An Examination of the Morpheme BE in Children With Specific Language Impairment: The Role of Contractibility and Grammatical Form Class

Patricia L. Cleave
Dalhousie University
Halifax, Nova Scotia
Canada

Mabel L. Rice
University of Kansas
Lawrence

This study examined the production of the morpheme BE, focusing on the influence of contractibility, the relationship between copula and auxiliary forms, and the occurrence of non-omission errors. Language samples collected from children with SLI and from normal language learners at equivalent MLU levels were analyzed. Three levels of contractibility were examined: contractible, syntactically uncontractible, and phonetically uncontractible. Contractible contexts were produced significantly more accurately than uncontractible contexts by both groups. There was no difference between the two forms of uncontractibility. Furthermore, there were no significant interactions between language status and contractibility, suggesting that contractibility influenced both groups equally. Copula forms were produced more consistently than auxiliary. There was no interaction between BE type and language status. The groups did not differ in proportion or type of non-omission error. The results are discussed in relation to accounts of morphological deficits in SLI.

KEY WORDS: specific language impairment, morphosyntax, grammatical impairment, copula BE, auxiliary BE

Language learning is generally thought to be quick and effortless. However, there is a group of children for whom the acquisition of language is problematic despite performance within the normal range in other areas, including hearing, nonverbal intelligence, emotional functioning, and motor development. The term specific language impairment (SLI) is used to describe this condition. Although many language areas are affected in children with SLI, a number of researchers have reported that the acquisition of morphology is particularly difficult for English-speaking children with SLI (Johnston & Schery, 1976; Kahn & James, 1983; Leonard, 1989; Leonard, Sabbadini, J. Leonard, & Volterra, 1987; Oetting & Rice, 1993; Rice & Oetting, 1993; Rice, Wexler, & Cleave, 1995; Steckel & Leonard, 1979—see Watkins & Rice, 1994, for extensive discussion). The evidence cited to support this conclusion is the fact that English-speaking children with SLI display less competency with morphology than children learning language typically who have been matched for language level.
BE (all caps denote the citation form of the set of BE verbs) is one morpheme that is problematic for children with SLI. This study examined the production of BE by children with SLI and by children learning language typically. BE is of particular interest because it has a number of unique characteristics. It carries tense and agreement features and demonstrates overt movement in questions and negatives. It can function as the sole verb in a sentence (copula form) or as part of a progressive verb phrase (auxiliary form). In addition, the paradigm of BE involves a number of suppletive forms (e.g., is, 's, were) that differ substantially in their surface structure.

In recent years there has been an increased interest in the morphological deficits of SLI because of the development of a number of hypotheses to account for these deficits. The Extended Optional Infinitive (EOI) account (Rice & Wexler, 1993; Rice et al., 1995) argues that in SLI there is an extension of the Optional Infinitive (OI) stage as proposed by Wexler (1994, 1996) for normal language acquisition. In the OI stage, young children sometimes produce infinitival forms in contexts that require finite forms in the adult grammar. In other words, finite forms (i.e., those that carry tense and agreement features) are used inconsistently from the perspective of the adult grammar. In the case of BE, sentences in which copula or auxiliary BE is omitted are interpreted as nonfinite. An OI account of English draws attention to the important distinction between the production of a surface form in contexts where finiteness is required and the accuracy of form choice when overt finiteness-marking is evident. Omissions of copula or auxiliary BE are regarded as omitted tense-markers, which are predicted. When copula or auxiliary BE appears, the form choice should agree with the person and number of the subject, thereby showing correct agreement. The EOI account of SLI proposes that children with SLI remain in the OI stage for a protracted period but that they have the same representations in Universal Grammar (UG) as typically developing children. This framework generates two important predictions for children with SLI who are in an OI stage: They should omit copula and auxiliary BE for a protracted period, and when they produce BE, they should observe subject agreement and follow the word order principles. Thus, non-omission errors should be relatively rare—that is, at a rate that does not exceed the occasional errors of younger nonaffected children. Non-omission errors involve the incorrect use of a BE form. Examples of these are agreement errors (e.g., “I is”), inversion errors (e.g., “What he is doing”), use of BE in non-BE contexts (e.g., “I am do that next”), and double marking (e.g., “Is he’s going!”). Recent reports show strong empirical support for these predictions (Rice et al., 1995; Rice & Wexler, 1996).

Other linguistically based accounts of the morphological difficulties of SLI posit that the language learning mechanisms of children with SLI are missing some linguistic constraints of UG. Clahsen (1989, 1992) proposed the Grammatical Agreement Deficit (GAD) account in which the morphological deficits of SLI are attributed to difficulty with grammatical agreement relationships. He argued that morphemes that involve this agreement, such as BE, will be problematic for children with SLI. As noted by Rice and Wexler (1993), missing constraint accounts such as those put forth by Clahsen predict that children with SLI will differ from typical language learners in terms of non-omission errors in that they will produce more, and possibly unique, non-omission errors because their underlying grammar is different. For GAD, these predictions apply specifically to agreement errors.

In contrast to the linguistic representation interpretations, there are interpretations that focus on the perceptual properties of BE, often attributing omissions to the fact that BE forms are small, unstressed elements in the incoming speech stream and therefore vulnerable to omission. The intuition that grammatical limitations of children with SLI are attributable to input limitations has recently received much attention as a result of the claims of Tallal and her colleagues: “The symptomatology of LLI children may reflect primarily bottom-up processing constraints rather than a defect in linguistic competence per se” (Tallal et al., 1996, p. 83). Because of the widespread public acceptance of this assertion, it is timely and crucial to examine in detail what such a claim might mean.

