures of receptive language. Each YND child matched to within a 2-month range of a child with SLI based on their *PPVT-R* age equivalent scores. The *PPVT-R* range for these younger children extended from 32–47 months (M = 36.90, SD = 4.78). Additionally, as a group the children classified as YND and SLI did not differ in *RDLS* receptive raw scores ($t\,(14) = 1.011$, $p > 0.05$) and *PPVT-R* raw scores (M = 25.25 in both cases with standard deviations of 6.10 and 7.34 for the SLI and YND groups respectively). The chronological ages in the YND group varied from 33–43 months (M = 39.50, SD = 3.74). These children earned scores within normal limits on the same measures used with SLI and OND groups. The mean length of utterance for 100-utterance spontaneous samples varied from 3.84 to 5.27 ($M = 4.40$, $SD = 0.54$). Five girls and three boys participated.

Procedures

Each child participated in four sessions of approximately 45 minutes in duration. Across these four sessions, each child heard, and was tested on eight different nonsense words. Four of these referred to actions and four to objects. Two nonsense words were presented per session.

The procedure resembled that used in Experiment 1 in several ways. Following a brief play period at the start of each session, a set of items was introduced. One of these was the item of interest, the referent of a CVC nonsense word; the others were familiar toys and objects that would later serve as foils during subsequent comprehension testing. Immediately following the exposure phase, comprehension testing took place. This process was repeated during the second half of the session using a new nonsense word and referent. Two sessions were held per week.

The procedure also differed in certain respects from that employed in Experiment 1. Only one novel referent was employed during each exposure phase. The remaining three items were objects already familiar to the child. The three familiar objects were acted on by the experimenter, and during the enactments with the familiar objects, the experimenter produced utterances that named the objects, and that named the actions being performed. Examples of these utterances include 'I found a ______' and 'Everyday it ______s'.

Following this exposure activity, the remaining item—the item of interest—was introduced. This item was a novel object made to perform a novel action. An example of one such item was a creature with a body made from a rubber ball, eyes mounted on the ball, a Slinky® attached to the top of the ball, and no arms. The creature was made to perform an action in which its Slinky® was pulled upward away from the body and then returned to its resting position. Depending on the condition to which the item was assigned (see below), the experimenter either produced a nonsense word in two sentence frames that supported a noun interpretation, or produced the nonsense word in two sentence frames that supported a verb interpretation. The first sentence frame containing the nonsense word was produced immediately before the action, the second, immediately after the action.

There were two pairs of sentence frames used to refer to actions, and two used to refer to objects. One pair used for action words provided the syntactic structure for a verb, along with adjacent closed-class morphemes that supported the same interpretation. These two frames were 'It's ready to ______' and 'It just ______ed'. One of the pairs of sentence frames used for object words likewise possessed both syntactic structure for a noun and supporting grammatical morphology. These frames were 'Let's see the ______' and 'I found a ______'.

The remaining pairs of sentence frames for action words and for object words possessed a syntactic structure for a verb or noun interpretation, respectively, provided that the grammatical morpheme immediately preceding the nonsense word was properly understood. The two sentence frames for verbs were 'I like to ______' and 'I want to ______'. For nouns, the frames were 'I like the ______' and 'I want the ______'. To ensure that a distinction could be made between these verb and noun frames, the experimenter articulated the initial consonant of *to* and *the*, thus avoiding ambiguous frames such as 'I wanna ______', which might be interpreted as 'I want a' as easily as 'I want to.' Apart from this precaution, no emphasis was placed on the pronunciation of these grammatical morphemes.

During pilot testing, an acoustic analysis of the experimenter's productions of *to* and *the* with four different children confirmed that they were generally pronounced as intended. Measurements using a Kay 5500 DSP Sona-Graph revealed that durations of *to* and *the* were always shorter than both the preceding verb ('want' or 'like') and the following nonsense noun. The mean duration for *to* was 111 msec (SD = 37); for *the*, the mean duration was 123 msec (SD = 36). Frication and aspiration provided evidence that the initial consonant was articulated. An example of four utterances produced with the same child appears in the appendix.

