RapidX

Rapid #: -5282256

CALL #: https://ezproxy.memphis.edu:3443/login?url=http://informahea ...

LOCATION: TMA :: Main Library :: Informa Healthcare

TYPE:	Article CC:CCG
JOURNAL TITLE:	Clinical linguistics & phonetics
USER JOURNAL TITLE:	Clinical linguistics & phonetics
TMA CATALOG TITLE:	Clinical linguistics & phonetics
ARTICLE TITLE:	Production of infinitival complements by children with specific language impairment.
ARTICLE AUTHOR:	Barako Arndt & Schuele
VOLUME:	26
ISSUE:	1
MONTH:	
YEAR:	2012
PAGES:	1-17
ISSN:	0269-9206
OCLC #:	14814635
CROSS REFERENCE ID:	[TN:680515][ODYSSEY:129.59.150.28/ILL]
VERIFIED:	

BORROWER: TJC :: Heard Library

PATRON:

PATRON ID:	
PATRON ADDRESS:	
PATRON PHONE:	
PATRON FAX:	
PATRON E-MAIL:	
PATRON DEPT:	
PATRON STATUS:	
PATRON NOTES:	

Clinical Linguistics & Phonetics, January 2012; 26(1): 1–17

informa
healthcare

Production of infinitival complements by children with specific language impairment

KAREN BARAKO ARNDT & C. MELANIE SCHUELE

Department of Hearing and Speech Sciences, Vanderbilt University Medical Center, Nashville, TN, USA

(*Received 31 January 2011; Accepted 20 April 2011*)

Abstract
The purpose of this study was to explore the production of infinitival complements by children with specific language impairment (SLI) as compared with mean length of utterance (MLU)-matched children in an effort to clarify inconsistencies in the literature. Spontaneous language samples were analysed for infinitival complements (reduced infinitives and true infinitives). Participants included children with SLI ($n = 19$; 5;2–7;10) and children with typical language ($n = 19$; MLU; 3;0–5;9). There was no group difference in the number of infinitival complements and the number of different complement-taking verbs. However, the SLI group produced more true infinitives than the MLU group. The SLI group was less accurate than the MLU group on inclusion of obligatory infinitival *to*, with 80.21% accuracy (SD = 29.42) and 99.81% accuracy (SD = 0.85), respectively. As a group, children with SLI did not have problems with the clausal structure of infinitives. However, they had difficulty with the specific grammatical requirement of infinitival clauses, that is, the inclusion of the infinitival marker.

Keywords: *complex syntax, infinitives, specific language impairment, language development*

Introduction

Although much is known about the preschool and school-age morphological development of children with specific language impairment (SLI), relatively little is known about the complex syntax development of children with SLI. Because grammatical impairment is a hallmark of children with SLI, an understanding of complex syntax development in children with SLI is critical for a full appreciation of the breadth and depth of the grammatical limitations associated with SLI (Tager-Flusberg and Cooper, 1999). This information is critical to constructing explanatory theories of SLI that account for the range of grammatical deficits in children with SLI as well as to formulating effective assessment and intervention protocols.

Infinitival complements are the earliest form of complex syntax to emerge in children with typical language development (Limber, 1973; Bloom, Tackeff, and Lahey, 1984; Diessel, 2004), and likely the same is true for children with language impairments (Schuele and

Correspondence: Karen Barako Arndt, Department of Hearing and Speech Sciences, Vanderbilt University Medical Center, Room 8310, Medical Center East, South Tower, 1215 21st Avenue South, Nashville, TN 37232-8242, USA. Tel: +(615) 936-7550. Fax: +(615) 936-6914. E-mail: karen.m.barako@vanderbilt.edu

ISSN 0269-9206 print/ISSN 1464-5076 online
DOI: 10.3109/02699206.2011.584137

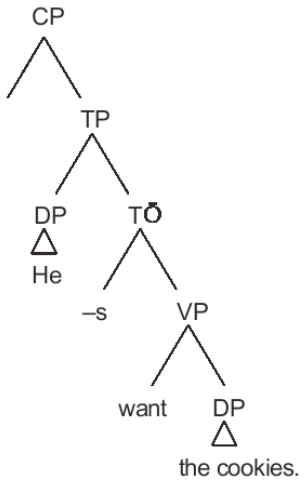

Figure 1. Syntax tree illustration of a simple sentence: *He wants the cookies.*

Dykes, 2005). In exploring complex syntax in children with SLI, infinitival complements are of interest for several reasons. First, the production of infinitival complements appears to mark the emergence of complex syntax development, that is, the embedding of a clause within a clause, for children with SLI and typical language learners. Second, the matrix verb in an infinitival complement has an argument structure that subcategorises for a noun phrase (NP) or for a complementiser phrase (CP; Carnie, 2007). The verb phrase (VP) *want*, for example, can take a NP, as in *He wants the cookies* (see Figure 1). *Want* can also take a non-finite complementiser phrase, where the subject of *eat* is co-referential with the matrix verb subject (i.e. *he*) as in *He wants to eat the cookies*, or where the subject of *eat* (i.e. Mary) is overt, *He wants Mary to eat the cookies* (see Figure 2). Third, infinitival complements have a required or obligatory grammatical morpheme, the infinitival *to* marker (e.g. *She likes to read*).

The purpose of this investigation was to explore production of infinitival complements in children with SLI as compared with children matched for mean length of utterance (MLU) in an effort to clarify inconsistencies in the literature. Research questions addressed were parallel to Eisenberg (2003). We use the term *infinitival complement* to encompass *true infinitives* (term used by Eisenberg (2003), e.g. *I want to eat* with obligatory *to* context) as well as *reduced infinitives*[1] (e.g. *gonna, hafta, wanna*).

Development of infinitival complements in typical children

True infinitives appear for at least some children shortly after the second birthday with a small set of complement-taking verbs (Limber, 1973; Bloom, et al., 1984; Diessel, 2004). Reduced infinitives, often not considered 'true complex' forms, emerge a few months before true infinitives (e.g. Limber, 1973; Paul, 1981). True infinitives are well established by the third birthday and at an MLU of 3.0 (Paul, 1981; Bloom et al., 1984; Tyack and Gottsleben, 1986). Early infinitival complements involve primarily a small set of complement-taking verbs: *want, have, get/got, like, try, need* (Diessel, 2004). Eisenberg and Cairns (1994) concluded that despite productivity, mastery of infinitival complements is not demonstrated even at 5 years of age. Lack of mastery of all infinitival complement control structures (measured in an elicited task) suggested protracted development of infinitival complements that proceeded on a verb by verb basis.