In the most precise formulation of an input-deficit account, Leonard (1989, 1992) has proposed the Surface Account (SA), which suggests that the surface form of a given morpheme, in interaction with the need to construct a morphological paradigm (Pinker, 1984), makes it problematic for children with SLI. Specifically, the proposal is that morphemes with low phonetic substance (i.e., short duration in relation to surrounding material), including various forms of BE, will be especially problematic because they are difficult to perceive and produce. When these difficulties are coupled with the cognitive demands of constructing morphological paradigms, the language-learning resources of children with SLI are particularly taxed. Thus, grammatical morphemes with low phonetic substance are slow to enter the language systems of children with SLI. Predictions put forth within SA emphasize that grammatical forms that have “low phonetic salience” are likely to be omitted. Predictions regarding non-omission errors are not clearly specified. The SA framework assumes that the underlying grammar is intact. However, Rice et al. (1995) and Rice and Wexler (1996) point out that the incomplete or faulty paradigm-building component suggests that correct form choice is
likely to be problematic (e.g., form choice errors such as "I is" are not ruled out).

**The Influence of Contractibility**

This study examined the acquisition of BE, focusing on the influence of contractibility, the relationship between copula and auxiliary forms, and the occurrence of non-omission errors. Following Brown’s (1973) seminal study of morphological development, many studies of morphological acquisition have divided BE forms into contractible and uncontractible contexts. The results from these studies are contradictory. Some studies have found that contractible forms are acquired first (Brown, 1973; Ingram, 1972; Khan, 1983). Others have found the reverse (deVilliers & deVilliers, 1973; Johnston & Schery, 1976; James & Khan, 1982).

Kuczaj (1979) suggested that these discrepant findings might be due to sampling differences (e.g., the number of question forms included) and to the sometimes complex distinctions between contractible and uncontractible contexts. BE forms can be contractible for syntactic, phonetic, and pragmatic reasons. The syntactic reasons include inverted Yes/No questions (e.g., “Is he coming?”), elliptical contexts (e.g., “Yes, he is”), and certain constructions when a wh-phrase is moved (e.g., “I know where he is”). For the elliptical and moved wh-contexts, Radford (1988) argued that contraction is not allowed in these contexts because contracted forms cannot be used if there is an empty trace immediately following the BE form. The phonetic reason involves the phonotactic constraints of English. One constraint prohibits two strident coronal consonants from being in a consonant cluster. Therefore, when the word before is ends in an strident coronal consonant, is is uncontractible for phonetic reasons (e.g., “The gas is gone”). Similarly, the suppletive are is generally uncontractible. The past-tense suppletives was and were are always uncontractible because of their phonetic characteristics. The pragmatic reason for uncontractibility involves emphasis. Emphasis naturally prohibits contraction (e.g., “I am coming”).

Researchers have used different criteria for uncontractible contexts. This may be another reason for the conflicting findings on the influence of contractibility. For example, Kuczaj (1979) chose to differentiate contractible versus uncontractible sentential positions regardless of other factors. Therefore, the sentence “This is a ball” was considered contractible, whereas other investigators who considered phonetic factors (Ingram, 1972; Khan & James, 1983) considered this uncontractible. Other researchers were not explicit in their definitions (Brown, 1973; deVilliers & deVilliers, 1973; James & Khan, 1982; Johnston & Schery, 1976).

<table>
<thead>
<tr>
<th>Findings/Predictions</th>
<th>Omissions of BE</th>
<th>Contractibility</th>
<th>Agreement errors</th>
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<tbody>
<tr>
<td>Empirical findings on development sequence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown (1973)</td>
<td>UC &gt; C</td>
<td>Not addressed</td>
<td></td>
</tr>
<tr>
<td>Ingram (1972)</td>
<td>UC &gt; C</td>
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<td></td>
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<tr>
<td>Khan &amp; James (1983)</td>
<td>UC &gt; C</td>
<td>Not addressed</td>
<td></td>
</tr>
<tr>
<td>deVilliers &amp; deVilliers (1973)</td>
<td>C &gt; UC</td>
<td>Not addressed</td>
<td></td>
</tr>
<tr>
<td>James &amp; Khan (1982)</td>
<td>C &gt; UC</td>
<td>Not addressed</td>
<td></td>
</tr>
<tr>
<td>Johnston &amp; Schery (1976)</td>
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</tr>
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</table>

**Theoretical predictions**

<table>
<thead>
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<th>Linguistic representation</th>
<th>Yes</th>
<th>No effect</th>
<th>Rare</th>
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</thead>
<tbody>
<tr>
<td>EOI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAD</td>
<td>Yes</td>
<td>No effect</td>
<td>Widespread</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input processing deficit</th>
<th>Yes</th>
<th>UC &gt; C</th>
<th>Probable</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA · Strong</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA · Weak</td>
<td>Yes</td>
<td>UC = C</td>
<td></td>
</tr>
</tbody>
</table>

*UC > C = uncontractible contexts before contractible contexts

Contractibility is an interesting testing-ground for some of the theories of the morphological impairments of children with SLI. Table 1 summarizes relevant empirical and theoretical points with regard to previous empirical findings. SA proposes that children with SLI are prone to omit grammatical morphemes because certain morphemic contexts have low phonetic salience, which makes the building of paradigms difficult for these children. This in turn leads to deletion of these forms from surface productions. Available formulations of the SA account do not specify precise predictions for the contractible/uncontractible distinction. Our understanding of the theory and the general framework generates two possible interpretations: a strong and a weak version. A strong interpretation of SA predicts that BE in uncontractible contexts should be more likely to appear in surface structures than BE in contractible contexts. A weaker interpretation predicts no difference between the two contexts. A clear and important prediction under either a strong or weak interpretation is that there should be no advantage for contractible BE contexts. Because SA does not address syntactic versus phonetic uncontractibility, there is no prediction for this comparison. In contrast, the linguistically motivated accounts of EOI and GAD propose that the source of the difficulty lies in the underlying linguistic functions or properties of a morpheme, regardless of the surface form. Because the grammatical functions of tense- and agreement-marking are carried out in both contractible and uncontractible contexts, there is no reason to predict a difference. If a significant effect of contractibility exists, it would be beyond the scope of these theories. The EOI account can be contrasted with the GAD
in the prediction that when children with SLI use forms of copula and auxiliary BE, the forms will show agreement with the subject. If children do, indeed, show an agreement deficit as suggested by GAD, they should not be able to construct a complete morphological paradigm and thus should demonstrate a number of non-omission errors. This prediction also differentiates EOI from SA, in that a weak paradigm building is not a component of EOI but is of SA.

