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Noun phrase morphology in Swedish-speaking children with specific language impairment

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ABSTRACT
Children with specific language impairment (SLI) are often described as having great difficulty with grammatical morphology, but most studies have focused only on these children's use of verb morphology. In this study, we examined the use of noun phrase (NP) morphology by preschool-age children with SLI who are acquiring Swedish. Relative to typically developing same-age peers and younger peers matched according to mean length of utterance, the children with SLI had greater difficulty in the use of genitive inflections, indefinite articles, and article + adjective + noun constructions. Their difficulties were evidenced in omissions as well as substitutions. Furthermore, article omissions were more frequent in NPs containing an adjective and a noun than in NPs with only a noun. These findings indicate that in languages such as Swedish, NP morphology as well as verb morphology can be quite problematic for children with SLI. Factors that might have contributed to these children's difficulties are the lack of transparency of the gender of Swedish nouns, the morphological complexity of NPs containing adjectives in Swedish, the weak syllable status of articles, and the consonantal nature of some of the inflections.

Researchers who study children with specific language impairment (SLI) are devoting increasing attention to languages other than English in their attempt to understand this disorder. There are usually two goals behind this type of endeavor. First, with data from each new language, professionals will have more information to use as a guide in their attempt to assist children with SLI who are acquiring this language. Second, by studying the profiles of children with SLI acquiring different languages, we might be able to identify the common denominator that represents the key feature of these children's difficulties. Because no single language is likely to permit an unobstructed view of all potential factors, such a cross-linguistic approach seems to offer a unique vantage point from which to examine the problem.

In the present study, the focus is on SLI in Swedish. Previously, we reported

on the verb morphology of a group of preschoolers with SLI along with that of comparison groups of normally developing children (Hansson, Nettelbladt, & Leonard, 2000). We found that the children with SLI made more limited use of regular past tense inflections and copula forms than younger, typically developing children matched according to mean length of utterance (MLU). Differences were not found between these groups for the use of present tense inflections. These findings reinforced the view that verb morphology pertaining to tense is vulnerable in children with SLI (see Rice & Wexler, 1996) but also alerted us to the possibility that some details of tense, such as past tense in particular, might be more problematic than others for these children.

Here, we present data on the use of noun phrase (NP) morphology by the same groups of children. There are several reasons to examine this area of the grammar in Swedish-speaking children with SLI. First, although verb morphology deficits in children with SLI are the most notorious, deficits in NP morphology have also been noted. In a richly inflected language such as Italian, differences between children with SLI and MLU controls have been limited to monosyllabic function words such as articles (Bortolini, Caselli, & Leonard, 1997; Leonard, Bortolini, Caselli, McGregor, & Sabbadini, 1992; Leonard, Bortolini, Caselli, & Sabbadini, 1993). In English, differences favoring MLU controls have been seen for NP inflections as well as for articles. These include genitive (possessive) *'s* (Leonard, Eyer, Bedore, & Grela, 1997) and, in some studies (e.g., Leonard et al., 1997) but not others (Oetting & Rice, 1993), noun plural inflections.

Swedish has properties in common with English in some respects and with Italian in others. As in English, plural and genitive inflections usually involve adding a suffix to the noun. Thus, the plural of *stol* (chair) is *stolar* (chairs). A possessive form such as "mommy's" requires the genitive suffix *-s* in Swedish, hence *mamma + s* or *mammas*. Some of these inflections, such as the plural, thus differ from English in that they involve syllabic, rather than consonantal, inflections. In this respect, they bear some similarity to Italian NP inflections, which are exclusively syllabic. In notable contrast to Italian, however, stems can be legal words in Swedish. In this respect, they resemble English. Singular nouns such as *stol* are examples. One characteristic of Swedish that is clearly closer to Italian than to English is its use of grammatical gender. Each noun has a gender, and the articles and adjectives used with the noun must carry the same gender, as in *en stol* (a chair), *en stor stol* (a big chair), *ett tåg* (a train), and *ett stort tåg* (a big train). In Italian, articles are often omitted by children with SLI but adjective agreement inflections are used with as much facility by children with SLI as by MLU controls (Leonard et al., 1992). It remains to be seen if this is true for Swedish, given that adjective inflections constitute additions to phonologically legal stems.

By studying a language that shares properties with two languages as different as English and Italian, it should be possible to gain a greater understanding of the basis for the difficulties experienced by children with SLI in these languages. This is highly relevant for the evaluation of processing-based accounts of SLI. For example, according to the morphological richness account (e.g.,

Leonard, Sabbadini, Leonard, & Volterra, 1987), children with SLI acquiring English might have special difficulties with inflections that must be added to legal, pronounceable stems. If the legal status of stems is the source of the problem, Swedish-speaking children with SLI can be expected to differ from their MLU-matched compatriots in their use of noun plural, genitive, and adjective agreement inflections. If, as proposed by the surface account (e.g., Leonard et al., 1997), the consonantal nature of inflections contributes to the problems of children with SLI acquiring English (Leonard et al., 1997), Swedish-speaking children should differ from MLU controls in genitive inflections, but not in noun plural and other syllabic inflections. Both the surface account and prosodic account of SLI (e.g., Leonard & Bortolini, 1998; McGregor & Leonard, 1994) assume that problems often reside in difficulties with nonfinal weak syllables. If so, Swedish children with SLI should have difficulties in the use of articles.

Other processing accounts of SLI place less emphasis on the perceptual and prosodic properties of the input but nevertheless hold that children with SLI are more limited than peers in their processing capacity (e.g., Ellis Weismer, 2000; Johnston, 1994). That is, specific material that might be processed adequately by these children becomes vulnerable to loss when other material must also be considered in completing the task. Dromi, Leonard, Adam, and Zadunaisky-Ehrlich (1999) interpreted their findings from Hebrew-speaking children with SLI along these lines. Dromi et al. noted that the children with SLI resembled MLU controls in their use of agreement inflections within present tense but lagged behind the control children in their use of agreement inflections within past tense. In the present tense, the verb must agree with the subject in gender and number. However, in the past tense, the verb must agree in person as well as gender and number. Many of the children's errors within past tense were "near misses" – productions of an inflection that shared most features with the correct form. Furthermore, the particular feature in error varied from production to production. No single feature (e.g., person, gender) was the source of the problem. These findings led Dromi et al. to propose that the grammatical processing ability of children with SLI may be exceeded when the features that must be manipulated exceed a certain number.