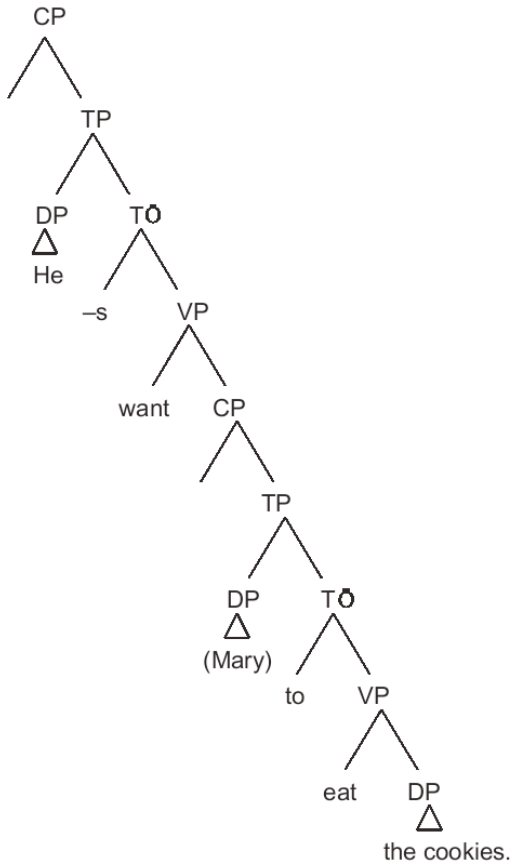

Figure 2. Syntax tree illustration of two infinitival complements: *He wants to eat the cookies* and *He wants Mary to eat the cookies.*

The inclusion of obligatory infinitival *to* undergoes developmental change in the early preschool years; omissions of *to* are characteristic of at least some children, but most often prior to 3;6 years of age (Menyuk, 1969; Limber, 1973; Bloom et al., 1984; Leonard, 1995; Eisenberg, 2003; Diessel, 2004). For example, from spontaneous language data, Leonard (1995) reported a mean rate of 46% for inclusion of infinitival *to* in a group of typical children between 2;11 and 3;4. Bloom et al. (1984) suggested that under the age of 3 inclusion of infinitival *to* was heavily reliant on the matrix verb.

Development of infinitival complements in children with SLI

In several cross-sectional studies of children with SLI, that in sum have included children between 3;7 and 6;0, the production of infinitival complements, primarily true infinitives, has been described alongside analysis of other grammatical structures (Johnston and Kamhi, 1984; Leonard, 1995; Leonard, Eyer, Bedore, and Grela, 1997). The findings from these studies provide information on inclusion of infinitival *to* but provide no insight into productivity across complement-taking verbs.

Leonard (1995) reported that 9 of 10 children with SLI between the ages of 3;8 and 5;7 (MLU 2.7–4.2) produced true infinitives, but *to* was included in obligatory contexts with only 34% accuracy (standard deviation and individual child accuracy were not reported). Although they did not report numerical data, Johnston and Kamhi (1984) reported that

omission of infinitival *to* was a 'typical error' for their group of SLI children (4;6–6;0). Both Leonard (1995) and Johnston and Kamhi (1984) analysed spontaneous language samples. In contrast, Leonard et al. (1997) examined SLI children's production of true infinitives in an elicited task; the elicitation protocol included the target structure, though not the target response (e.g. Experimenter: *This boy likes to skate and this girl* ~ Child response: *likes to swim*). The children with SLI, between 3;7 and 5;9, included *to* in an average of 45% of obligatory contexts, but there was substantial variability across children (SD = 42.46). Most recently, in an exploration of elicited infinitival complement clauses, Owen and Leonard (2006) reported that 5- to 8-year-old children with SLI were less proficient in marking the obligatory infinitival *to* (at 67.10% inclusion) as compared to both age-matched (100% inclusion) and vocabulary-matched, but chronologically younger (97.87% inclusion) groups.

In sum, children with SLI between 3;6 years and 6 years of age produce infinitival complements. However, the infinitival productions for at least some children with SLI under the age of 6 are sometimes grammatically inaccurate (i.e. omission of *to)*; the large standard deviation in Leonard et al. (1997) indicates substantial individual variability in inclusion of infinitival *to*. The extent to which individual children with SLI in these studies omitted infinitival *to* is not discernible. The studies summarised thus far have not explored productivity across complement-taking verbs for children with SLI.

In a longitudinal case study, Schuele and Dykes (2005) reported on the infinitival complement productions of a male child with SLI from 3;3 through 7;10. Reduced infinitives and true infinitives were produced in the first sample, but were not frequent until 4 years of age. The inclusion of *to* in true infinitives was virtually absent until age 5;3 when MLU was 3.58. Even by age 7;10, *to* inclusion did not surpass 50% correct in obligatory contexts (MLU = 5.46). Through 4;3, complement-taking verbs were limited to *go, got, have* and *want.* A wide range of complement-taking verbs was observed when MLU first exceeded 3.0 at 4;8 (e.g. *pretend, try, need*). The omission of the infinitival *to* was independent of verb selection. It is the protracted development of infinitival complements for this child with SLI that is most remarkable.

Recently, Eisenberg (2003, 2004) provided a more thorough analysis of infinitival complements in a small group of 5-year-old children (5;1–5;11) with SLI ($n = 8$). Spontaneous productions of infinitival object complements were evaluated in Eisenberg (2003) and elicited productions in Eisenberg (2004).

In Eisenberg (2003) spontaneous language samples were examined for the frequency of production of infinitival complements, the range of complement-taking verbs, use of infinitival complements with an overt subject (e.g. *he wants* ***Mary*** *to eat the cookie*, as compared to *he wants to eat the cookie*), as well as inclusion of infinitival *to*. The nature of this study lent itself to a description of findings without statistical analysis because sample length was not equated across participants. Eight 5-year-old children with SLI were compared with a group of 25 children with typical language skills (3;7–5;4; first described in Eisenberg and Cairns, 1994). Most informative was the comparison with a subset of 5-year-old typical language learners. The average number of infinitives produced was similar across groups. But three of the eight children with SLI produced two or fewer true infinitives, whereas all 5-year-old typical children produced at least four true infinitives. The group means for the number of complement-taking verbs were similar. But again, within-group performance varied. All of the 5-year-old typical children produced true infinitives with at least three verbs but the same was true for only half of the SLI group. Neither group produced many infinitival complements with overt subjects. Lastly, omissions of infinitival *to* were rare in both groups. In typical language learners, omission of infinitival *to*, with one exception, was restricted to typical language learners under the age of 4;0 (35% of participants) with an overall omission

rate of 11% (15/132). Only one child in the SLI group omitted infinitival *to* (2/3 true infinitives). Eisenberg (2003) concluded that difficulty in the production of infinitival complements was not characteristic of all 5-year-old children with SLI, but rather was limited to a subset of children with SLI, perhaps contrary to prior research findings (Johnston and Kamhi, 1984; Leonard, 1995). She acknowledged, however, that her SLI participants could have evidenced problems with infinitival complements earlier in development.