Methodological issues also motivate further investigation of the influence of contractibility. Although the distinction seems to be intuitively straightforward, procedural definitions actually vary considerably among studies, and there are various degrees of contractibility, including neutralized vowels and contexts in which the vowel is deleted. In this study, we develop and evaluate definitions of contractibility in sufficient detail to allow replication in future studies.

The Relationship Between Copula and Auxiliary Forms

Another issue in the acquisition of BE is the relationship between copula and auxiliary forms. The finding that copula forms are acquired before auxiliary forms has been consistent across a number of studies, but a fully detailed analysis has rarely been conducted (Brown, 1973; de Villiers & de Villiers, 1973; Ingram, 1972; James & Khan, 1982; Johnston & Schery, 1976; Khan & James, 1983). One of the exceptions is the study by Stromswold (1991) in which children acquiring language typically displayed distinct error patterns for copula and auxiliary forms. Specifically, the children occasionally treated copula BE as a typical main verb, which takes regular tense and agreement inflections (e.g., “This be here”) and DO support (e.g., “This doesn’t be straight”), but they never did so with the auxiliary forms. Furthermore, inversion errors were more common in copula contexts. Thus, the children appeared to know the grammatical categories of lexical verbs and auxiliary verbs that are assumed to be part of UG.

Whether children with SLI display the same differences between copula and auxiliary forms is unknown. The EOI account predicts that children with SLI will display the same error pattern as normally developing children. GAD proposes that children with SLI are missing some linguistic constraints of UG, and thus more and unusual errors, specifically agreement errors, would be expected. Finally, if children with SLI have difficulties constructing morphological paradigms, as proposed by SA, unique errors would be expected, as noted above.

This study was designed to test various theories of the morphological difficulties seen in children with SLI by examining the acquisition of BE. To do this, three factors were examined: the influence of contractibility, non-omission errors, and the relationship between copula and auxiliary forms, specifically with respect to the error patterns found by Stromswold (1991).

Method

Subjects

A total of 22 children participated in this study. Twelve were children with SLI (SLI group), and 10 were typical language learners who were at equivalent language levels (ND group). All of the children were from monolingual English-speaking homes and attended one of several preschools or day care centers in eastern Kansas and western Missouri. Each child passed a hearing screening and displayed no clinically significant neurological or social/behavioral problems according to parent or teacher report. The Goldman Fristoe Test of Articulation (GFTA; Goldman & Fristoe, 1986) was administered to assess the children’s sound production. In addition, to ensure that the children’s phonological system did not adversely affect their production of the BE forms, a nonstandardized measure of the children’s production of nonmorphemic, word final /s/ and /z/ was administered. Five instances of each phoneme were included. All of the children produced a correct or recognizable distortion of the targeted morpheme at least 4 of 5 times.

The children in the SLI group ranged in age from 54 to 62 months ($M = 66.9$) and met a number of inclusionary and exclusionary criteria. They all had been identified by a certified speech-language pathologist as having SLI and were currently receiving services. In addition, they met the following inclusionary criteria: (a) normal intelligence as defined by a standard score within one standard deviation of the mean (i.e., between 85 and 115) on the Columbia Mental Maturity Scale (CMMS; Burgemeister, Blum, & Lorge, 1972); (b) a standard score more than one standard deviation below the mean (i.e., < 85) on the Peabody Picture Vocabulary Test–Revised (PPVT-R; Dunn & Dunn, 1981); and (c) an MLU more than one standard deviation below the predicted mean for chronological age (Leahdahl & Miller, 1993). This last measure was based on a spontaneous language sample of at least 200 utterances.

In the SLI group there were two dizygotic twin pairs. All of the testing and sampling procedures were conducted with both members of the two sets. However, because of the assumption of independence involved in analyses of variance, the data from only one member of each twin pair were included for all inferential statistical analyses. The data from the other member of the twin were included in qualitative analyses.

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The 10 children in the ND group ranged in age from 31 to 42 months \((M = 36.3)\). To ensure that the ND group was at a language level equivalent to that of the SLI group, each child in the ND group demonstrated an MLU within .15 morphemes of the MLU of at least one member of the SLI group. Nine of the children achieved standard scores within one standard deviation on the PPVT-R, and one child’s score was 118. Eight of the children had MLUs that fell within one standard deviation of the mean predicted for their chronological age (Leadholm & Miller, 1993). The MLUs for the other two children fell between 1 and 2 standard deviations. Table 2 shows the mean scores and standard deviations from the identification measures for both groups.

\(T\) tests were conducted on the various identification measures to confirm the expected group differences. The groups did not differ significantly on MLU \((p > .05)\), but they did differ on standard scores of the PPVT-R and on percentile rank for the GFTA \((ps < .05)\). More interestingly, the groups did not differ significantly in their raw scores on the PPVT-R and GFTA \((ps > .05)\). Thus, although the two groups differed when comparing age-indexed scores, they did not differ on the number of correct items.

**Procedures**

**Data Collection**

Each child in this study participated in standardized testing and three language samples, which were collected with three separate standard toy kits. All sessions took place at the child’s preschool or day care. The standardized testing and the initial language sample were collected as part of a larger, ongoing study conducted by Rice and Waxler (1993). All language sampling was done by the first author. The samples were audiorecorded for later transcription.