Across the four sessions, the order of presentation of the different form classes (noun or verb) and types of sentence frames (syntax and grammatical morphology or grammatical morpheme as sole structural cue) was varied with the restriction that the two words presented in each session be different form classes.

The children's comprehension of the nonsense words was assessed by placing three familiar items and the novel item of interest in front of the child in a row in random position. These items were the three familiar objects whose names, and whose actions were named by the experimenter and the target object whose name or whose action's name had been provided by the experimenter.

Unlike Experiment 1, the request made by the experimenter during comprehension testing varied according to the presentation condition to which the nonsense word had been assigned. For verbs presented in the frames containing cues of syntax and grammatical morphology, the request took the form of 'It's ready to ______. Here, you show me. It's about to ______. Here, you show me'. For verbs in sentence frames whose structure relied on a particular grammatical morpheme (*to*) for proper interpretation, the request was 'We like to ______. Here, you show me. We want to ______. Here, you show me'. Nonsense words in the form of nouns presented in the syntax plus supporting grammatical morphology condition were tested by the request 'You find the ______. Show me a ______'. Nonsense nouns in syntactic structures that depended crucially on a grammatical morpheme (*the*) were tested using the request 'We like the ______. Here, you show me. We want the ______. Here, you show me'. Table 3 illustrates the procedures from Experiment 2.

Scoring

Children were credited with a correct response to a verb if they selected the object and made it perform the appropriate action with no intervening pointing or displaying gesture. Responses to nouns were scored as correct if the children pointed to or held up the appropriate object, or handed it to the experimenter. Action responses to noun items and pointing or displaying responses to verb items were scored as incorrect. Likewise, failure to respond constituted an error.

To assess interjudge reliability in scoring responses, 20% of the responses were independently scored by a second individual, who observed the interaction via videotape without the benefit of sound. The experimenter and independent judge agreed on the accuracy and error type on 37 of 38 responses (97%). The single discrepant judgement involved the experimenter assigning a verb interpretation to a response, while the independent judge considered it to indicate a noun.

The children's responses were also scored relative to chance. Given the results

Table 3. *Experiment 2 procedures summarized*

I. Warm up items exposed during play with familiar objects: 'I found a car. Watch! It's ready to crash. Let's see the dog. Watch! It just jumped. I took the apple. Every day it plays'.
II. Exposure to novel object or action in either morphology and syntax frames or morphology only frames.
  A. Noun, morphology and syntax: 'I found a neen. Let's see the neen'.
  B. Noun, morphology only: 'I like the foob. I want the foob'.
  C. Verb, morphology and syntax: 'Watch! It just kifed. Watch! It's ready to kife'.
  D. Verb, morphology only: 'I like to shoop. I want to shoop'.
III. Five minutes of play with new toys or another activity.
IV. Comprehension testing with corresponding sentence frames.
  A. Noun, morphology and syntax: 'You find the neen. Show me a neen'.
  B. Noun, morphology only: 'We like the foob. Here you show me. We want the foob. Here you show me'.
  C. Verb, morphology and syntax: 'It's ready to kife. Here you show me. It's about to kife. Here you show me'.
  D. Verb, morphology only: 'We like to shoop. Here you show me. We want to shoop. Here you show me'.

Note. The procedure was followed twice in each session, once each requiring a noun and verb interpretation. Order of nouns vs. verbs and morphology and syntax vs. morphology only conditions were systematically varied across subjects and sessions.

of Experiment 1, it was assumed that the children would treat the nonsense word as the name for either the object in whose presence the word was heard or the action of the object. With the plausible referents reduced to two possibilities—either the object or its action—chance performance was regarded as 50%.