Current study

Although Eisenberg's work represents a more thorough analysis of infinitival complements than previous work, her conclusions are challenged potentially by methodological limitations. In the current investigation, we addressed research questions parallel to Eisenberg (2003) but with methods that allowed for group comparison. First, we included 19 children with SLI whereas Eisenberg included only 8. Second, typical children were MLU-matched to the SLI children. Eisenberg included a 3- to 5-year-old comparison group but there was no matching of participants across groups. Consistent with the majority of studies of grammatical skills in children with SLI (cf. Plante, Swisher, Kiernan, and Restrepo, 1991), the inclusion of the MLU-matched group allowed for consideration of the extent to which the children with SLI performed similar to typical language learners who produced utterances of equivalent length (Leonard, 1998). Third, we used a 133 utterance set from the language sample for frequency-derived variables. Eisenberg used samples of at least 100 utterances but did not equate for length of sample across participants for frequency-derived variables. Fourth, because we had samples of equal length, we conducted statistical analysis whereas Eisenberg's (2003) descriptive analysis focused more on individual differences.

The research questions addressed in this study were as follows: (1) Do children with SLI produce infinitival complements with the same frequency as MLU-matched children? (2) Do children with SLI produce equivalent numbers of infinitival complements with an intervening NP between the main verb and the complement-taking verb as compared to MLU-matched children? (3) Are the infinitival complements of children with SLI produced with a similar range of verbs as MLU-matched children? (4) Do children with SLI use high-frequency complement-taking verbs with the same proportional frequency as MLU-matched children? (5) Are children with SLI less accurate than MLU-matched children in their use of obligatory infinitival *to*?

Method

Participants

The data analysed for this investigation were drawn from an archival database of language samples collected to describe the production of complex syntax in children with SLI and children with typical language skills (Schuele, 2002).

Children with SLI. Participants included 19 children with SLI, who were between the ages of 5;2 and 7;10 ($M = 6;6$; SD = 9.47 months), who were in kindergarten or beyond and who were enrolled in language therapy. Of the 13 children for whom family data were reported, 46% had mothers who had completed at least some college; 54% had a positive family history for speech-language impairment. Three children in the SLI group were African American and speakers of African American English (AAE) dialect; the AAE dialect speakers were identified based on informal observation of the child's expressive language and on the parent's expressive language. The remaining children were Caucasian and spoke a mainstream dialect of American English. All children were monolingual speakers of English.

Based on prior research, it was anticipated that children with SLI in the age range studied would be in the process of acquiring complex syntax (Leonard, 1995; Eisenberg, 2003; Schuele and Dykes, 2005). Children with SLI met typical inclusionary and exclusionary criteria (Leonard, 1998). All children with SLI had a standard score more than 1 SD below the age mean on the *Structured Photographic Expressive Language Test* – II (SPELT-II; Werner and Kresheck, 1983a), confirming a previous diagnosis of language impairment in a school or clinic evaluation. Scores for the three children identified as dialect speakers of AAE were based on the SPELT-II African American Vernacular English Response Variations. Additionally, all of the children earned standard scores of 85 or higher (i.e. no lower than 1 SD below the standardisation sample mean) on the Columbia Mental Maturity Scale (CMMS; Burgemeister, Blum, and Lorge, 1972), a measure of nonverbal intellectual ability. The children with SLI had no history of hearing loss, no frank neurological impairment and typical socio-emotional and motor development (see Table I).

Children with typical language skills. Participants included 19 preschool children with typical language development between the ages of 3;0 and 5;9 *(M* = 4;7; SD = 7.23 months). Of the 11 children for whom family data were reported, 91% had mothers who had completed at least some college; only 18% had a positive family history for speech-language disability. All of the children were Caucasian, monolingual speakers of English and spoke a mainstream dialect of American English. None of the children had a history of language impairment, nor for any child was a developmental concern expressed by the parents or teachers. Children earned standard scores of 85 or higher (i.e. no lower than 1 SD below the standardisation sample mean) on the SPELT-II or the *Structured Photographic Expressive Language Test – Preschool* (SPELT-P; Werner and Kresheck, 1983b). In addition, children earned standard scores of 85 or higher (i.e. no lower than 1 SD below the standardisation sample mean) on the CMMS. One child was too young to be administered the CMMS; observation suggested cognitive ability within the normal range.

MLU matching

The children with typical language, heretofore referred to as the MLU group, were matched to the children with SLI based on MLU derived from a spontaneous language sample.

Table I. Characteristics of participant groups.

Measure	SLI (n = 19)	MLU (n = 19)
SPELT z-score		
M	–3.90	0.01
SD	1.86	0.48
CMMS standard score		
M	99.53	107.06
SD	7.53	8.91
MLU		
M	5.99	5.94
SD	1.33	1.26

Note: SLI, specific language impairment; MLU, mean length of utterance; SPELT, Structured Photographic Expressive Language Test – Preschool or Structured Photographic Expressive Language Test – II; CMMS, Columbia Mental Maturity Scale.

Each child with SLI was matched with one or more children from the typical language group at ± 0.2 morphemes. With the *Systematic Analysis of Language Transcripts* (SALT) program (Miller and Iglesias, 2006), MLU in morphemes was calculated for each child from 100 complete and intelligible utterances excluding single-word yes/no responses.

Procedure

Language sample elicitation. The archival database included spontaneous language samples that had been transcribed and coded for grammatical morphology (Howe, 1992) and for complex syntax (Schuele, 2003).

Children with SLI were typically visited in their homes ($n = 15$) but four were visited in their schools ($n = 3$) or the research lab ($n = 1$). Regardless of setting, the children completed all study procedures in one visit that lasted about 90 minutes. The sequence of data collection was norm-referenced assesment, a language sample and an elicited relative clause task. A 30-minute conversation-based language sample, adapted from Hadley (1998), was elicited from each child in an examiner–child interaction. For example, children talked about school and home activities, favourite movies and television shows and explained how to play a favourite game. The conversation-based protocol was chosen because the production of complex syntax by school-age children is more likely to occur in this context as compared to play (Evans and Craig, 1992). Three children with SLI initially had difficulty engaging in conversational discourse; for these children the language sample began with a short play-based interaction and transitioned to the conversation-based interaction. In the written transcripts for these children, however, the conversational portion of the sample was placed at the beginning of the transcript.