<table>
<thead>
<tr>
<th>Group</th>
<th>Age*</th>
<th>MLU</th>
<th>PPVT-R*</th>
<th>GFTA*</th>
<th>CMMS®</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLI ((N = 10))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>56.90</td>
<td>3.78</td>
<td>75.10</td>
<td>15.60</td>
<td>97.00</td>
</tr>
<tr>
<td>(SD)</td>
<td>2.56</td>
<td>0.61</td>
<td>3.45</td>
<td>6.54</td>
<td>7.69</td>
</tr>
<tr>
<td>Range</td>
<td>54–62</td>
<td>2.76–4.64</td>
<td>69–81</td>
<td>4–23</td>
<td>85–109</td>
</tr>
<tr>
<td>ND ((N = 10))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>36.30</td>
<td>3.81</td>
<td>101.70</td>
<td>71.80</td>
<td></td>
</tr>
<tr>
<td>(SD)</td>
<td>3.80</td>
<td>0.54</td>
<td>9.02</td>
<td>26.97</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>31–42</td>
<td>2.99–4.78</td>
<td>90–118</td>
<td>26–98</td>
<td></td>
</tr>
</tbody>
</table>

*chronological age in months  
*Peabody Picture Vocabulary Test – Revised, standard score reported  
*Goldman-Fristoe Test of Articulation, percentile rank reported  
*Columbia Mental Maturity Scale, age deviation score reported

The first language sample collected was used to determine the child’s MLU as a criterion for inclusion in the study. A minimum of 200 complete and intelligible utterances were collected. In the second and third language samples, specific efforts were made to elicit infrequently occurring BE forms. These samples were 25 to 30 minutes in length. To obtain enough unique instances of phonetically uncontractible contexts, the toy kits contained a number of items whose names end in a staid coronal consonant (e.g., *suitcase, orange, carwash*), and multiple exemplars of the same item were included to encourage the use of plural subjects. The toys were chosen to allow the child to adopt roles that were likely to elicit a number of questions. For instance, encouraging the child to assume the doctor’s role when playing with a doctor’s kit allowed many opportunities for questions. When appropriate, the experimenter prompted for a question by saying, for example, “*Her ear might be sore. You’d better ask.*” False assertions by the experimenter were used to encourage production of elliptical and negative contexts (e.g., “I’m not going to fit”). The language samples were collected within 12.6 days on average \((Range = 8–28)\).

**Transcription and Coding**

All samples were transcribed from the audio recordings and coded following the conventions of the Kansas Language Transcript Database (KLTD; Rice, 1992) Coding Manual (Howe, 1992) by the first author. The KLTD coding system outlines procedures for transcription and coding of language samples and is compatible with the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 1991). The system involves codes for a number of morphemes, including contractible and uncontractible copula and auxiliary BE forms. The SALT program was used to calculate MLU and to perform computerized searches to identify all obligatory contexts for BE. In addition, all utterances that contained an error code (ERR) were identified. All concordances that resulted from these searches were examined by the first author, and the uncontractible contexts were divided further into syntactically and phonetically uncontractible contexts. There are various degrees of contractibility, including neutralized vowels and contexts in which the vowel is lost entirely. For this study, a BE form was considered contractible if it occurred in a context in which it was possible to attach the form to the previous word, resulting in the loss of a syllable pulse (e.g., “The dog’s running away”). An uncontractible context was considered phonetically uncontractible if the uncontractibility was a result of the phonotactic constraints of English (e.g., “The dish is broken”). Contexts in which a syllabic consonant could be used for the BE form were not considered contractible because a syllabic consonant retains the syllable pulse (e.g., “The children...”)
are running"). Syntactically uncontractible contexts were ones in which the syntactic framework was such that contractibility was not allowed, regardless of the phonetic characteristics of the words (e.g., “Is the book ready?” “Yes it is”). Following the precedence of previous investigations (Brown, 1973; Ingram, 1972; Khan & James, 1983; Kuczaj, 1979), Yes/No questions were considered uncontractible. Note that this is a possible exception to the “syllable pulse” criteria for contractibility. In conversational speech, it is possible in some cases to omit the vowel and contract the BE form onto the following word (e.g., /zmaTkhIr/ = “Is Mike here?”). In addition to the precedence for classifying all Yes/No questions as uncontractible, the utterance initial position makes this context highly salient even with the occasional loss of the vowel. The few instances of emphatic use of BE were included in the phonetically uncontractible category. Correct uses, omissions, and non-omission errors (e.g., agreement errors, use of BE in non-BE contexts) of BE were identified. Only BE contexts in which an intelligible subject was present were included because the presence of a subject was necessary to determine if the correct suppletive was used. Furthermore, if the utterance was abandoned or contained an unintelligible part such that the correct suppletive of BE could not be determined, the utterance was excluded from analyses.

Reliability

Six samples (10%) were independently transcribed by two graduate students trained in the KLTD coding system and unfamiliar with the details of this study. These samples were chosen following the strategy that one sample using each language sample kit be selected from each group and that the six samples be from six different children. Reliability was calculated point-by-point across morphemes. The average was 86.6%, with a range of 85.2%–88.4%.

Coding reliability of the BE contexts, including correct productions, errors, and omissions, was conducted on 10% of the samples by a trained research associate. Again, a total of six samples were chosen in the manner described above. Point-by-point agreement on coding was calculated. The average was 96.4% agreement, with a range of 90.2%–100.0%.

Results

Preliminary Analyses

BE Contexts

The BE contexts from the three samples were combined for analysis. Across the three samples, the mean number of BE contexts produced by the children was 248.60 (Range = 172–353) for the SLI group and 266.70 (Range = 140–437) for the ND group. The number of BE contexts did not differ between the groups, t(18) = .58, p = .572. BE contexts were divided into copula and auxiliary contexts and then into contractible, syntactically uncontractible, and phonetically uncontractible contexts. Despite efforts to elicit less frequently occurring forms of BE, some children produced only a few instances of some forms. A criterion of a minimum of 3 obligatory contexts for each BE context used in an analysis was set. For the group comparison analyses, which involved all of these divisions, this resulted in samples of 7 children per group. The mean number of BE contexts for each category for the 14 children involved in the group comparisons are included in Table 3.

Table 3. Mean number (and standard deviation) of BE contexts.