Results

The children's correct responses relative to chance on the eight nonsense words revealed that each group of children was significantly above the level of chance on nouns in the syntax and grammatical morphology condition. For the children with SLI, $t\ (7)=7.0$, $p<0.001$; for the YND children, $t\ (7)=1.9$, $p<0.05$; for the OND children, $t\ (7)=1.9$, $p<0.05$. In instances where a noun interpretation relied exclusively on morphological information, only the OND children responded at levels significantly above chance, $t\ (7)=2.4$, $p<0.05$. Each group's performance on verbs was at chance levels. It should be pointed out that this pattern of findings does not mean that the children responded as if the word were a noun regardless of correctness. If this had been the case, the children's performance on verbs would have been significantly below the level of chance. The mean number of correct responses for the three groups of children can be seen in table 4.

An analysis of the errors revealed that the most frequent type of error committed by the children in each group was the selection of the appropriate novel object but a response that represented the wrong form class. These responses constituted 77%, 86%, and 63% of the errors of the children with SLI, the YND children, and the OND children, respectively. The selection of a foil item was the next most frequent error type for each group, representing 23%, 14%, and 33% of the errors for the three groups, respectively.

The children's correct responses were further examined through a mixed model ANOVA with subject group (SLI, YND, OND) as a between-subjects variable and

Table 4. *Mean number of correct responses with standard deviations in Experiment 2 according to subject group, form class and type of sentence frame*

	SLI		YND		OND	
Sentence frame	N	V	N	V	N	V
Syntax and morphology	1.9 ± 0.4	1.0 ± 0.8	1.5 ± 0.8	0.9 ± 0.8	1.5 ± 0.8	1.0 ± 0.9
Syntax dependent on morphology	1.4 ± 0.7	1.0 ± 0.8	1.0 ± 0.8	0.9 ± 0.8	1.6 ± 0.7	1.1 ± 0.8

Note. Maximum = 2.00. SLI = Children with specific language impairment. YND = Younger, normally developing children. OND = Older, normally developing children. N = Noun. V = Verb.

form class (noun, verb) and presentation condition (syntax and grammatical morphology, syntax dependent on grammatical morphology) as within-subjects variables. One of the three main effects was significant, namely, form class F (1, 21) = 4.55, $p < 0.05$. The main effect for subject group, F (2, 21) = 1.32, $p > 0.05$, presentation condition, F (1, 21) = 1.35, $p > 0.05$, and all interactions, $F < 2.80$, $p > 0.05$, failed to reach significance. The significant main effect for form class revealed that across all subject groups and both presentation conditions, accuracy was higher on nouns than on verbs. Seven of the eight children with SLI conformed to this pattern, as did six of the YND and five of the OND children. Four children representing all three groups produced only noun responses (one child each from the SLI and OND groups and two children from the YND group).

General discussion

Preschool children's ability to quickly identify a new word as a verb beyond chance levels was examined in two experiments. The results of Experiment 1 indicated that preschool-age children with SLI can interpret novel words as referring to unfamiliar actions when the names of the animate figures performing these actions are already known. However, these children do not seem to benefit further from verb cues that are available in the morphosyntax. In this regard, the children are similar to normally developing children who are 18–24 months younger. In Experiment 2, children's use of morphosyntactic cues was put to a stronger test. We found that children with SLI and younger normally developing peers could use multiple morphosyntactic cues to identify nouns but not verbs. Yet even the children's performance with nouns fell to chance levels when a noun- or verb-supporting syntactic frame hinged on a single morpheme (*the* versus *to*). A group of normally developing children matched to the children with SLI according to age did not fare much better. However, in one important respect, they were more capable than the other children: these older normally developing children were above chance levels when noun interpretation depended on a single morpheme. We discuss these findings in terms of how best to interpret them, and in terms of their implications for the study of language development and disorders.