The children matched for MLU typically were visited at their childcare centres ($n = 15$) but four were visited in their homes ($n = 1$) or the research lab ($n = 3$). For the children visited at the childcare centres, the procedures were completed over two to three sessions, spread out over approximately 1 week. For the most part, the norm-referenced assessments were administered on the first day, and the 30-minute language sample and elicited task were completed on a subsequent day. Children visited in their homes or seen in the lab completed all tasks in one session. Given their age, we anticipated that exclusive use of Hadley's protocol would be too difficult for the MLU group. Thus, the MLU children were engaged in an examiner–child conversational interaction with a playhouse and associated objects to manipulate as they were talking. To provide ample opportunity for the production of complex syntax, the children were engaged in conversational discourse adapted from Hadley (1998) within the play interaction by topic shading. For example, when a child pretended the play people were going to the zoo, the examiner said, 'Tell me about when you went to the zoo.' These procedures resulted in language samples that were similar across the two groups and at the same time, allowed for developmentally appropriate interactions across the varying ages of children (i.e. included talk about decontextualised topics). Both groups produced comparable proportions of complex syntax (Schuele and Wisman Weil, 2004).

Language sample transcription. The archival database included transcripts fully prepared for analysis. The samples had been transcribed, checked and coded for complex syntax by the second author and several research assistants. Research assistants prepared initial transcripts with coding. The second author exhaustively checked all transcription and coding. For the current study, the authors reviewed all coding of complex syntax to ensure accurate identification of all infinitival complements.

Data analysis. The language sample analysis set was total verbal utterances (SLI: $M = 219.63$, SD = 63.21; MLU: $M = 231.42$, SD = 61.81), which included complete and intelligible utterances, partially intelligible utterances and abandoned or interrupted utterances. The total verbal utterance analysis set option within SALT was selected because we believe that analysing only complete and intelligible utterances provides a limited picture of complex syntax production. Eisenberg (personal communication, 22 January 2007) reported also using total utterances as the analysis set in her 2003 study.

SALT was used to identify all utterances with infinitival complements. A final data set was derived to include only infinitival complement clause types examined by Eisenberg (2003) (see Appendix for utterances included and excluded).

The final data set included (1) reduced infinitive utterances that included the reduced complement-taking verb (e.g. *I am gonna eat*) and (2) true infinitives, where the infinitival clause functioned as the direct object of a verb and included a complement-taking verb and an infinitival complement verb (e.g. *I want to eat; I want Bill to eat*). True infinitives potentially included utterances with the obligatory infinitival *to* marker produced or omitted (e.g. **I want eat*; **I want Bill eat*). (Note: An asterisk designates an ungrammatical utterance.)

Analysis of the final data set focused on three facets of production: (1) frequency of infinitival complements: frequency of reduced infinitives and frequency of true infinitives as well as frequency of single-noun and two-noun true infinitives, (2) types and tokens of complement-taking verbs in reduced infinitives (e.g. *wanna* go, *hafta* go) and in true infinitives (e.g. *want* to go, *need* to go, *have* to go) and (3) percent inclusion of infinitival *to* in obligatory contexts (e.g. correct: *I want to eat*; omission: **I want eat*). The first two aspects yielded frequency-based variables derived from a 133 utterance transcript cut for each participant, beginning at utterance 21. Recall that this procedure did not follow Eisenberg (2003), who derived frequency variables from samples that varied in length across participants. In contrast, the third aspect of production, the percent inclusion of infinitival *to*, was evaluated across the full transcript of total verbal utterances for each child ($M = 226$, SD = 62). Because this variable is a proportional variable, equal length samples were not necessary. For the frequency-derived variables, the chosen sample length (133 utterances) was the longest transcript cut that could be equated across participants within the total verbal utterances analysis set.

True infinitives were classified as either a single-noun infinitive, following a noun-verb-to-verb structure (e.g. *I want to eat cookies*), or a two-noun infinitive, following a noun-verb-noun-*to*-verb structure (e.g. *I want Bill to eat cookies*).

With respect to complement-taking verbs, the frequency of each verb across each group was calculated (total tokens for each verb type), and the number of children who used each verb type also was identified. Thus, frequency of complement-taking verbs could be considered from each of these perspectives. We initially considered complement-taking verbs across all infinitival complements (true infinitives and reduced infinitives), and then only for true infinitives. True infinitives were the primary interest of this analysis as only a small set of verbs can be produced as reduced infinitives. Lastly, for each child, we calculated the number of different complement-taking verbs for all infinitival complements and then separately for true infinitives.

For each child, percent inclusion of obligatory *to* was calculated by dividing the correct inclusions of *to* by the number of obligatory *to* contexts. Two children in the MLU group and four children in the SLI group occasionally substituted a neutral schwa vowel for *to* (e.g. *I like* /ə/ go to the zoo); we considered these substitutions as inclusions of *to* as there were no changes to

Table II. Number of infinitives produced in 133 total verbal utterances by language group.

Group		Infinitival complement	Reduced infinitive	True infinitive	Single noun	Two noun
SLI	Total	267	85	182	178	4
	M	14.82	4.40	9.88	9.71	0.18
	SD	6.35	4.90	6.65	6.53	0.39
	Range	7–31	0–20	0–22	0–22	0–1
MLU	Total	221	113	108	94	14
	M	11.63	5.95	5.68	4.95	0.74
	SD	8.22	7.97	3.18	2.74	0.99
	Range	3–39	0–33	1–13	0–11	0–3

Note: SLI, specific language impairment; MLU, mean length of utterance.

the infinitival complement-taking verb that would indicate a reduced infinitive (e.g. *want* /tə/ vs. *want* /ə/ vs. *wanna*).

Results

Statistical comparisons were conducted with a Kruskal–Wallis one-way analysis of variance with group as the between-subjects factor, as production of infinitival complements and complement-taking verbs are non-normally distributed data.

Frequency of infinitival complements

There was no statistical group difference for the number of infinitival complements (reduced infinitives and true infinitives), H (1, 37) = 2.41, $p = 0.12$ (see Table II). The number of infinitival complements included reduced infinitives and true infinitives. Examination of each type of infinitival complement indicated no group difference on number of reduced infinitives, but a group difference on number of true infinitives, H (1, 37) = 4.10, $p = 0.04$, $d = 0.81$. The SLI group produced more true infinitives than the MLU group (see Table II).