A similar situation may arise when Swedish-speaking children must use NPs containing an adjective. The example *en stor stol* (a big chair) seems straightforward. However, when the NP is definite, definiteness must be expressed on the article, the adjective, and the noun (e.g., *den stora stolen* [the big chair]). When a definite NP is plural, a different definite article is needed (unlike English) and the noun requires suffixes for both plural and definiteness, as in *dom stora stolarna* (the big chairs). The coordination of definiteness, number, and gender across the article, adjective, and noun may exceed the grammatical processing ability of children with SLI.

The status of NP morphology in Swedish-speaking children with SLI should also have implications for some recent linguistically based accounts of grammatical deficits in SLI. According to Clahsen and his colleagues (Clahsen, 1989; Clahsen, Bartke, & Göllner, 1997; Clahsen & Hansen, 1997), children with SLI have a selective deficit in establishing the structural relationships of agreement.

Specifically, children with SLI presumably lack the knowledge of asymmetrical relations between categories, in which one category controls the other. This type of deficit is assumed to cause significant problems in these children's ability to express relations such as article–noun agreement, adjective–noun agreement, and grammatical case. Relations of each type are involved in Swedish NP morphology. Accordingly, Swedish-speaking children with SLI would be expected to differ from MLU control children in the use of each of these details. For grammatical morphemes that do not involve agreement, such as noun plural inflections, no such differences are expected. Likewise, no differences are expected for the marking of definiteness, since in the linguistic framework used by Clahsen and his colleagues, definiteness is considered to be an inherent property of the article.

Another account of grammatical deficits in SLI that employs a linguistic framework is that of van der Lely (1994, 1996, 1998; van der Lely & Christian, 2000). According to this account, children with SLI have serious problems with dependent grammatical relationships in general. The difficulty is seen for those aspects of grammar that involve movement. This includes movement for checking features of tense, number, as well as agreement, along with movement of constituents as required in passives and *wh-* questions. Importantly, van der Lely characterizes the problem as the children's lack of knowledge that movement is obligatory. The grammars of children with SLI presumably possess features of agreement, number, tense, etc.; the children's problem is that they treat movement as optional. The details of Swedish NP morphology that should be obstacles for children with SLI according to van der Lely's dependent relations deficit account are similar to those expected to be difficult according to the agreement deficit account of Clahsen and his colleagues. One difference concerns the use of noun plural inflections when other plural features appear in the NP (as in *two dogs*, *many cats*). In these instances, children with SLI may fail to check the number feature of the noun, and thus produce the noun without the plural inflection (van der Lely & Christian, 2000).

Another difference between the accounts as they apply to NP morphology is that, in van der Lely's account, the agreement relations are presumably known by Swedish-speaking children with SLI; the children's problem is not knowing that movement for agreement feature checking is obligatory. This means that productions should not be haphazard according to the dependent relations deficit account. For example, given the sequence of movement and feature checking assumed in this account, children with SLI may show an error of agreement on both the article and adjective, or on the article only. However, an agreement error on the adjective only would not be expected.

The goal of the present study, then, was to examine several details of NP morphology in the speech of Swedish-speaking children with SLI. It was hoped that the resulting evidence would provide information useful to the clinical assessment of SLI in Swedish. In addition, given the NP properties of Swedish, it was expected that the findings would assist us in interpreting earlier findings from SLI research in other languages. A clearer understanding of these findings should benefit the development or refinement of theories of this disorder. We begin with a brief sketch of NP morphology in Swedish.

SWEDISH NOUN PHRASE MORPHOLOGY

The NP forms of interest in the present study were genitive (possessive) inflections, noun plural inflections, indefinite articles, and article + adjective + noun constructions. We take these in turn.

Genitive inflections

The genitive is formed with the addition of *-s* to the noun. Examples are *pappas bil* (daddy's car), *flickans bil* (the girl's car), and *flickornas bil* (the girls' car). This suffix has approximately the same form and function as its counterpart *'s* in English.

Noun plural inflections

Number is expressed on nouns through the use of inflections for the plural and the noun stem alone for singular. The plural inflections vary according to the declension of the noun. The plural inflections used with indefinite nouns are: *-or*, *-ar*, *-(e)r*, *-n*, or no suffix (e.g., *många tåg* [many trains]). A noun's declension (and hence the plural inflection used with the noun) can be determined in part by its phonological properties (e.g., singular nouns ending in /a/ are likely to employ *-or* as the plural inflection); however, there are many exceptions. For the definite plural, the suffix *-(n)a* is added to the indefinite plural form, for the first four declensions (e.g., *stolarna* [the chairs]). For the remaining declension, whose indefinite plural involves no suffix (as in *tåg*), *-en* serves as the definite plural suffix (e.g., *tågen* [the trains]).

Indefinite articles and definite forms

Swedish nouns belong to one of two genders, the uter or the neuter. The gender of a noun must be learned by rote; unlike in languages such as Italian or Spanish, the noun provides no phonological cues for gender. Nouns of uter gender are more prevalent in the language; they occur more than twice as frequently as do nouns of neuter gender (Allén, 1971). Uter nouns require the indefinite article *en* (e.g., *en stol* [a chair]), whereas neuter nouns require the indefinite article *ett* (e.g., *ett tåg* [a train]). The indefinite forms *en* and *ett* can also be used as prenominal numerals with the meaning of *one*. Even as numerals, these forms must agree with the noun in gender. The difference between their use as indefinite articles and their use as numerals rests in prosody: The former are unstressed and the latter are stressed.