Over the last 20 years, there has been an impressive literature documenting the relative ease of learning nouns compared to verbs (e.g., Gentner, 1982; Maratsos, 1991; Merriman, Marazita and Jarvis, 1993; Golinkoff, Jacquet, Hirsh-Pasek and Nandakumar, 1996; Merriman, Evey-Burkey, Marazita and Jarvis, 1996; Gelman and Tardif, 1998). Such findings have sometimes been taken to mean that young children display a distinctive noun bias. To a degree, such a bias could have been present in our study. Specifically, in Experiment 2, a noun bias might have prompted the children to seek out those morphosyntactic cues that could help them identify nouns. Because verbs were not favoured, morphosyntactic cues associated with these kinds of words might not have been analysed as carefully.

Although this kind of strategy can be characterized as reflecting a type of noun bias, it is far from a simple tendency to interpret any novel word as the name for an unfamiliar object. If the latter were true, the children would have performed significantly below chance on the novel action names in Experiment 2. That is, because an unfamiliar object was performing the unfamiliar action, blind adherence to a noun interpretation should have led the children to treat the object as the referent in these circumstances as well. The fact that the children were at chance levels on such items indicates that they were instead confused about the proper referent of the novel word.

It also appears that the children were able to suppress a noun interpretation, even when the syntax would support it, if there were compelling cues of a nongrammatical nature that favoured a verb interpretation. In Experiment 1, the request used during comprehension testing was 'Show me ______'. Given the syntax of this request and the fact that the nonsense word was an apparent bare stem with no preceding article, a proper noun interpretation would have been reasonable (Katz *et al*., 1974; Gelman and Taylor, 1984). That is, although the children knew words such as 'baby' and 'doll', they could have easily interpreted nonsense words such as *koob* and *tiv* as the animate figure's actual name, much like *Bob* or *Bev*. That they did not respond with a noun response suggests that upon first hearing the nonsense word in an unfamiliar action context, the children associated the word with the action and retained this association in memory.

In Experiment 1, the children with SLI performed similarly to a group of YND children with similar MLUs and *TELD-2* raw scores. Other studies have found differences between children with SLI and MLU controls (favouring the latter) in the ability to discern the meaning of new words (Rice *et al*., 1990; Oetting, Rice and Swank, 1995). However, in those studies, the comprehension of the grammatical material in which the word appeared might have played a role. In Experiment 1 of the present investigation, children with SLI responded slightly more accurately than the MLU controls, though not at a statistically significant level. This trend suggests that Experiment 1 may not have tapped into the same grammatical knowledge required in previous research. Rather, the recognition of an unfamiliar word coupled with the children's knowledge of the name of the animate figure may have been sufficient for them to respond correctly.

In designing Experiment 2, we removed the possibility of a simple associative response as in Experiment 1 in an effort to examine the children's ability to rely on morphosyntactic information in the early stages of word learning. We anticipated that the sentence frames in which a noun or verb interpretation of the nonsense word rested solely on the presence of *to* versus *the* would prove most problematic for the children with less language skill (i.e., SLI and YND groups). These grammatical morphemes are weak syllables whose clause-internal, phrase-initial position rendered them brief in duration. In most circumstances, the phonetic details of such fleeting forms can be missed without leading to misinterpretation because more robust, structural cues are present as well. However, given the make-up of these particular frames, the children did not have the benefit of such built-in redundancy.

Although sentence interpretations that depend entirely on distinctions such as these can be expected to be difficult for all young children, there was reason to believe that the children with SLI would do especially poorly. Leonard and his colleagues (Leonard, 1989; Leonard, 1992; Leonard, McGregor and Allen, 1992; Leonard, Eyer, Bedore and Grela, 1997) have proposed that many of the morphosyntactic limitations in children with SLI may be the result of these children's difficulties in perceiving and processing grammatical morphemes of low phonetic substance. Indeed, the children with SLI performed at chance levels with sentence frames of this type and thus provided no indication of processing these details. Unfortunately, the YND children did not fare any better, a finding that we had not predicted. Children with SLI somewhat older than the children studied here have been found to produce articles (Rice and Wexler, 1996) and infinitival *to* forms (Leonard *et al.*, 1997) less consistently than younger normally developing children matched according to MLU. For this reason, we had expected that the YND children would be more likely than the children with SLI to make use of these grammatical morphemes when interpreting novel words.