Two-noun infinitives were infrequent in both groups (see Table II). The two-noun infinitives represented 12.9% of the true infinitives for the MLU group but only 2.2% for the SLI group. Although there was no significant group difference (H (1, 37) = 3.49, $p = 0.06$), the effect size ($d = 0.74$) suggests a need for further investigation.

Types and tokens of complement-taking verbs

To explore the most frequently used complement-taking verbs, we considered the number of children that used each complement-taking verb and the total number of infinitival complements produced by each group for each complement-taking verb (see Table III). To be consistent with Eisenberg (2003), first this analysis included reduced infinitives as well as true infinitives. For the SLI group, *get, go, have, like, want* and *try* were the most frequent complement-taking verbs and for the MLU group, *get, go, have* and *want* were the most frequent; the remaining complement-taking verbs were used by six or fewer children in each group. For the SLI group, *get, go, have, like, want* and *try* accounted for 91% of the complement-taking verbs. For the MLU group, this same group of complement-taking

Table III. Most frequent complement-taking verbs in infinitival complements in 133 TVU: Number of children used and total use by all children by language group.

	SLI				MLU			
Verb	Number of children	Infinitival complement	Reduced infinitives	True infinitives	Number of children	Infinitival complement	Reduced infinitives	True infinitives
Go	14	52	50	2	14	85	84	1
Want	14	22	7	15	15	32	14	18
Have	13	60	2	58	14	40	2	38
Like	13	26	0	26	6	8	0	8
Get	11	44	26	18	10	23	13	10
Try	10	40	0	40	6	14	0	14

Note: SLI, specific language impairment; MLU, mean length of utterance; TVU, total verbal utterances.

Table IV. Complement-taking verbs in true infinitival complements in 133 TVU: Number of children used and total use by all children by language group for most frequent complement-taking verbs.

	SLI			MLU		
Verb	Number of children	True infinitives	Percent of true infinitives	Number of children	True infinitives	Percent of true infinitives
Want	13	15	8.24	16	18	16.67
Have	13	58	31.87	14	38	35.19
Like	13	26	14.29	6	8	7.41
Get	10	18	9.89	10	10	9.26
Try	6	20	10.99	6	14	12.96
Total			75.28			81.49

Other complement-taking verbs by SLI children	Other complement-taking verbs by MLU children
Allow	
Decide	Forgot
Go	Go
Hate	Love
Need	Need
Start	Start
Suppose	Suppose
Tell	Take
Use	
Wait	

Note: SLI, specific language impairment; MLU, mean length of utterance.

verbs accounted for 89% of the infinitival complements. For both groups, *get, go* and *have* accounted for about two-thirds of the infinitival complement productions (SLI = 64%, MLU = 67%). The children with SLI, therefore, were not more reliant on a limited set of complement-taking verbs to formulate infinitival complements as compared to the younger children with typical language.

Second, frequency of complement-taking verbs also was evaluated in only the true infinitive productions (see Table IV). In the SLI group, nine or more of the children used *get, have, like, try* and *want* as complement-taking verbs, accounting for 86% of the complement-taking verbs

Table V. Number of different verbs used by SLI and NL children in true infinitives and reduced infinitives in 133 TVU by language group.

Group	Total	True infinitive	Reduced infinitive
SLI			
M	4.74	3.84	1.42
SD	1.70	1.77	1.07
Range	2–8	0–7	0–3
MLU			
M	4.05	2.89	1.53
SD	1.08	1.15	1.12
Range	2–6	0–5	0–3

Notes: Some verbs were used in reduced infinitives form and true infinitives form. Hence, the total does not represent a sum of true infinitive plus reduced infinitive. SLI, specific language impairment; MLU, mean length of utterance; NL, normal language.

in true infinitives. The remaining verbs were used by four or fewer children with SLI. This same set of verbs accounted for 81% of the complement-taking verbs in the MLU group. In the MLU group, only *want* and *have* were used by at least 10 of the children, accounting for 51.85% of the complement-taking verbs in true infinitives. The remaining complement-taking verbs were used by seven or fewer children in the MLU group (see Table IV).

Overall, the SLI group used 15 different complement-taking verbs in true infinitives whereas the MLU group used 12 different complement-taking verbs (see Table IV). However, there was no statistical difference between the groups for the mean number of different complement-taking verbs (H (1, 37) = 1.84, $p = 0.17$; see Table V).

Production of infinitival to in obligatory contexts

There was a significant group difference in the inclusion of infinitival *to* (H (1, 37) = 16.54, $p = 0.00$, $d = 0.94$; see Table VI). Children with SLI included the obligatory infinitive marker *to* less often than the children matched for MLU. Across all true infinitives, in the MLU group there was only one omission of infinitival *to*, an omission rate of less than 1%. In contrast, in the SLI group there were 33 omissions, an omission rate of nearly 20%. Thirteen of 19 children with SLI omitted infinitival *to*; 9 children omitted *to* more than once.

Discussion

The overriding questions regarding complex syntax development in children with SLI parallel questions posed about other aspects of grammatical development in children with SLI. There is interest in how the complex syntax abilities of children with SLI compare to age-matched typical language learners (e.g. Marinellie, 2004) as well as to younger typical language learners matched on some aspect of language performance, for example, MLU (e.g. Schuele, Dykes, and Wisman, 2001) or vocabulary (Owen and Leonard, 2006). As the details of complex syntax development in children with SLI are revealed, effort can be devoted to exploring why children with SLI have particular strengths and weaknesses in complex syntax development.

Given their well-documented grammatical limitations (Leonard, 1998), it is anticipated that children with SLI will have less skill in producing complex syntax than their same-age peers. But this may be true for only specific aspects of complex syntax production or particular complex syntax structures. The production of complex syntax involves knowledge

Table VI. Percent correct use of infinitival to in obligatory contexts by language group.