<table>
<thead>
<tr>
<th>Context</th>
<th>SLI (n=7)</th>
<th>ND (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractible</td>
<td>125.14 (46.05)</td>
<td>135.00 (37.96)</td>
</tr>
<tr>
<td>Syntactically uncontractible</td>
<td>22.71 (5.02)</td>
<td>25.57 (7.59)</td>
</tr>
<tr>
<td>Phonetically uncontractible</td>
<td>35.43 (12.74)</td>
<td>35.43 (14.99)</td>
</tr>
<tr>
<td>Auxiliary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractible</td>
<td>61.43 (9.68)</td>
<td>69.29 (27.45)</td>
</tr>
<tr>
<td>Syntactically uncontractible</td>
<td>6.00 (1.83)</td>
<td>9.43 (6.05)</td>
</tr>
<tr>
<td>Phonetically uncontractible</td>
<td>10.43 (5.26)</td>
<td>7.57 (3.15)</td>
</tr>
</tbody>
</table>

Group Comparisons

Percent Correct

To test the influence of contractibility on the production of BE forms, a mixed-model ANOVA with one between-subject variable (group) and two within-subject variables (contractibility and BE type) was conducted. Percent correct use of BE forms in obligatory contexts was the dependent variable. Percent correct was

Table 4. Mean (and standard deviation) of group performance in BE contexts.

<table>
<thead>
<tr>
<th>Context</th>
<th>SLI (n=7)</th>
<th>ND (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractible</td>
<td>.723 (.293)</td>
<td>.956 (.032)</td>
</tr>
<tr>
<td>Syntactically uncontractible</td>
<td>.351 (.153)</td>
<td>.808 (.124)</td>
</tr>
<tr>
<td>Phonetically uncontractible</td>
<td>.594 (.210)</td>
<td>.793 (.156)</td>
</tr>
<tr>
<td>Auxiliary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractible</td>
<td>.629 (.244)</td>
<td>.916 (.067)</td>
</tr>
<tr>
<td>Syntactically uncontractible</td>
<td>.376 (.194)</td>
<td>.762 (.260)</td>
</tr>
<tr>
<td>Phonetically uncontractible</td>
<td>.318 (.227)</td>
<td>.588 (.235)</td>
</tr>
</tbody>
</table>

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calculated independently for each category of BE (e.g., number of correct phonetically uncontractible copula forms/total number of phonetically uncontractible copula contexts). The means and standard deviations for the groups are reported in Table 4. There was a significant main effect for group \( F(1, 12) = 23.42, p < .001 \), with the children in the ND group significantly more accurate in their productions of BE. The first interaction considered was the three-way interaction between group, contractibility, and BE type. Because the Mauchly sphericity test was nonsignificant \( W = .711, p = .154 \), the univariate analysis was used. The three-way interaction was not significant \( F(2, 24) = 1.12, p = .344 \). Next, the various two-way interactions were examined. The planned comparison involving the interaction between group and contractibility was examined first. Again, because the Mauchly sphericity test was nonsignificant \( W = .977, p = .888 \), the univariate analysis was used. There was no significant two-way interaction between group and contractibility \( F(2, 24) = 1.24, p = .308 \). However, the influence of contractibility was significant \( F(2, 24) = 8.69, p = .001 \). Follow-up univariate tests conducted as part of the MANOVA indicated that contractible contexts were produced correctly significantly more often than uncontractible contexts \( F(1, 12) = 15.980, p = .002 \). There was no significant difference between syntactically and phonetically uncontractible contexts \( F(1, 12) = .000, p = .986 \). These data are depicted in Figure 1.

The second two-way interaction considered was the other planned comparison, the interaction between group and BE type. This interaction also was nonsignificant \( F(1, 12) = .08, p = .786 \). There was a significant effect of BE type, with copula contexts being produced significantly more accurately than auxiliary contexts \( F(1, 12) = 10.78, p = .007 \). These data are depicted in Figure 2.

**Figure 2.** Percent correct in obligatory contexts for BE forms: BE type (copula, auxiliary) by group (SLI group, ND group).

The final two-way interaction involved the two within-subject factors, contractibility and BE type, regardless of group. The Mauchly sphericity test was nonsignificant \( W = .711, p = .154 \); therefore, the univariate analysis was used. The interaction was significant \( F(2, 24) = 10.82, p < .001 \). Follow-up testing revealed that the significant interaction involved the two uncontractible contexts \( F(1, 12) = 14.548, p = .002 \). The interaction involving contractible versus uncontractible contexts and BE type was not significant \( F(1, 12) = 2.751, p = .123 \). These data are depicted in Figure 3. The significant interaction suggests that the planned comparisons involving group by contractibility and group by BE type may be confounded. Thus, the effect of contractibility was tested for the two BE types, and the effect of BE type was tested for each level of contractibility. This method of analysis involved nine separate tests. The same pattern of significant results was found even when the significance level was set at .05/9 = .0055, using Bonferroni's method.

**Figure 3.** Percent correct in obligatory contexts for BE forms: contractibility [contractible, syntactically uncontractible (syn uncon), phonetically uncontractible (phon uncon)] by BE type (copula, auxiliary).
The significant interaction between uncontractible contexts and BE type was unexpected given that the two types of uncontractibility were not significantly different when the interaction with group was considered. The group means revealed that the syntactically uncontractible context was responsible for the significant interaction. Unlike the other contexts, the auxiliary form of BE was produced as accurately in syntactically uncontractible contexts as was the copula form. One possible explanation for this unexpected finding is that because of sampling variability, the syntactically uncontractible category for the auxiliary and copula forms consisted of different proportions of Yes/No questions and elliptical contexts. To examine this question, the proportion of syntactically uncontractible contexts that were elliptical for copula and auxiliary forms was compared. The proportion of elliptical contexts was significantly greater in auxiliary contexts for both groups \( F(1, 12) = 14.29, p = .003 \). There was no group difference \( F(1, 12) = .29, p = .600 \) or interaction \( F(1, 12) = .03, p = .876 \). When the accuracy of the BE forms in the two contexts was compared, elliptical contexts were significantly more likely to be produced correctly than Yes/No questions by both groups \( F(1, 12) = 11.48, p < .005 \).