Swedish differs from both English and Italian in that the definite is expressed through a suffix attached to the end of the noun. These, too, are distinguished according to gender. For uter, the suffix *-(e)n* is used (e.g., *stolen* [the chair]). For neuter, the suffix *-(e)t* is employed (e.g., *tåget* [the train]). In singular definite NPs without adjectives an article is not required; the definite suffix on the noun is sufficient to mark definiteness (as in the previous examples). Definite articles are also employed in Swedish (*den* for uter, *det* for neuter); however, these are restricted to NPs in which the noun is preceded by an adjective.

Article plus adjective plus noun constructions

When the noun is preceded by an adjective, an article is obligatory even if the noun is definite. Thus, singular definite NPs with adjectives mark definiteness on the article as well as on the noun suffix (e.g., *den stora stolen* [the big chair]; *det stora tåget* [the big train]). Each varies according to gender. Furthermore, when the adjective appears in a definite NP, it, too, must be inflected, with *-a*, as in the examples *den stora stolen* and *det stora tåget*. This adjective inflection does not vary with the gender of the noun. In contrast, when the singular NP is indefinite, the adjective does vary according to gender. Specifically, for uter nouns, the adjective remains in stem form (e.g., *en stor stol* [a big chair]) but the inflection *-t* is added to the adjective for neuter nouns (e.g., *ett stort tåg* [a big train]). For plural NPs with adjectives, an article is not required in the indefinite (e.g., *stora stolar* [big chairs]; *stora tåg* [big trains]). The adjective must carry an *-a* inflection in such cases, however. If the plural NP is definite, the plural definite article *de* (pronounced as, and hereafter referred to as *dom*) is required (e.g., *dom stora stolarna* [the big chairs]; *dom stora tågen* [the big trains]). Here it can be seen, as in singular definite NPs with adjectives, that definiteness is marked on more than one element in the NP.

METHOD

Participants

The participants were 42 Swedish-speaking children from southern Sweden, of whom 14 met the criteria for SLI (8 girls, 6 boys). All had been diagnosed by speech-language pathologists as exhibiting problems with language, including grammar. These children ranged in age from 4;3 to 5;7. Each child scored within one standard deviation of the mean for his or her age on the Swedish standardization of the Leiter International Performance Scale (Leissner, Nilsson, Nyström, & Wastesson, 1962). They passed both a hearing screening (20 dB at 500, 1000, 2000, and 4000 Hz) and an oral–motor screening. According to parental report, no child had been diagnosed or suspected of having frank neurological impairment or social–emotional disturbance. The MLUs of these children ranged from 2.36 to 4.41 words, based on a spontaneous speech sample of 100 complete, intelligible, nonimitative, and nonelliptical utterances. The children scored more than one standard deviation below the mean for their age on the grammatical subtest of the Lund Test of Phonology and Grammar (Holmberg & Stenkvist, 1983), a Swedish test of expressive language abilities. Although this test does include noun inflections, the majority of the items deal with other aspects of grammar, such as verb inflections, possessive pronouns, prepositions, and negation. Although the children exhibited below-age-level phonological skills, an assessment of their phonology indicated that they all showed adequate use of the vowels and consonants (word-final /s/, /t/ and /n/) necessary to produce the noun morphemes under investigation.

The children's language comprehension was assessed with the Spåkligt Impressivt Test för Barn (SIT; Hellquist, 1982). This test yields a single score that

reflects the children's comprehension of lexical items, noun and verb inflections, negation, prepositions, and various complex sentence constructions. The SIT does not provide standard scores. However, the raw scores earned by the children with SLI were compared with those obtained by the two groups of normally developing children participating in this study. A significant difference was found, $F(2, 38) = 15.59$, $p < .001$. Tukey comparisons at the .05 level indicated that the normally developing children serving as age controls ($M = 39.71$, $SD = 3.83$) earned higher scores than both the children with SLI ($M = 34.00$, $SD = 5.28$) and the younger normally developing children serving as MLU matches ($M = 29.62$, $SD = 4.94$). The scores of the latter two groups did not differ. Thus, it appears that, as a group, the children with SLI displayed comprehension skills that were somewhat below age level.

A total of 14 normally developing children served as age controls (hereafter, ND-A children). Each of these children was matched with a child with SLI according to chronological age to within 2 months. These children (9 girls, 5 boys) ranged in age from 4;3 to 5;7. The children in this group attended day care centers in the same communities as the children with SLI. These children scored within normal limits on the battery of language and non-language measures described previously; however, we inadvertently failed to complete testing on the LIPS for two of these children. Their data are retained because all teacher and parental reports indicated normal cognitive functioning. Not surprisingly, the ND-A children's MLUs were higher than those of the children with SLI, ranging from 4.23 to 6.49 words.

A third group of participants consisted of 14 younger, normally developing children ranging in age from 2;1 to 3;7. Eight were girls, six were boys. These children were attending daycare centers in the same communities as the children in the other two groups. Each of these children (hereafter, ND-MLU children) was matched with a child with SLI according to MLU to within .35 words (for 11 pairs, the matching was to within .20). The MLU range for this group was 2.04 to 4.21. These children scored within normal limits on the language and non-language battery.

Procedure

During initial sessions with each child, the language and nonlanguage test batteries were administered. A play period was designed to obtain a 100-utterance sample of the child's spontaneous speech. Audiorecordings were made of the speech samples. If the child met the selection criteria, the child was seen for subsequent sessions. During these sessions, the children took part in four different tasks, specifically designed to elicit genitive *-s* inflections, noun plural inflections, indefinite articles, and article + adjective + noun constructions. The elicitation materials consisted of drawings. The sessions were both audio- and videotaped. The examiner transcribed the children's responses on test sheets.

Tasks and scoring

Genitive forms of nouns were elicited with 12 test items. The task consisted of pairs of pictures with animals or persons, and objects that belonged to each

animal/person. The examiner began each item by introducing the persons or animals. She then described one of the possessive relationships for the child, and asked the child to describe the other, as shown in example 1.