	SLI				MLU		
Age	MLU in LS	Frequency of *to* inclusion	Percent correct	Age	MLU in LS	Frequency of *to* inclusion	Percent correct
5;8	6.51	5/5	100	3;0	3.79	3/3	100
6;3[a]	4.30	5/5	100	3;10	4.85	8/8	100
7;1	6.56	11/11	100	4;4	8.79	16/16	100
7;2[a]	7.80	25/25	100	4;4	5.40	4/4	100
7;7[a]	8.09	13/13	100	4;5	5.30	15/15	100
7;8	6.49	11/11	100	4;5	5.67	11/11	100
7;10	8.86	20/21	95	4;6	6.31	15/15	100
7;8	6.58	30/32	94	4;6	7.64	6/6	100
5;9	5.24	22/24	92	4;7	6.24	10/10	100
6;7	4.77	9/10	90	4;9	5.73	2/2	100
5;2	3.95	15/17	88	4;10	5.31	5/5	100
6;2	6.75	23/26	88	4;11	6.89	17/17	100
5;10	5.74	18/21	86	5;1	5.26	14/14	100
6;3	6.31	6/7	86	5;1	6.48	14/14	100
6;9	5.66	17/21	81	5;1	4.55	7/7	100
6;1	5.80	7/10	70	5;1	5.74	5/5	100
6;5	4.36	3/8	38	5;6	4.48	8/8	100
5;11	4.59	1/6	17	5;9	8.02	12/12	100
5;10	5.38	0/1	0	4;8	6.45	26/27	96
Total		241/274		Total		198/199	
M			80.21				99.81
SD			29.42				0.85

Note: [a]Child who speaks African American English (AAE); MLU in LS, mean length of utterance in 100-utterance spontaneous language sample; SLI, specific language impairment.

of verb vocabulary, verb argument structure and morphology specific to complex syntax (e.g. relative markers, infinitival *to*; Owen and Leonard, 2006). In the present investigation, we examined the production of one complex syntax structure, infinitival complements, by children with SLI as compared to a group of younger MLU-matched children, in an effort to clarify inconsistencies in the literature between more broad studies of complex syntax that included infinitival complements (Johnston and Kamhi, 1984; Leonard, 1995; Leonard, et al.,1997; Schuele and Dykes, 2005; Owen and Leonard, 2006) and analyses specific to infinitival complement production (Eisenberg, 2003, 2004). We did not have a comparison group of same-age language-typical peers. Thus, at present we can consider only the extent to which children with SLI are similar to younger MLU-matched children.

Consistent with Eisenberg (2003), the children with SLI in our study were as productive with infinitival complements (reduced infinitives and true infinitives) as children matched for MLU. However, we found that the SLI group was more likely to produce true infinitives than the MLU group. The MLU group produced reduced infinitives and true infinitives with similar mean frequency. But the mean number of true infinitives for the children with SLI was double the mean frequency for reduced infinitives. This difference may be attributable to chronological age.

Although there was no significant group difference on two-noun infinitives, the effect size of 0.74 is notable. This analysis may have been underpowered and further investigation is warranted to determine if this structure is truly problematic for children with SLI. Because this structure is infrequent in spontaneous language samples as illustrated in the current

investigation and Eisenberg (2003), elicited production tasks may provide a better method for investigation. In an elicited task the verbal prompts along with the nonverbal context set up a situation where the two-noun infinitive efficiently conveys the intended meaning (Eisenberg, 2004; Fisher and Schuele, 2009).

Examination of complement-taking verbs across infinitival complements (reduced infinitives, true infinitives) suggested that both groups were equally reliant on a small set of complement-taking verbs. *Get, go* and *have* accounted for about two-thirds of the complement-taking verbs for each group. This finding is not surprising given that there is a small set of verbs that take the reduced infinitive form. A much wider range of verbs can take true infinitival complements. Thus, examination of complement-taking verbs in only true infinitives likely provides a more stringent test of whether children with SLI rely on a small set of complement-taking verbs in their production of infinitival complements. Rice and Bode (1993) as well as Watkins, Rice, and Moltz (1993) argued that children with SLI have reduced diversity in their verb lexicon (cf. Conti-Ramsden and Jones, 1997).

We did not find that the children with SLI were more likely than the children matched on MLU to restrict their true infinitives to a small set of complement-taking verbs. The five most frequent complement-taking verbs for the SLI group (*get, have, like, try, want*) accounted for a similar proportion of true infinitives in both groups, about 80%. Likewise, the mean number of complement-taking verbs was similar for the two groups. Thus, children with SLI were not more restricted than the children matched for MLU in their productivity of complement-taking verbs in infinitival complements. As they learn to produce infinitival complements, children with SLI do so with a variety of complement-taking verbs, similar to their peers matched for MLU. Eisenberg's data suggested that the normal language children used a greater variety of complement-taking verbs than the language-impaired children, but this was not statistically validated in her study; group differences may have been attributable to variation in sample length across participants. Thus, at least within this age group, the SLI children's production of infinitival complements is not restricted to a small set of verbs. It would be of interest to explore whether children with SLI with limited vocabulary have less verb diversity on infinitival complements than children with SLI who have age-appropriate vocabulary. We did not have vocabulary scores on the children with SLI.

In our data, a clear difference between the groups emerged on the use of infinitival *to* in obligatory contexts. Contrary to Eisenberg (2003), but consistent with Johnston and Kamhi (1984), Leonard (1995), Leonard et al. (1997), Schuele and Dykes (2005) and Owen and Leonard (2006), we found that children with SLI were less proficient than their peers in the inclusion of infinitival *to* in obligatory contexts. All participants in both groups produced at least one true infinitive in the full sample and thus, all participants were included in this analysis. (Three participants did not produce any true infinitives in the 133 utterance sample.) Omission of infinitival *to* was characteristic of the SLI group with an overall accuracy rate of 80% but almost non-existent in the MLU group, with an overall accuracy rate of 99%. Of the 19 MLU children, only 1 child omitted *to*, with this child only having one omission (96% accuracy). We conclude that for this sample of typical language learners between 3 and 5 years of age, inclusion of infinitival *to* did not present any challenges. This conclusion is consistent with other reports of typical children in this age range (Bloom, et al., 1984; Leonard, 1995; Diessel, 2004). In contrast, only 6 of the 19 children with SLI always included *to*, and only 4 additional children were at 90% or greater accuracy. Thus, as a group, the children with SLI were far less proficient in marking obligatory *to* than a younger, MLU-matched group of children. Other grammatical markers in complex syntax structures appear to be problematic for children with SLI (Schuele and Nicholls, 2000; Schuele and Tolbert, 2001; Schuele and Dykes, 2005).

The production of complex syntax requires various embedded clausal structures. Within some of these embedded clauses, grammatical markers are obligatory (relative markers, infinitival *to*, complementisers). It may be the case that children with SLI are less challenged by the embedded clauses than they are by the grammatical markers, which do not carry semantic meaning. This difficulty potentially parallels the well-documented tense marking difficulties for children with SLI (e.g. Rice, Wexler, and Hershberger, 1998).