We also examined the individual subject data to determine how many of the subjects followed the group pattern. Six of the seven children in the ND group and five of the seven children in the SLI group were more accurate in uncontractible contexts than in either uncontractible context. For the copula-auxiliary distinction, an examination of the individual data revealed that, in the ND group, four of the children were more accurate in copula contexts, two were more accurate in auxiliary contexts, and for one child there was no difference. In the SLI group, six of the children were more accurate in copula contexts, whereas one was more accurate in auxiliary contexts. Thus, the individual data followed the group patterns.

**Error Rate**

For both groups of children, the primary error type was omission. The mean proportion of contexts that contained non-omission errors (i.e., number of non-omission errors/total number of BE contexts) was .095 (SD = .02) for the ND group and .057 (SD = .03) for the SLI group. A t test for independent samples revealed that the difference between the groups did not reach statistical significance \( t(18) = 1.76, p = .095 \). When only agreement errors were considered, the mean proportions were .010 (SD = .01) and .013 (SD = .008) for the ND and SLI groups respectively. Because the test for equality of variance was significant at the .05 level, the t test for unequal variance was used in testing group differences. There was no significant difference \( t(16.94) = .70, p = .495 \). Thus, the rate of agreement errors was very low (around 1% of total contexts) for both groups, and the SLI group was not different from the ND group.

For both groups of children, inversion and agreement errors were the most frequent non-omission errors. The only error that was noted in the SLI group that was not seen in the ND group was a substitution of a modal auxiliary for BE. However, this occurred on only one occasion. There were some errors that appeared more frequently in the SLI samples than in the ND samples, but these errors were extremely rare. The children in the SLI group produced a BE form without a subject nine times, whereas this occurred only once in the ND group. Person-agreement errors (e.g., “I is”) occurred four times in the SLI group and only once in the ND samples. Auxiliary DO was substituted for BE nine times by the SLI group and only twice by the ND group. Given that there were approximately 250 occurrences of BE per child for both groups on average, these errors were so rare it is difficult to know how to interpret them.

Another way to examine error rates is to look at the proportion of incorrect responses that were non-omission errors (i.e., number of non-omission errors/number of omission + non-omission errors). The mean proportions were .302 (SD = .139) and .190 (SD = .159) for the ND and SLI groups respectively. Correlations between percent correct in obligatory contexts and proportion of total incorrect contexts that were non-omission errors were high. The correlations were .820 (p < .004) and .609 (p < .001) for the ND and SLI group respectively. Thus, the incorrect contexts of children at higher levels of accuracy were more likely to involve non-omission errors.

**The Relationship Between Copula and Auxiliary Forms**

As reported above, there was a significant difference between copula and auxiliary forms for percent correct in obligatory contexts for both the SLI and ND groups. However, in a number of other ways, the copula and auxiliary forms were very similar. The correlation between the two forms of BE was very high for both groups: SLI, \( r = .919 \) (p < .001); ND, \( r = .948 \) (p < .001). As a further comparison of copula and auxiliary contexts, the proportion of non-omission errors for each context was compared for each group. The means and standard deviations for the groups are reported in Table 5. A mixed-model ANOVA

**Table 5.** Mean proportion (and standard deviation) of total contexts that were non-omission errors.

<table>
<thead>
<tr>
<th>Group</th>
<th>Copula</th>
<th>Auxiliary</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU</td>
<td>.061</td>
<td>(.039)</td>
</tr>
<tr>
<td>ND</td>
<td>.037</td>
<td>(.025)</td>
</tr>
</tbody>
</table>

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with group as the between-subject variable and BE type as the within-subject variable was conducted. The effect of group failed to reach statistical significance \( F(1, 18) = 2.43, p = .137 \) as did the effect of BE type \( F(1, 18) = 3.59, p = .074 \). The interaction between the two factors was also nonsignificant \( F(1, 18) = 1.16, p = .296 \).

To explore further the relationship between copula and auxiliary forms, the type of non-omission errors produced was examined. Specifically, the errors were examined for overregularizations, unnecessary DO support, and inversion errors. For these nonquantitative analyses, the data from the other member of the two twin pairs were added, resulting in 12 children with SLI. Instances of be in a finite context were rare in both groups, and all occurred in copula contexts (e.g., SLI4: "I am a cowboy" when the context called for the past tense). In the SLI group, uses of be in a clearly finite context occurred a total of four times—once each in the samples of four children. On only one occasion was a regular inflection applied to the be (SLI7: "my kitchen bes right there"). There were an additional 12 times in which be was used, but it was impossible to determine if the error was a substitution of be for a finite form or if a modal auxiliary was omitted (e.g., ND1: "This is my sister" for "This is will be in can be / might be my sister"). For the ND group, there were no instances of the use of be in a clearly finite context and only one instance in which be was used where a modal omission was a possible interpretation. There were no instances of unnecessary DO support produced by either group in copula or auxiliary contexts. That is, in no utterances was a DO form used in conjunction with a BE form (e.g., "Does that be red?"). However, there were instances in which a form of the auxiliary DO was substituted for a BE form. These occurred in both copula and auxiliary contexts.

For the inversion error analysis, only those question contexts in which a BE form was produced were relevant. There were not enough occurrences to conduct group comparisons of inversion errors in copula versus auxiliary contexts. However, by collapsing across children in the groups, it was possible to derive the percentage of inversion errors. In this analysis, Stromswold's (1991) procedure of using only uncontracted forms of BE was followed to allow a comparison to her results. Thus, question forms such as "What is he doing?" were omitted. The children in the ND group inverted the copula in 90.8% (188/207) of the copula contexts and in 97.6% (40/41) of the auxiliary contexts. In the SLI group, the percentages were 83.6% (117/140) for copula contexts and 70.0% (7/10) for auxiliary contexts. If both contracted and uncontracted contexts were included, the inversion rates for the ND group were 93.4% (352/377) for copulas and 93.8% (44/47) for auxiliaries. For the SLI group, the values were 84.3% (231/274) and 42.9% (9/21) respectively.