1. a. Här är en katt och här är en hund. Detta är kattens mat och detta är . . . [hundens mat]
   Here is a cat and here is a dog. This is the cat's food and this is . . . [the dog's food]
   b. Här är Kalle och här är Mimmi. Detta är Kalles kaka och detta är . . . [Mimmis kaka]
   Here is Kalle and here is Mimmi. This is Kalle's cake and this is . . . [Mimmi's cake]

The children's responses were scored as correct (use of the genitive *-s*), incorrect (absence of *-s* as in *Mimmi kaka* [Mimmi cake] for *Mimmis kaka* [Mimmi's cake]), or unscorable (e.g., use of a possessive pronoun or a refusal to respond). Six ND-MLU children and one child with SLI were not able to participate in the genitive test.

For plural inflections, the task consisted of 18 test items, 15 that obligated plural forms and 3 that obligated singular forms. The singular items were included simply to ensure that any child who made consistent use of plural forms was also capable of using singular forms when these were required. Each item involved the presentation of a pair of pictures. The examiner described one picture and asked the child to describe the other, as in example 2.

2. a. Här är en pojke. Här är många . . . [pojkar]
   Here is one boy. Here are many . . . [boys]
   b. Här är nycklar. Här är . . . [telefoner]
   Here are keys. Here are . . . [telephones]

The plural forms that were elicited belonged to the three most common declensions, requiring *-or*, *-ar*, or *-er* (five items each). The three singular forms belonged to these same three declensions. A total of 11 of the plural forms was elicited as in example 2a, in which the examiner produced a singular noun, and included a quantifier (e.g., *många* [many]) in her prompt for the child to describe the second picture. The remaining 4 plural forms were elicited as in example 2b, in which the examiner provided a plural form and the child (without hearing a quantifier) was required to produce the plural form of a noun from a different declension. The children's responses to the 15 plural items were scored as use of the correct plural form, a singular form, an overgeneralized plural form (a plural inflection from the wrong declension, as in *telefonor* for *telefoner*) or as unscorable (e.g., an irrelevant comment or refusal to respond). For computation of accuracy for plural inflections, only the correct plural forms and incorrect uses of the singular in plural contexts were considered. Four of the children in the ND-MLU group refused to participate in the plural task. All children in the two other groups participated.

Fourteen test items were used to elicit use of indefinite articles. For each item, two drawings were shown; the examiner described the first and the child described the second. Some examples appear in example 3.

3. a. Här är en hund, och . . . [här är en pojke]
   Here is a dog, and . . . [here is a boy]
   b. Mamma ser en bil, och . . . [Pappa ser ett tåg]
   Mommy sees a car, and . . . [Daddy sees a train]

The drawings obligated the use of seven nouns from each gender. Because most common nouns are of the uter gender requiring *en*, these nouns were used in disproportionate numbers in the examiner's descriptions that preceded the children's response. This article appeared in the examiner's production for all seven of the *en* items and for five of the seven *ett* items. The children's responses were scored as containing a noun with the correct article, the omission of the article, an article with incorrect gender, or unscorable. The latter were productions of a definite suffix instead of an indefinite article, a pronoun, an irrelevant comment, or a refusal to respond. Four ND-MLU children (the same as for the plural test) and one child from the SLI group did not participate in this task.

The task for article + adjective + noun constructions consisted of 24 test items, elicited with pairs of pictures and a model sentence. The examiner described one picture and the child was asked to describe the other, as in example 4.

4. a. Det är ett grönt hus och det är . . . [en gul bil]
   This is a green house and this is . . . [a yellow car]
   b. Det är den lessna flickan och det är . . . [den glada pojken]
   This is the sad girl and this is . . . [the happy boy]
   c. Det är dom rena pojkarna och det är . . . [dom smutsiga flickorna]
   These are the clean boys and these are . . . [the dirty girls]

A total of 12 items required the use of singular indefinite NPs such as example 4a. Six were of uter and six of neuter gender. Six items required use of singular definite NPs as in example 4b (four uter, two neuter) and six required plural definite noun phrases as in example 4c (three uter, three neuter). As can be seen from example 4, the correct responses required the same number and definiteness as the NP provided in the examiner's description. However, for 8 of the 18 singular items, the gender of the noun differed. For plural definite NPs – in which the article (always *dom*) and adjective (always *-a*) forms never vary – four of the six items required the child to use a plural from a declension that differed from that used in the examiner's preceding description. For all article + adjective + noun items, the child had to select an adjective and/or noun that differed from the one just used by the examiner.

The children's responses were scored for the presence or absence of articles and adjectives and for their correct agreement marking (number, gender, definiteness). If a child responded to a definite plural NP item with an indefinite plural NP, an article was not obligated; in all other cases, an article was obligatory. Because NPs without adjectives are not ungrammatical (even though they were not pragmatically responsive to the task), they were not scored as errors unless they contained an error on the article or noun. All NP productions could be scored for agreement. Unscorable responses were irrelevant comments or refusals to respond. All children except one child in the ND-MLU group participated in this task.

Table 1. *Mean percentages of correct use* (M)*, standard deviations* (SD)*, and number of children* (N) *in each group for each morpheme type*

Morpheme type	SLI	ND-MLU	ND-A
Genitive *-s* inflections			
M	76.46	96.88	100
SD	29.33	6.27	—
N	13	8	14
Noun plural inflections			
M	81.07	88.50	95.57
SD	23.92	14.91	7.77
N	14	10	14
Indefinite articles			
M	59.15	79.70	96.00
SD	29.38	20.18	6.98
N	13	10	14
Article + adjective + noun			
M	23.79	57.50	88.36
SD	14.85	30.80	15.55
N	14	13	14

Because unscorable responses occurred, the number of scorable items differed across children for each task. Accordingly, we computed each child's percentage correct for each task, based on the number of items that could be scored.