The children with SLI who marked *to* with 90% or greater accuracy had a mean MLU of 6.52 whereas those below 90% had a mean MLU of 5.30. A tense composite score was derived based on marking of finiteness within the language sample (third person, regular past tense, copula and auxiliary BE) for all the children with SLI, excluding the children identified as AAE dialect speakers (Bedore and Leonard, 1998). This tense composite represents the percentage that finiteness was marked in obligatory contexts throughout the language samples. The mean tense composite of children with SLI who marked *to* with 90% or greater accuracy was 0.79 (SD = 0.17), whereas the mean tense composite of children with SLI who marked *to* below 90% accuracy was 0.60 (SD = 0.27). Thus, the children with SLI who have difficulty marking infinitival *to* have lower grammatical proficiency, based on MLU and the tense composite score, as compared to the children with SLI who marked *to* consistently. Although variable use of infinitival *to* (Zero TO; Washington and Craig, 1994; Oetting and McDonald, 2001) has been reported as a dialectal feature of AAE, the three children with SLI who were speakers of AAE use infinitival *to* in all obligatory contexts.

In spite of Eisenberg's (2003) negative findings, the current study along with the extant literature provides sufficient evidence to suggest that children with SLI omit infinitival *to* at an age where their typically developing peers no longer do. Further, these omissions are incongruent with developmental expectations given the language level of the children with SLI, as indexed by MLU (present investigation) or vocabulary (Owen and Leonard, 2006). For the children in our study who had reached consistent usage of infinitival *to* (i.e. 90%), it is not known whether omissions would have been evident had these same children been studied at an earlier age. Future longitudinal studies that capture the earliest emergence of complex syntax might address the extent to which omissions of infinitival *to* are characteristic of all children with SLI.

Across all children, *to* omission was most likely with the complement-taking verb *have*. However, within individual children, there was no link between *to* omission and particular complement-taking verbs. This finding is in contrast to the suggestion made by Bloom et al. (1984) that inclusion of *to* may be dependent on the complement-taking verb. The argument structure of infinitival clauses is attempted with a variety of verbs by the children with SLI, and the omission of *to* is not unique to particular verbs. A likely possibility for this difference is that Bloom and colleagues studied typical language learners between 2 and 3 years of age; our study participants had moved beyond this point of emergence of complex syntax.

Limitations

At the outset of this discussion, we noted the absence of a same-age comparison group as a limitation to the interpretation of our findings. An additional limitation might be the language-sampling procedure. One challenge in studying complex syntax in spontaneous language is the collection of a sample that has sufficient tokens of complex syntax. Our experience and the literature (e.g. Evans and Craig, 1992; Nippold, Hesketh, Duthie, and Mansfield, 2005) suggested the methodological challenges of language sampling context. Play-based samples were unlikely to yield sufficient complex syntax production in our SLI group, given their chronological age. But a strictly conversational protocol was likely to be too challenging for our MLU-matched group. We struck a compromise with an exclusive use of

Hadley's (1998) conversational protocol with the SLI group and a play-based *conversation* sample with the younger children. We believe that this procedure yielded comparable samples of the complex syntax proficiency across the two groups.

Conclusion

In conclusion, our findings indicate that for children with SLI from 5 to 7 years of age as compared to a language-typical MLU-matched group of children, production of the general clausal structure of infinitival complements is not challenging and productivity of infinitival complement-taking verbs is comparable. Admittedly, their abilities may be less proficient than age-matched language-normal peers, but further study with an age-matched group is needed to explore this issue. Despite their proficiency with the general clausal structure of infinitival complements, children with SLI struggle with the specific grammatical requirements of the infinitival complement structure. Similar to other morphological markers known to be challenging for children with SLI, the inclusion of obligatory infinitival *to* presents challenges for the majority of children with SLI. Whereas typical language learners master the use of this morpheme long before entry to kindergarten, at least some children with SLI continue to show less proficient performance at least into the early school-age years. Future research should explore further the production of infinitival complements of children with SLI as compared to same-age peers, and within an SLI group, comparison of children with limited vocabulary to those with age-appropriate vocabulary. Future longitudinal studies might evaluate also the course of acquisition of infinitival complements. Of particular interest is the extent to which the course of development of marking infinitival *to* is parallel to other grammatical deficits within children with SLI, such as less accurate tense marking (cf. Rice, et al., 1998) as well as whether omissions of infinitival *to* are characteristic of all SLI children at some point of development.

***Declaration of interest*:** This research was supported by a New Investigator Award from the American Speech-Language-Hearing Foundation, by the National Institute of Health, NIDCD R03DC00729 to the second author and NICHD P30HD15052 to the Vanderbilt Kennedy Center for Research on Human Development, as well as by a Students Preparing for Academic-Research Careers Award from the American Speech-Language-Hearing Association to the first author.

Preliminary findings were presented at the Tennessee Association of Audiologists and Speech-Language Pathologists Conference in October 2005 and at the Symposium for Research in Child Language Disorders in June 2006.

Note

1. In the literature what we have chosen to call reduced infinitives have sometimes been referred to as catenatives (e.g. Paul, 1981). This term is particularly prevalent in the speech-language pathology literature. But our exploration of the meaning of this term suggested that the term catenative is a more encompassing term and is not limited to forms such as gonna and wanna. Crystal (2008) defines catenative as a term to refer 'to a lexical verb ("a catenative") which governs the non-finite form of another lexical verb' (p. 69), for example, 'she likes to write, she wants to hate, she hates waiting' (p. 69).

References

Bedore, L. M., & Leonard, L. B. (1998). Specific language impairment and grammatical morphology: A discriminant function analysis. *Journal of Speech, Language, and Hearing Research*, *41*, 1185–1192.

Bloom, L., Tackeff, J., & Lahey, M. (1984). Learning to in complement construction. *Journal of Child Language*, *11*, 391–406.