**Discussion**

In this investigation, the morpheme BE was examined in order to test some of the hypotheses that flow from various accounts of the morphological deficits of SLI. Specifically, the role of contractibility, the presence of non-omission errors, and the relationship between copula and auxiliary forms were examined. Unlike previous studies, this study examined the child's use of BE in language samples designed to elicit frequent occurrences of a variety of BE contexts. The children's error types, as well as accuracy, were examined as well.

The significant group effect replicates the previous findings that the acquisition of BE is particularly problematic for children with SLI (Hadley & Rice, 1996; Ingram, 1972; Johnson & Schery, 1976; Khan & James, 1983; Rice et al., 1995; Stockel & Leonard, 1979). The children with SLI were significantly less accurate in their productions of BE than were the typical language learners, who were at equivalent language levels in terms of MLU but were, on average, 20 months younger. Furthermore, this pattern held across both copula and auxiliary forms and across all three levels of contractibility. Given this finding, it was important to identify any particular characteristic of BE that could be a factor in this increased difficulty for the SLI group.

The influence of contractibility was evaluated because (a) previous studies had reported conflicting findings with regard to its effect on acquisition; and (b) input processing deficits accounts, such as SA (Leonard, 1989, 1992), propose that the surface structure of a morpheme has a critical influence on its acquisition by children with SLI. Another reason for examining the influence of contractibility was to improve on some of the methodological weaknesses of previous work by employing a clear definition of contractibility. In this study, the surface advantages for the uncontractible contexts did not lead to better performance. Instead, the opposite finding emerged; contractible contexts were produced more correctly by both groups. Six of seven children in the ND group and five of seven children in the SLI group followed this pattern. Furthermore, the interaction between contractibility and group was nonsignificant, indicating that the effects of contractibility were the same for both groups.

The findings from an investigation of German-speaking children revealed similar patterns (Rice, Noll, & Grimm, 1997). In German, a language in which SEIN (the German form of BE) forms are not generally contracted, children with SLI omitted SEIN forms at a higher rate than normal language learners but they did not show errors of form choice. Their greater tendency to omit SEIN was not attributable to contractibility.
Looking beyond summary measures like percent correct in obligatory contexts yields important information in acquisition studies and studies of SLI. The language groups did not differ significantly on the proportion of non-omission errors nor on the proportion of agreement errors. For both groups, the non-omission error rate was very low. Except for one modal substitution, the children with SLI did not produce unique errors. Finally, the percent correct in obligatory contexts was highly correlated with the proportion of incorrect forms that were non-omission errors. For both groups, a higher accuracy level was associated with a larger proportion of non-omission errors. Thus, what was different at higher levels of accuracy was the number of contexts that did not contain any tense or agreement marker. Although non-omission errors were always rare, it was the number of omissions that changed the most with increased accuracy.

The data also were examined for the particular non-omission errors reported by Stromswold (1991) in her analyses of samples from typically developing children. She noted that there were differences between the copula and auxiliary BE in emergence and in a variety of non-omission errors. From this, she concluded that the children occasionally treated copula BE as a regular lexical verb, but that they did not do so for auxiliary BE. Thus, she proposed that the children made a distinction between main and auxiliary verbs from early on in development.

Consistent with Stromswold’s (1991) findings, overregularizations, unnecessary DO support, and inversion errors were rare in both groups of children. Although the language samples in this investigation were large by general standards, they were smaller than the samples from some of the children whom Stromswold studied. This might explain why some of the errors noted by Stromswold were not found here—specifically overregularizations with tense and agreement markers in the ND group and unnecessary DO support in both groups. At the observed low rates of occurrence of the errors of interest, a larger database will be required in order to include enough instances to allow a full analysis. The children did produce copula forms more accurately, and the overregularizations all occurred in copula contexts for both groups. For the typically developing children, the inversion rates closely paralleled Stromswold’s rates. The fact that copula contexts were inverted less frequently by the ND children is in line with Stromswold’s position. For the SLI group the opposite was found. The auxiliary contexts were inverted less frequently. The low frequency of these errors makes it difficult to know how to interpret this discrepancy. All that can be said is that the typically developing children performed as predicted by Stromswold. Thus, they seemed to be honoring the distinctions between main and auxiliary verbs. For the children with SLI, the results were inconclusive. They did substitute be for a finite form only in copula contexts, but the inversion error data were not in the direction predicted.

As a further comparison of the BE system in children with SLI and those learning language typically, the relationship between copula and auxiliary forms was examined. Copula forms were produced more accurately than auxiliary forms by both groups of children. As with contractibility, there was an effect of BE type, but the effect was the same for the children regardless of their language-learning abilities. Despite this difference, there was evidence that copula and auxiliary forms are closely related. Accuracy levels for the two forms were highly correlated, and similar types and rate of non-omission errors were seen.

**Implications for Theoretical Accounts of SLI**

As noted, a number of theories have been proposed to explain the morphological difficulties seen in SLI. These theories differ with regard to how they can account for the findings of this study. The EOI account proposes that in children with SLI there is an extension of the Optional Infinitive stage. It predicts that children with SLI will omit grammatical morphemes that carry tense features more frequently than children at equivalent language levels. At the same time, it is predicted that the children with SLI will not produce more or unique non-omission errors because their underlying grammars are essentially the same in ways in which word order, agreement, and related grammatical processes are represented. Because both contractible and uncontractible contexts carry tense, the EOI account would not predict a significant effect of surface form. The fact that there was no interaction between contractibility and language status is in line with this prediction. The non-omission error results are generally in line with the predictions made by the EOI account. The proportion of non-omission errors did not differentiate the groups. For the most part, the type of error also did not distinguish the groups. As shown here and elsewhere (Rice et al., 1995; Rice & Wexler, 1996), children with SLI who omit BE forms are nevertheless very accurate in their choice of form (i.e., am, is, are).

The results of the examination of Stromswold’s (1991) errors are also in line with the EOI account. Because ND children and children with SLI are assumed to have identical underlying grammars, both groups should distinguish copula and auxiliary forms. Generally, the distinctions between copula and auxiliary forms were seen in the data from both groups of children.