Although the ANOVA for Experiment 2 showed no differences among subject groups, the children with SLI and the YND children were successful with novel nouns when noun-supporting syntax accompanied the grammatical morphology. The OND group was the only group that demonstrated above-chance performance when a noun interpretation depended on a single grammatical morpheme (*the*) for interpretation. Furthermore, the failure to detect differences among groups was not likely to have been caused by ceiling effects; the OND children responded with only 66% accuracy. Further studies employing designs with greater statistical power might provide additional detail regarding group differences.

It is possible that details in our procedure rendered the task difficult for the children. Certainly evidence from other studies suggests that slight procedural adjustments can alter the outcome, for both children with SLI (Oetting, 1999; Hoff *et al.*, 2000) and those developing normally (Dockrell and McShane, 1990; Behrend, Harris and Cartwright, 1995; Merriman *et al.*, 1996). Such manipulations likely vary the language processing demands of the task (O'Hara and Johnston, 1997; Oetting, 1999; Rice, Cleave and Oetting, 2000) and interfere with the child's ability to assign specific properties to novel nouns and verbs. Experiment 2 of the present investigation was preceded by two pilot experiments, in which we identified and then eliminated procedural details that seemed to produce artefacts in the data. However, we cannot rule out the possibility that other unintended factors were playing a role.

Yet, we suspect that the findings were largely attributable to the difficulty children have in determining form class when there is little to go on but morphosyntax. It is not clear how common an occurrence it is for children to be confronted with events in which both the object name and action name are unknown, with morphosyntactic information serving as the sole basis for an appropriate interpretation. For example, much of the work accomplished by syntactic bootstrapping (e.g., Gleitman and Gleitman, 1992; Naigles, Gleitman and Gleitman, 1993) involves refining the meaning of verbs whose form class is already known. Assuming that there are many instances in which the participants in an unfamiliar action are already known, considerable development in shaping a verb's meaning on the basis of morphosyntactic information might be possible without additional gains in the particular ability assessed in Experiment 2.

In contrast to our investigation, several studies have included the grammatical morpheme *–ing* as an essential cue to a novel word's form class. Because this syllabic morpheme appears in clause-final position, it is significantly lengthened and presumably more salient than the grammatical morphemes we employed. Golinkoff *et al.* (1992) used *–ing* as the cue to verb status and found that children in the approximate age range of 2;0 to 2;10 were above chance in identifying novel verbs as well as novel nouns. The YND children in Experiment 2 of the present investigation performed above the level of chance for nouns only, and even in this case, when noun interpretation depended crucially on the non-clause final morpheme *the*, performance remained at chance levels.

Much work remains before the details of this budding ability to distinguish form classes are well understood. Remaining questions centre on the relative strength of verb versus noun interpretations and the degree to which structural cues in the form of a single grammatical morpheme can be exploited to classify a new word as a verb. The present results suggest that even into the late preschool years when considerable language facility has emerged, this is no easy task.

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References

Arthur, G., 1952, *The Arthur Adaptation of the Leiter International Performance Scale* (Chicago: Stoelting).

Behrend, D., Harris, L. L. and Cartwright, K. B., 1995, Morphological cues to verb meaning: verb inflections and the initial mapping of verb meanings. *Journal of Child Language*, **22**, 89–106.

Bender, J., 1940, A case of delayed speech. *Journal of Speech Disorders*, **5**, 363.

Bishop, D. V. M., 1992, The underlying nature of specific language impairment. *Journal of Child Psychology and Psychiatry*, **33**, 3–66.

Brown, R., 1957, Linguistic determinism and the part of speech. *Journal of Abnormal and Social Psychology*, **55**, 1–5.