Reliability

Reliability was measured for both transcription and scoring of the children's responses. For nine of the children (three in each group) an independent judge transcribed the children's responses from the audiotapes. Reliability of transcription was measured as the percentage of items in each task with identical transcriptions of the relevant morphemes. Agreement on this measure ranged from 86.5% for indefinite articles to 98.5% for noun plural inflections. The independent judge also scored the responses with respect to accuracy and, for the indefinite article and article + adjective + noun items, with respect to type of error (omission or agreement error). Agreement for scoring for accuracy ranged from 96.0% for indefinite articles to 100% for genitive inflections. Agreement for type of error was 100% for indefinite articles and 94.4% for article + adjective + noun constructions.

RESULTS

A summary of the children's use of each morpheme type appears in Table 1. For each morpheme type – possessive *-s* inflections, noun plural inflections, indefinite articles, and article + adjective + noun constructions – the three groups' accuracy was compared through analyses of variance (ANOVAs), using arc-sine

transformations of the percentage data. For each morpheme type, the question of particular interest was whether the children with SLI would score lower than the ND-MLU children as well as the ND-A children. Accordingly, significant differences for group on the ANOVA were followed by one-tailed post hoc testing at the .05 level to determine whether the children with SLI performed more poorly than each of the other groups. The effect size *d* was also computed for each of the significant differences between the children with SLI and the ND-MLU children (or between the SLI and ND-A groups if the SLI and ND-MLU groups did not differ). All of the effect sizes reported are considered large based on Borenstein and Cohen (1988) and Cohen (1988). In addition to the analyses based on degree of correct use, the children's errors for each morpheme type were examined.

The analysis for possessive *-s* inflections revealed a group difference, $F(2, 32) = 10.18$, $p < .001$. Post-hoc testing indicated that the children with SLI had significantly lower scores than both the ND-MLU ($d = 0.96$) and the ND-A children. All errors were omissions of *-s* (e.g., *mamma nyckel* [mommy key] for *mammas nyckel* [mommy's key]).

A group difference was also seen for noun plural inflections, $F(2, 35) = 3.69$, $p < .05$. Only the ND-A children and children with SLI differed significantly on this morpheme type ($d = 0.82$). All errors were productions of the singular noun. Four of the plural items requiring the inflection *-er* were the most likely to be in error. Although these four items constituted 26.7% of the plural items, they represented 44.1% of the errors on plural items by the children with SLI, 78.6% of the errors by the ND-MLU children, and 88.9% of the errors by the ND-A children. Along with their common declension, these words also shared the property of having at least two syllables and carrying word-final stress (*tele'fon* [telephone], *ka'mel* [camel], *ba'nan* [banana], and *apel'sin* [orange]).

The presence of a quantifier such as *många* 'many' in the examiner's prompt did not diminish the likelihood of a plural inflection appearing in the children's responses. For the test items that involved a quantifier, mean percentages of correct use by the children with SLI was 83.7 (compared to 81.1 across all items; see Table 1). The corresponding means for the ND-MLU and ND-A children were 94.4 (88.5 across all items) and 98.1 (95.6 across all items), respectively. As was true for the analysis using all noun plural items, there was no significant difference between the children with SLI and the ND-MLU children in their use of noun plural inflections when only items involving quantifiers were considered.

As noted in the Tasks and Scoring section, use of the plural inflection from a different declension (e.g., *flickar* for *flickor* [girls]) was not included in the calculation of accuracy. However, these were seen in the responses of all three groups. Seven such overgeneralizations were produced by five different children with SLI. Four such productions (from four different children) were noted in the ND-MLU group. Finally, one ND-A child produced a total of two overgeneralizations.

Three singular items were included in the noun plural inflection task to ensure that the children were capable of using singular as well as plural forms. This was confirmed. Mean percentages of correct use of the singular forms were

92.9, 91.7, and 97.7% for the children with SLI, ND-MLU children, and ND-A children, respectively.

The analysis for indefinite articles also revealed a significant difference, $F(2, 34) = 14.55$, $p < .001$. Post-hoc testing at the .05 level indicated that the ND-A children's accuracy was higher than that of both the ND-MLU children and the children with SLI. The ND-MLU children, in turn, were more accurate than the children with SLI ($d = 0.82$). For the children with SLI, 33 of 58 (57%) errors were productions of an indefinite article with the wrong gender (e.g., *en bord* for *ett bord* [a table]) and 25 (43%) errors were omissions of the article (e.g., *bord* [table] for *ett bord* [a table]). For the ND-MLU children, the majority of errors – 16 of 26 (61%) – were omissions; the remaining 10 (39%) errors involved use of the wrong gender. The few errors committed by the ND-A children were approximately evenly divided between omissions (4, or 57%) and gender errors (3, or 43%).

The omissions and substitutions were examined to determine whether uter (*en*) or neuter (*ett*) were comparable in their difficulty. For the children with SLI, omission of *en* (64% of omissions) was somewhat more frequent than omissions of *ett* (36%). For the ND-MLU children, the two articles were omitted to a similar degree (*en*, 53%; *ett*, 47%). The four omissions by the ND-A children were evenly divided between the two articles. The item with the highest number of omissions required use of *en* with the noun *elefant*. This was the only noun in the task that contained three syllables. Its syllable-final stress also makes it less typical of Swedish nouns. Unlike omissions, substitutions were not evenly distributed across the two genders. For each group of children, all substitutions involved inappropriate use of *en* in contexts requiring *ett*, such as *en tåg* for *ett tåg* (a train). A disproportionate number of items were preceded by the examiner's use of *en* in the description that set the occasion for the child's own response. However, a comparison of the percentage of *ett* items preceded by *en* that were produced with *en* (39%) was not appreciably higher than the percentage of *ett* items preceded by *ett* that were produced with *en* (32%). This finding suggests that the unidirectionality of the children's substitutions was more likely due to the higher frequency of words of the uter gender in the language.