Finally, the finding that the percent correct in obligatory contexts is highly correlated with the proportion of
incorrect forms that are non-omission errors has a possible explanation under the EOI account. In both groups, the children at higher levels of accuracy chose nonfinite forms less frequently. Thus, with development, the biggest change noted was a reduction of nonfinite forms (i.e., omission of BE forms).

The results of the non-omission errors are not in line with missing constraints accounts. The GAD account proposes that the grammars of children with SLI are qualitatively different from those of typical language learners in terms of agreement. Given that BE forms encode agreement, more and possibly unique errors would be expected in children with SLI. This was not found. Further, the copula/auxiliary distinction and the error pattern reported by Stromswold (1991) also suggest that the underlying grammatical representations of children with SLI do not differ from those of children developing typically. Because contractible and uncontractible contexts do not differ in terms of agreement, the GAD account would not predict a significant effect of contractibility. This is line with the contractibility results of this study.

The findings on contractibility are interesting because an explanation must be external to SA or other input processing explanations that focus on the surface properties of individual morphemes. SA proposes that when the perception and production difficulties of morphemes of low phonetic substance are combined with the need to construct morphological paradigms, the learning resources of children with SLI are severely taxed such that these morphemes are late to be acquired. Neither the prediction that uncontractible contexts should show an advantage (the strong interpretation of SA) nor the prediction that there should be no difference between the contexts (the weak interpretation of SA) was supported. In this study, it was contractible contexts, which contain less phonetic substance, that were produced more accurately.

Although SA clearly predicts a high rate of omissions of BE by children with SLI, the predictions regarding non-omission errors have not been clearly specified. However, if the children are unable to process incoming instances of BE, this should result in weak or faulty paradigms. In turn, some confusions as to where is, for example, should occur in a sentence are likely to appear (Rice et al., 1995; Rice & Waxler, 1996). Yet that is not the case. Children with SLI show very clearly that "he's" and "she's" are allowable in the grammar, but "It's" is not, and they never show confusions such as "is he runs?" or "is he happy's?"

The new question that arises from this study is why there was an advantage for the contractible context. The linguistically based accounts are silent in this matter, and the SA predicts an uncontractible advantage. One possibility is that the children produced contractible forms more accurately because they were unanalyzed. Kuczaj (1985) and Stromswold (1991) examined only uncontracted forms to avoid this complication. The problems with this strategy are obvious: By excluding all contractible forms, the majority of BE contexts are excluded, and the differences between the two contexts cannot be systematically examined.

Various analyses were conducted to determine if unanalyzed forms provided the advantage for the contractible contexts. The conclusion is that this explanation does not have much support. All the children were beyond the very early stage of language in which unanalyzed forms are generally found. In these samples, the children clearly showed productive use of BE. The number of contractible contexts produced for each child ranged from 58 to 212. Furthermore, BE forms occurred with a variety of subjects, and the words used as subject of a BE form also occurred with a variety of predicates and in a variety of sentence contexts. As a further check on the possible use of unanalyzed forms, two specific error types were examined. The reasoning (cf. Brown, 1973, p. 265) was that if forms such as "what's" or "it's" were being used as unanalyzed units, then two possible errors would be likely to appear. One would be a BE form in a context where it is not allowed (e.g., "It's went there"), and the other would be double marking (e.g., "What's is he doing"). Errors that were possible unanalyzed forms were very rare. They occurred only 78 times in 18,755 utterances across all 22 children. The weight of the evidence, we believe, is on the side of productive uses of BE in contractible as well as uncontractible contexts.

The second possible explanation for the advantage for contracted contexts is a frequency effect. Contractible contexts appeared more frequently than uncontractible contexts in this study and in a study by Valian (1992). The higher frequency may be responsible for the higher accuracy in contractible contexts. However, it is important to remember that whatever the basis for the better performance in contractible contexts, it affected both groups of children equally. Thus it does not appear to be an explanation for the particular morphosyntactic deficits of SLI.

Summary and Conclusions

Children with SLI are more likely to omit BE forms than are younger unaffected children at equivalent stages of language acquisition. These omissions are part of what appears to be a clinical marker of SLI (Rice et al., 1995; Rice & Waxler, 1996). A major impetus of this study was to determine if two precise features of BE forms, those of contractibility and grammatical class (copula versus auxiliary), are implicated in this clinical marker and if the
presence of non-omission errors would distinguish children with SLI. The feature of contractibility is relevant to two opposing models of the source of the clinical difference. One set of models posits an input processing limitation. The prediction from these models is that contractibility should prove to be a significant factor, with contractible contexts being more difficult for children with SLI. The second set of models posits a linguistic explanation, in which linguistic representations are implicated. Most relevantly, the EOI account predicts that, although BE forms are likely to be omitted in surface structures, their omission is attributable to the underlying linguistic property of tense-marking, not surface properties. The conclusion of this study is that the contractibility of surface forms is not playing some underlying role in the morphosyntactic vulnerabilities of children with SLI. These findings join a set of findings pointing toward the specific grammatical property of tense-marking and its related manifestations in underlying grammatical representations (Hadley & Rice, 1996; Oetting & Rice, 1993; Rice et al., 1995; Rice & Wexler, 1996). Furthermore, although children with SLI differ from other children in their knowledge of the obligation to mark tense in main clauses, they are remarkably similar to unaffected children in their knowledge of other grammatical properties. They show knowledge of the copula/auxiliary distinction, and they do not produce more or unique non-omission errors.

This study suggests that careful consideration of grammatical contexts, carried out in the context of theoretical predictions, can further our understanding of the possible clinical markers of SLI and our understanding of the underlying linguistic and nonlinguistic mechanisms involved. Ultimately, this understanding will lead to the development of more effective and efficient intervention programs for children with SLI.

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Contact author: Patricia L. Cleave, PhD, School of Human Communication Disorders, Dalhousie University, 5599 Fenwick Street, Halifax, Nova Scotia, Canada B3H 1R2