Burgemeister, B. B., Blum, L., & Lorge, I. (1972). *Columbia Mental Maturity Scale (3rd ed.)*. New York, NY: Harcourt Brace Jovanovich, Inc.
Carnie, A. (2007). *Syntax: A generative introduction*. Oxford: Blackwell Publishing.
Conti-Ramsden, G., & Jones, M. (1997). Verb use in specific language impairment. *Journal of Speech, Language, and Hearing Research*, *40*, 1298–1313.
Crystal, D. (2008). *A dictionary of linguistics and phonetics*. Oxford: Blackwell Publishing.
Diessel, H. (2004). *The acquisition of complex sentences*. Cambridge: Cambridge University Press.
Eisenberg, S. (2003). Production of infinitival complements in the conversational speech of 5-year-old children with language impairment. *First Language*, *23*, 327–341.
Eisenberg, S. (2004). Production of infinitives by 5-year-old language impaired children on an elicited production task. *First Language*, *24*, 305–321.
Eisenberg, S., & Cairns, H. S. (1994). The development of infinitives from three to five. *Journal of Child Language*, *21*, 713–734.
Evans, J. L., & Craig, H. K. (1992). Language sample collection and analysis: Interview compared to freeplay assessment contexts. *Journal of Speech and Hearing Research*, *35*, 343–353.
Fisher, J. D., & Schuele, C. M. (2009, November). Elicited production of infinitival complements by preschoolers: Age and socioeconomic influences. Technical session presented at the Annual Convention of the American Speech-Language-Hearing Association, New Orleans, LA.
Hadley, P. (1998). Language sampling protocols for eliciting text-level discourse. *Language, Speech, and Hearing Services in Schools*, *29*, 132–147.
Howe, M. (1992). *Transcription and coding manual for analysis of language samples: Kansas Language Transcript Database (KLTD)*. Lawrence, KS: University of Kansas.
Johnston, J., & Kamhi, A. (1984). Syntactic and semantic aspects of the utterances in language-impaired children: The same can be less. *Merrill-Palmer Quarterly*, *30*, 65–86.
Leonard, L. (1995). Functional categories in the grammars of children with specific language impairment. *Journal of Speech and Hearing Research*, *38*, 1270–1282.
Leonard, L. (1998). *Children with specific language impairment*. Boston, MA: MIT Press.
Leonard, L., Eyer, J., Bedore, L., & 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.
Limber, J. (1973). The genesis of complex sentences. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language* (pp. 169–185). New York, NY: Academic Press.
Marinellie, S. A. (2004). Complex syntax used by school-age children with specific language impairment (SLI) in child-adult conversation. *Journal of Communication Disorders*, *37*, 517–533.
Menyuk, P. (1969). *Sentences children use*. Cambridge, MA: MIT Press.
Miller, J., & Iglesias, A. (2006). Systematic Analysis of Language Transcripts (SALT), English & Spanish (Version 9) [Computer Software]: Language Analysis Lab, University of Wisconsin-Madison.
Nippold, M. A., Hesketh, L. J., Duthie, J. K., & Mansfield, T. C. (2005). Conversational versus expository discourse: A study of syntactic development in children, adolescents, and adults. *Journal of Speech, Language, and Hearing Research*, *48*, 1048–1064.
Oetting, J. B., & McDonald, J. L. (2001). Nonmainstream dialect use and specific language impairment. *Journal of Speech, Language, and Hearing Research*, *44*, 207–223.
Owen, A. J., & Leonard, L. B. (2006). The production of finite and nonfinite complement clauses by children with specific language impairment and their typically developing peers. *Journal of Speech, Language, and Hearing Research*, *49*, 548–571.
Paul, R. (1981). Analyzing complex sentence development. In J. Miller (Ed.), *Assessing language production in children: Experimental procedures* (pp. 36–40). Baltimore, MD: University Park Press.
Plante, E., Swisher, L., Kiernan, B., & Restrepo, M. A. (1991). Language matches: Illuminating or confounding? *Journal of Speech and Hearing Research*, *16*, 772–776.
Rice, M. L., & Bode, J. V. (1993). GAPS in the verb lexicon of children with specific language impairment. *First Language*, *13*, 113–131.
Rice, M., Wexler, K., & Hershberger, S. (1998). Tense over time: The longitudinal course of tense acquisition in children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, *41*, 1412–1431.
Schuele, C. M. (2002). Archival database of spontaneous language samples of children with SLI and children with typical language skills (Unpublished data).
Schuele, C. M. (2003). *Research manual for complex syntax coding*. Nashville, TN: Vanderbilt University.

Schuele, C. M., & Dykes, J. (2005). Complex syntax: A longitudinal case study of a child with specific language impairment. *Clinical Linguistics and Phonetics*, *19*, 295–318.
Schuele, C. M., Dykes, J., & Wisman, L. (2001). Relative clauses: Production of complex syntax by children with SLI. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, New Orleans, LA.
Schuele, C. M., & Nicholls, L. M. (2000). Relative clauses: Evidence of continued linguistic vulnerability in children with specific language impairment. *Clinical Linguistics and Phonetics*, *14*, 563–585.
Schuele, C. M., & Tolbert, L. (2001). Omissions of obligatory relative markers in children with specific language impairment. *Clinical Linguistics and Phonetics*, *15*, 257–274.
Schuele, C. M., & Wisman Weil, L. (2004, June). Complex syntax productions of children with specific language impairment and MLU-matched peers. Poster session presented at the Symposium for Child Language Disorders, Madison, WI.
Tager-Flusberg, H., & Cooper, J. (1999). Present and future possibilities for defining a phenotype for specific language impairment. *Journal of Speech, Language, and Hearing Research*, *42*, 1275–1278.
Tyack, D., & Gottsleben, R. (1986). Acquisition of complex sentences. *Language, Speech, and Hearing Services in Schools*, *17*, 160–174.
Washington, J., & Craig, H. (1994). Dialectal forms during discourse of poor, urban, African American preschoolers. *Journal of Speech and Hearing Research*, *37*, 816–823.
Watkins, R. V., Rice, M. L., & Moltz, C. C. (1993). Verb use by language-impaired and normally developing children. *First Language*, *13*, 133–143.
Werner, E., & Kresheck, J. (1983a). *Structured Photographic Expressive Language Test-II*. Sandwich, IL: Janelle Publications.
Werner, E., & Kresheck, J. (1983b). *Structured Photographic Expressive Language Test-Preschool*. Sandwich, IL: Janelle Publications.

Appendix

Infinitival complement utterances for analysis was selected, consistent with Eisenberg (2003; personal communication, 27 January 2007).

Utterance types included Explanation	Examples
True infinitives that included a complement-taking verb, an obligatory context for infinitival to and a complement verb.	I tried to eat my cookies. I try eat my cookies. Bill wanted Mary to go to the baseball game. Bill wanted Mary go to the baseball game.
Reduced infinitives that included the reduced infinitive form and the complement verb.	They wanna have cookies for dessert.

Utterance types excluded Explanation	Examples
Unmarked infinitive clauses	He made me eat cookies.
WH non-finite clauses	I know how to ride a bike.
True infinitives which lacked the complement-taking verb	To go home.
True infinitives that lacked the complement verb	I like to.
Reduced infinitives that lacked the complement verb	I'm gonna.
Non-complementing infinitives	It's fun to eat ice cream. It is time to go.

Note: SLI, specific language impairment; MLU, mean length of utterance.