Analysis of the children's accuracy on the article + adjective + noun construction also yielded a significant group difference, $F(2, 39) = 32.07$. Post hoc testing indicated that the children with SLI performed significantly more poorly than either the ND-MLU children ($d = 1.39$) or the ND-A children. The ND-MLU children were significantly less accurate than the ND-A children. The errors made by the children on this construction are provided in Table 2.

The most conspicuous detail in Table 2 is the high frequency of article omission in the responses of the children with SLI, both when such omissions constituted the only error, and when they occurred in combination with an error of gender or definiteness. In fact, article omissions occurred in a higher percentage of items for the children with SLI than for the ND-MLU children, $t(25) = 2.76$, $p < .05$. However, the preponderance of article omissions in the SLI data should not mask the difficulty these children seemed to have with other aspects of this construction. Whereas article omissions only were twice as frequent in the

Table 2. *Distribution of errors on article + adjective + noun items*

Type of error	SLI	ND-MLU	ND-A
Article omission only	110	47	21
Article omission, adjective wrong gender	50	9	2
Article omission, adjective wrong definiteness	6	1	0
Total errors of substitution only	19	12	16

Table 3. *Distribution of gender errors in indefinite singular NPs with adjectives*

Type of error	Example	SLI	ND-MLU	ND-A
Art–, Adj–	*En stor tåg* for e*tt stort tåg*	6	5	6
Art–, Adj+	*En stort tåg* for *ett stort tåg*	4	2	2
Art+, Adj–	*Ett stor tåg* for *ett stort tåg*	0	0	3

Note: +, correct; –, incorrect.

responses of the children with SLI as in the responses of the ND-MLU children (110 vs. 47), errors containing both an article omission and a substitution error were five times more frequent in the speech of the children with SLI than in the speech of the MLU control children (56 vs. 10).

The cases of substitution errors only reported in Table 2 were examined in finer detail to discover their precise nature. The children's use of articles and adjectives in indefinite singular items provided an especially good view of the children's ability to mark correct gender. For these items, the gender marking on both the article and the adjective is unambiguous (e.g., *en stor stol* [a big chair], *ett stort tåg* [a big train]). Given the feature checking assumptions of the dependent relations deficit account, when only one error occurs in the NP, it should be an error on the article not the adjective. Table 3 provides the relevant data. For all groups of children, gender errors on both the article and the adjective were more numerous than errors on only one of these elements. However, when only one error occurred, the children with SLI and the ND-MLU children erred on the article, not on the adjective. The ND-A children did not show this pattern. This issue could not be explored with definite NPs, because in these instances the adjectives are not distinguished according to gender (compare *den stora stolen* [the big chair] with *det stora tåget* [the big train]).

It should be noted that gender substitutions were bidirectional; that is, both uter for neuter and neuter for uter substitutions were seen. Unlike the case for the indefinite article task, in all instances of gender substitution in the article + adjective + noun task, the child adopted the gender provided in the examiner's model sentence.

The children's errors on definiteness when producing articles and adjectives can be seen in Table 4. For this feature, errors on the article only were no more frequent than errors on the adjective only.

Table 4. *Distribution of definiteness errors*

Type of error	Example	SLI	ND-MLU	ND-A
Art–, Adj–	*Ett stort tåget* for *det stora tåget*	3	1	1
Art–, Adj+	*Ett stora tåget* for *det stora tåget*	2	1	0
Art+, Adj–	*Det stort tåget* for *det stora tåget*	2	1	1

Note: +, correct; –, incorrect.

There were substitution (only) patterns in addition to those shown in Tables 3 and 4. A total of two such errors were seen for the children with SLI, two such errors for the ND-MLU children, and three errors of this type for the ND-A children. For all but one error by a child with SLI, these errors involved a gender error on an article in a definite NP, with correct definiteness on both the article and adjective (e.g., *den stora tåget* for *det stora tåget*) or correct definiteness on the article but omission of the definite suffix from the adjective.

The children were remarkably accurate on number. One-third of the items were plural and such items could have been produced, say, with a singular article (e.g., *den stora stolarna* for *dom stora stolarna*) or with a singular noun (e.g., *dom stora stolen* for *dom stora stolarna*). Yet, only one error of number was observed. One child produced the adjective form *lilla* (little), which is the definite singular form. Unlike most adjectives whose singular and plural definite forms are identical, this adjective is irregular, requiring a distinct form in the plural, *små*.

To assess the effects of possible processing capacity limitations on the part of the children, the children's use of articles in the indefinite article task (e.g., *en bil* [a car]) was compared to their use of indefinite articles in the indefinite singular NPs of the article + adjective + noun task (e.g., *en gul bil* [a yellow car]). For the latter, we included only those cases in which both an adjective and a noun were produced. Both article gender agreement errors and omissions were examined. For the children with SLI, the percentages of articles that were produced with a gender error were similar in the two tasks. For the indefinite article task, 33 of the 120 (27.5%) indefinite articles produced showed a gender error; for the article + adjective + noun task, 11 of the 40 (27.5%) indefinite articles produced showed an error of gender. However, for omissions, the two tasks were not comparable. For the indefinite article task, omissions occurred in 25 of the 145 (17.2%) contexts requiring an indefinite article. However, for the article + adjective + noun task, omissions occurred in 40 of the 80 (50%) such contexts. For the ND-MLU children, the likelihood of gender errors on the indefinite article was slightly higher on the article + adjective + noun task. On the indefinite article task, 10 of the 107 (9.3%) indefinite articles produced reflected an error of gender, whereas gender errors constituted 11 of the 70 (15.7%) indefinite articles used on the article + adjective + noun task. Article omissions were somewhat more likely on the article + adjective + noun task than on the indefinite article task, although the differences were not as dramatic as were seen for

the children with SLI. For the ND-MLU children, 16 of 123 (13.0%) articles were omitted on the indefinite article task, whereas 26 of 96 (27%) were omitted on the article + adjective + noun task.