Dockrell, J. and McShane, J., 1990, Young children's use of phrase structure and inflectional information in form-class assignments of novel nouns and verbs. *First Language*, **10**, 127–140.

Dollaghan, C., 1987, Fast mapping in normal and language-impaired children. *Journal of Speech and Hearing Disorders*, **52**, 218–222.

Dunn, L. and Dunn, L., 1981, *Peabody Picture Vocabulary Test-Revised* (Circle Pines, MN: American Guidance Service).

Fletcher, P., 1992, Lexical verbs and language impairment: a case study. *Clinical Linguistics and Phonetics*, **6**, 147–154.

Fletcher, P. and Peters, J., 1984, Characterizing language impairment in children: an exploratory study. *Language Testing*, **1**, 33–49.

Gelman, R. and Markman, E., 1985, Implicit contrast in adjectives vs. nouns: implications for word-learning in preschoolers. *Journal of Child Language*, **12**, 125–143.

Gelman, R. and Taylor, M., 1984, How two-year-old children interpret proper and common names for unfamiliar objects. *Child Development*, **55**, 1535–1540.

Gelman, S. A. and Tardif, T., 1998, *Acquisition of nouns and verbs in Mandarin and English*. 29th Annual Child Language Research Forum: Stanford Linguistics Association, Center for Study of Language and Information, pp. 27–36.

Gentner, D., 1982, Why nouns are learned before verbs: linguistic relativity versus natural partitioning. In S. Kuczaj (ed.) *Language Development: Volume 2. Language, Thought, and Culture* (Hillsdale, NJ: Lawrence Erlbaum), pp. 301–334.