DISCUSSION

The children with SLI had more difficulty than the ND-A children on all details of Swedish NP morphology examined. They showed lower percentages of appropriate use of genitive *-s*, noun plural inflections, indefinite articles, and article + adjective + noun constructions. Although these findings reinforce the notion that grammatical deficits are among the language problems of Swedish-speaking children with SLI, they do not constitute evidence of an extraordinary deficit in the area of grammar. Stronger evidence for the latter interpretation comes from the comparisons between the children with SLI and the younger ND-MLU children. These children produced utterances of comparable length, but were two years younger than the children with SLI. Yet differences favoring the ND-MLU children were seen for three of the four grammatical forms under investigation. Only noun plural inflections failed to reveal a difference between these two groups of children.

In Swedish, as in English, both genitive inflections and plural inflections constitute suffixes added to the noun. Our findings for genitive inflections mirrored the findings from English in showing a higher degree of omission in children with SLI than in MLU control children (Leonard et al., 1997). However, noun plural inflections did not reveal a difference between the Swedish-speaking children with SLI and the ND-MLU children. In English, the evidence is mixed. Oetting and Rice (1993) did not find differences in noun plural inflection use between children with SLI and MLU control children, whereas group differences favoring MLU controls have been reported by Leonard et al. (1992), Rice and Oetting (1993), and Leonard et al. (1997). In English, noun plural inflections resemble genitive inflections in their phonetic form. In Swedish, genitive inflections are consonantal (*-s*), whereas noun plural inflections are syllabic (e.g., *-or*, *-ar*). It seems possible, then, that the phonetic properties of the inflections played a role in the findings, in keeping with the surface account.

Because function words such as articles have revealed differences between children with SLI and younger MLU controls in languages as diverse as Italian (e.g., Bortolini et al., 1997) and English (e.g., Rice & Wexler, 1996), the group difference seen for indefinite articles in the present study was not surprising. In both Italian and English, omissions are the predominant type of error. Omissions of the indefinite article were also quite frequent in the Swedish SLI data. Given the brief durations of non-final weak syllables such as articles, these findings are in line with the surface account. However, McGregor and Leonard (1994) and Leonard and Bortolini (1998) provided evidence suggesting that omissions of articles in Italian and English are related to the difficulty experienced by children with SLI in using weak syllables that cannot be aligned in a strong syllable–weak syllable sequence. The indefinite articles required of the Swedish-speaking children in the present study involved the same kinds of contexts.

For this reason, prosodic factors could have played a role in the findings reported here.

Less expected was the high degree of substitution errors seen in the indefinite article use of the Swedish-speaking children with SLI. Italian, like Swedish, requires gender agreement between the article and the noun. Yet when articles are produced by Italian-speaking children with SLI, in the great majority of instances they show appropriate gender agreement (Leonard et al., 1993; Bortolini et al., 1997). One possible explanation for the higher rate of gender errors in Swedish is the fact that nouns in Swedish do not provide phonological clues to their gender. In contrast, many Italian nouns provide such information. It might be the case that Swedish-speaking children with SLI have a difficult time learning on an item-by-item basis the articles that are to be used with each noun. If this is true, they may err on the side of probability when in doubt, by choosing the most frequent indefinite article in the language. This strategy seemed to be at work in the indefinite article items, given these children's tendency to use the more frequently occurring *en* as a replacement, even when *ett* was used in the examiner's immediately preceding picture description. In the article + adjective + noun task, however, the children seemed to use another strategy when in doubt, that of relying on the gender provided in the examiner's preceding description. This difference in response strategy between tasks might be related to the processing demands of the article + adjective + noun task.

The difference between the children with SLI and ND-MLU children that showed the largest effect size was the difference in the accuracy of article + adjective + noun constructions. The children with SLI were more likely than the MLU controls to omit articles and to commit a substitution error. Errors of gender were the most frequent substitution error. Errors of definiteness were less frequent, and errors of number were rare. There are at least two possible reasons for the differences in the degree to which these features were problematic for the children. First, gender agreement depends on the children's knowledge of each noun's gender, yet, as noted above, Swedish nouns provided no phonological cues to their gender. Therefore, the children may have committed agreement errors not because of a problem in expressing agreement but because they did not know the noun's gender in the first place.

The second possible reason for the differences in accuracy across features is that number is a semantically interpretable feature (see Radford, 1997). It seems plausible that the children's ability to express agreement was facilitated by this fact.

The Swedish-speaking children with SLI were even more likely to omit indefinite articles from article + adjective + noun constructions than from simple article + noun constructions as used in our indefinite noun task. This suggests that the requirement of producing a more elaborate NP might have had an adverse effect on these children's ability to use all elements. Dromi et al. (1999) have proposed a similar processing constraint when Hebrew-speaking children with SLI are faced with an unusually complex morphological paradigm.

According to Dromi et al. (1999), if difficulties with complex grammatical constituents are due to capacity limitations rather than to a particular grammatical feature, the accuracy differences between simple and complex constituents

should be larger for children with SLI than for ND-MLU children and, moreover, no single grammatical feature should be in error on a consistent basis. The first condition seems to hold true. The differences between the percentage of indefinite articles omitted in the indefinite article and the article + adjective + noun tasks were larger for the children with SLI than for their MLU controls. The second condition was also generally true; the Swedish-speaking children with SLI did not consistently err on the same feature when attempting the article + adjective + noun construction. However, it is also true that some features seemed to pose greater difficulties for these children than others. As noted earlier, gender seemed more problematic than definiteness, and number seemed the least problematic for the children.

It is possible that this pattern of difficulty was affected by our task. The examiner's description of the preceding picture provided the same definiteness and number that was required in the child's response. Of course, the child had to apply this information to a different noun. However, since both definiteness and number information was provided, this cannot explain why errors of definiteness were more frequent than errors of number.