Gleitmen, L., 1990, The structural sources of verb meanings. *Language Acquisition*, **1**, 3–55.
Gleitman, L. and Gleitman, H., 1992, A picture is worth a thousand words, but that's the problem: the role of syntax in vocabulary acquisition. *Current Directions in Psychological Science*, **1**, 31–35.
Golinkoff, R., Diznoff, J., and Yasik, A., 1992, *How children identify nouns verses verbs*. Paper presented at the International Conference on Infant Studies, Miami.
Golinkoff, R., Jacquet, R., Hirsh-Pasek, K. and Nandakumar, R., 1996, Lexical principles may underlie the learning of verbs. *Child Development*, **67**, 3101–3119.
Haynes, C., 1982, V*ocabulary acquisition problems in language disordered children*. Unpublished thesis, Guys Hospital Medical School, University of London.
Hoff, E., Kelly, D. and Sullivan, M., 2000, *New evidence that children with specific language impairment have difficulty with syntactic bootstrapping and that memory deficits play a role*. Paper presented at the Society for Research in Child Language Disorders, Madison, WI.
Hoff-Ginsberg, E., Kelly, D. and Buhr, J., 1996, Syntactic bootstrapping by children with SLI: implications for a theory of specific language impairment. In A. Stringfellow, D. Cahana-Amitay, E. Hughes and A. Zukowski (eds) *Proceedings of the 20th Annual Boston University Conference on Language Development*. (Somerville, MA: Cascadilla Press), pp. 328–339.
Hresko, W., Reid, D. and Hammill, D., 1991, *Test of Early Language Development-2*. (Austin, TX: ProEd).
Johnston, J., 1988, Specific language disorders in the child. In N. Lass, J. Northern, L. McReynolds and D. Yoder (eds) *Handbook of Speech-Language Pathology and Audiology* (Toronto: B. C. Decker), pp. 685–715.
Johnston, J., 1992, Specific language impairment in three languages: some cross-linguistic evidence. In P. Fletcher and D. Hall (eds) *Specific Speech and Language Disorders in Children* (London: Whurr).
Johnston, J. and Kamhi, A., 1984, Syntactic and semantic aspects of the utterances of language-impaired children: the same can be less. *Merrill-Palmer Quarterly*, **30**, 65–85.
Johnston, J. and Schery, T., 1976, The use of grammatical morphemes by children with communication disorders. In D. Morehead and A. Morehead (eds) *Normal and Deficient Child Language* (Baltimore: University Park Press), pp. 239–258.
Kail, R. and Leonard, L., 1986, *Word-Finding Abilities in Language-Impaired Children* (ASHA Monograph No. 25) (Rockville, MD: ASHA).
Katz, N., Baker, E. and Macnamara, J., 1974, What's in a name? A study of how children learn common and proper names. *Child Development*, **45**, 469–473.
King, G. and Fletcher, P., 1993, Grammatical problems in school-age children with specific language impairment. *Clinical Linguistics and Phonetics*, **7**, 339–352.
Lederer, A., Gleitman, H. and Gleitman, L., 1995, Verbs of a feather flock together: semantic information in the structure of maternal speech. In M. Tomasello and W. E. Merriman (eds) *Beyond Names for Things: Young Children's Acquisition of Verbs* (Hillsdale, NJ: Lawrence Erlbaum Associates), pp. 277–297.
Lely, H. v. d., 1994, Canonical linking rules: forward versus reverse linking in normally developing and specifically language-impaired children. *Cognition*, **51**, 29–72.
Leonard, L., 1989, Language learnability and specific language impairment in children. *Applied Psycholinguistics*, **10**, 179–202.
Leonard, L., 1992, The use of morphology by children with specific language impairment: evidence from three languages. In R. Chapman (ed.) *Processes in Language Acquisition and Disorders* (St. Louis, MO: Mosby-Yearbook), pp. 186–201.
Leonard, L., 1998, *Children with Specific Language Impairment* (Boston, MA: MIT Press).
Leonard, L., Eyer, J., Bedore, L. and Grela, B., 1997, Three accounts of the grammatical morpheme difficulties of English-speaking children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, **40**, 741–753.
Leonard, L., McGregor, K. and Allen, G., 1992, Grammatical morphology and speech perception in children with specific language impairment. *Journal of Speech and Hearing Research*, **35**, 1076–1085.
Macnamara, J., 1982, *Names for Things* (Cambridge, MA: MIT Press).
Maratsos, M., 1991, How the acquisition of nouns may be different from that of verbs. In

N. Krasnegor, D. Rumbaugh, R. Schiefelbusch and M. Studdert-Kennedy (eds) *Biological and Behavioral Determinants of Language Development* (Hillsdale, NJ: Lawrence Erlbaum), pp. 67–88.

McGregor, K. and Leonard, L., 1995, Intervention for word-finding deficits in children. In M. Fey, J. Windsor and S. Warren (eds) *Language Intervention: Preschool through the Elementary Years* (Baltimore: Paul H. Brookes), pp. 85–105.

Merriman, W. E., Evey-Burkey, J. A., Marazita, J. and Jarvis, L. H., 1996, Young two-year-olds' tendency to map novel verbs onto novel actions. *Journal of Experimental Child Psychology*, **63**, 466–498.

Merriman, W. E., Marazita, J. and Jarvis, L. H., 1993, Four-year-olds' disambiguation of action and object word reference. *Journal of Experimental Child Psychology*, **56**, 412–430.

Miller, J. and Chapman, R., 1981, The relation between age and mean length of utterance in morphemes. *Journal of Speech and Hearing Research*, **24**, 154–161.

Morley, M., Court, D., Miller, H. and Garside, R., 1955, Delayed speech and developmental aphasia. *British Medical Journal*, **2**, 463–467.

Naigles, L., Gleitman, H. and Gleitman, L., 1993, Children acquire word meaning components from syntactic evidence. In E. Dromi (ed.) *Language and Cognition: A Developmental Perspective* (Norwood, NJ: Ablex), pp. 104–140.

Newborg, J., Stock, J., Wnek, L., Guidubaldi, J. and Svinicki, J., 1984, *Battelle Developmental Inventory* (Allen, TX: DLM Teaching Resources).