The account of Clahsen (Clahsen, 1989; Clahsen et al., 1997; Clahsen & Hansen 1997) predicts differences between children with SLI and MLU controls for adjective–noun agreement and article–noun agreement as a result of difficulties with establishing agreement relations in the grammar. The gender errors seen in the children's article and adjective use certainly conform to the predictions of this account. Agreement according to number should also be problematic for children with SLI, yet we observed very little difficulty of this type. To explain such a finding, it would have to be assumed that the children merely copied the number (singular or plural) provided in the examiner's preceding production. This is plausible, but it would not explain why the children sometimes erred on definiteness even though this information, too, was provided in the examiner's production.

Genitive inflections would be expected to be difficult according to the agreement deficit account, because case assignment is involved. Thus, the lower percentages of use of *-s* by the children with SLI than by the ND-MLU children are consistent with this account. The absence of a difference between the children with SLI and the ND-MLU children in the use of noun plural inflections is also in keeping with this proposal, as noun plurals do not involve agreement.

Some of the findings from NP morphology from the present study thus seem to confirm the agreement deficit account, whereas others – namely, the omission of articles – clearly did not. It is also unlikely that this account can accommodate some of the extraordinary grammatical difficulties seen in these Swedish-speaking children with SLI in previous studies. Hansson et al. (2000) found that these same children had greater difficulty than ND-MLU children in the use of copula forms and past tense inflections. In Swedish, verbs mark tense, not agreement. Thus, the children's difficulties with these verb forms seem to fall outside the purview of this account.

As with the agreement deficit account, the account of van der Lely (van der Lely, 1994, 1996, 1998; van der Lely & Christian, 2000) regarding dependence relations predicts serious problems with subject–verb agreement, adjective–

noun agreement, article–noun agreement, and case relations. In addition, problems are expected in the area of tense. Thus, this account can handle the Hansson et al. (2000) findings regarding copula forms and past tense inflections, along with many of the group differences observed in the present study. According to this account, in contexts where noun plurals are preceded by other NP elements with the plural feature, the noun plural inflections may be omitted due to a failure to check the number feature of the noun (van der Lely & Christian, 2000). In the present study, the children with SLI did not differ from the ND-MLU children in the use of noun plural inflections, even for the items in which a plural element such as "many" was provided in the examiner's prompt. Following this account, it is not clear why the children with SLI performed rather well on these forms. Based on their overgeneralizations of plural inflections from the wrong declension, they were clearly using noun plural inflections productively; these could not be taken as the product of rote memorization.

One important component of this account is its assumption that features of agreement and case are not absent, but simply expressed only intermittently due to the optional movement in these children's grammars. For grammatical forms such as genitive *-s*, such optionality can be operationalized. Specifically, if dependent relations are expressed in the utterance, *-s* will be produced. If dependent relations are not expressed, *-s* will be absent.

Gender errors are also expected according to this account. Thus, errant productions such as *en tåg* and *en stor tåg* are expected to co-occur with their correct counterparts *ett tåg* and *ett stort tåg*. However, according to this account, complexity also plays a role. For example, a gender error on the article is more likely in an article + adjective + noun constituent than in an article + noun constituent. This is because checking proceeds from the noun, to the adjective, and then to the article. It is assumed that in some instances the checking operation will not proceed beyond the adjective. This will lead to errors on the article but not the adjective. The reverse should not be true. The data shown in Table 3 were consistent with these expectations. However, we did not find gender errors on articles to be more likely in article + adjective + noun constituents than in article + noun constituents. The error rate (27.5%) was identical in these two contexts.

We did not find any directionality of errors for definiteness, as can be noted in Table 4. Errors such as *det stort tåget* for *det stora tåget* occurred no less frequently than errors such as *ett stora tåget*. Because definite NPs with no adjective possess a definite suffix on the noun with no article (e.g., *tåget* [the train]), the checking of definiteness presumably proceeds from the noun to the adjective to the article. Given this assumption, if an error were to occur on only one element, it should be on the article.

Because the dependent relations deficit account allows for incomplete checking in cases of complexity, it is fair to regard it as a type of processing limitation account. However, in contrast to other accounts assuming processing capacity limitations, the processing limitation assumed in this account is confined to movement and checking operations. One advantage that this approach seems to hold over other processing limitation accounts is that it provides a means of explaining the directional pattern of gender errors, that is, the greater likelihood

of incorrect article gender and correct adjective gender than correct article gender and incorrect adjective gender (though this directional pattern was not evident for definiteness). On the other hand, it is not obvious how article omissions are to be handled in this account. If incorrect forms (e.g., *en* for *ett* or *en* for *den*) can be produced if the checking (of gender and definiteness, respectively) operation is not performed, the motivation for omission is not apparent.

To conclude, this study of NP morphology in Swedish-speaking children with SLI has provided several interesting findings. First, the grammatical problems of Swedish children with SLI are not restricted to verb morphology – noun morphology is also clearly affected. These problems take the form of both omission errors and substitution errors affecting bound as well as freestanding grammatical morphemes. A second important finding is that these children's difficulties with at least some elements seem related to the complexity of the construction of which they are part. It appears that some of the data presented here are in line with the prominent accounts of SLI discussed previously. However, none of these accounts is capable of explaining all details of the Swedish data.

It would appear, then, that contemporary accounts of grammatical deficits in children with SLI might have to be refined to accommodate some of the findings presented here. In the meantime, these findings have implications for clinical assessment and intervention. First, in languages in which gender agreement is not transparent, children with SLI might be at risk for problems in marking gender in articles and adjectives. Second, expressing genitive case through inflection might be quite difficult for children with SLI, especially when the language makes use of a consonantal inflection for this purpose. Third, these children's ability to use a particular grammatical morpheme might be significantly affected by the type of construction in which the morpheme appears. Although the children with SLI in this study sometimes omitted articles when only article + noun constructions were required, they had much greater difficulty including the article when adjectives were required along with the nouns. Mastery of such grammatical morphemes should not be assumed – or intervention considered successful – unless the child demonstrates the ability to use the morphemes in more complex constructions.

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