Nice, M., 1925, A child who would not talk. *Pedagogical Seminary*, **32**, 105–144.

Oetting, J., 1999, Children with SLI use argument structure cues to learn verbs. *Journal of Speech, Language, and Hearing Research*, **42**, 1261–1274.

Oetting, J., Rice, M. and Swank, L., 1995, Quick incidental learning (QUIL) of words by school-age children with and without SLI. *Journal of Speech and Hearing Research*, **38**, 434–445.

O'Hara, M. and Johnston, J., 1997, Syntactic bootstrapping in children with specific language impairment. *European Journal of Disorders of Communication*, **32**, 189–205.

Rescorla, L. and Schwartz, E., 1990, Outcome of toddlers with expressive language delay. *Applied Psycholinguistics*, **11**, 393–407.

Reynell, J. K., and Gruber, C. P., 1990, *Reynell Language Development Scales, U.S. Edition* (Los Angeles, CA: Western Psychological Services).

Rice, M., 1991, Children with specific language impairment: toward a model of teachability. In N. Krasnegor, D. Rumbaugh, R. Schiefelbusch and M. Studdert-Kennedy (eds) *Biological and Behavioral Determinants of Language Development* (Hillsdale, NJ: Lawrence Erlbaum), pp. 447–480.

Rice, M., Buhr, J. and Nemeth, M., 1990 Fast mapping word-learning abilities of language-delayed preschoolers. *Journal of Speech and Hearing Disorders*, **55**, 33–42.

Rice, M., Buhr, J. and Oetting, J., 1992, Specific-language-impaired children's quick incidental learning of words: the effect of a pause. *Journal of Speech and Hearing Research*, **35**, 1040–1048.

Rice, M., Cleave, P. and Oetting, J., 2000, The use of syntactic cues in lexical acquisition by children with SLI. *Journal of Speech, Language, and Hearing Research*, **43**, 582–594.

Rice, M., Oetting, J., Marquis, J., Bode, J. and Pae, S., 1994, Frequency of input effects on word comprehension of children with specific language impairment. *Journal of Speech and Hearing Research*, **37**, 106–122.

Rice, M. and Wexler, K., 1996, Toward tense as a clinical marker of specific language impairment in English-speaking children. *Journal of Speech and Hearing Research*, **39**, 1239–1257.

Steckol, K. and Leonard, L., 1979, The use of grammatical morphemes by normal and language-impaired children. *Journal of Communication Disorders*, **12**, 291–301.

Taylor, M. and Gelman, S., 1988, Adjectives and nouns: children's strategies for learning new words. *Child Development*, **59**, 411–419.

Thal, D., Tobias, S. and Morrison, D., 1991, Language and gesture in late talkers: a 1-year follow-up. *Journal of Speech and Hearing Research*, **34**, 604–612.

Tomasello, M. and Akhtar, N., 1995, Two-year-olds use pragmatic cues to differentiate reference to objects and actions. *Cognitive Development*, **10**, 201–224.

Tomasello, M. and Kruger, A. C., 1992, Joint attention on actions: acquiring verbs in ostensive and non-ostensive contexts. *Journal of Child Language*, **19**, 311–333.

Watkins, R., Kelly, D., Harbers, H., and Hollis, W., 1995, Measuring children's lexical diversity: differentiating typical and impaired language learners. *Journal of Speech and Hearing Research*, **38**, 1349-1355.

Werner, L., 1945, Treatment of a child with delayed speech. *Journal of Speech Disorders*, **10**, 329–334.

Appendix

Word durations for four sentences in which the syntactic structure was determined by a single grammatical morpheme (the or to).

Word	Duration in msec
I	97
like	320
the	70
/moʃ/	620
I	95
want	275
the	123
/moʃ/	569
I	142
like	306
to	153
/pek/	531
I	113
want	288
to	114
/pek/	466