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Case Marking in Hungarian Children with Specific Language Impairment

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Abstract

This study examines whether children with specific language impairment (SLI) acquiring a language with a rich case marking system (Hungarian) have difficulty with case, and, if so, whether the difficulty is comparable for spatial and nonspatial meanings. Data were drawn from narrative samples and from a sentence repetition task. Suffixes were tested both in their spatial and nonspatial meanings. Participants with SLI were compared to same-age peers and younger typically developing children matched on receptive vocabulary scores (VC children). Results show that although case-marking errors are very rare in spontaneous speech in Hungarian children with SLI, the number of case marked nouns and of different case markers is significantly lower in children with SLI. In the elicited production task, overall performance of the children with SLI was significantly below that of VC children, but children with SLI and VC children scored higher with spatial than with nonspatial meanings. The results are in line with expectations based on processing accounts which posit greater difficulties with less transparent details of grammar.

Keywords

morphology; specific language impairment; production; case marking; Hungarian

Problems with grammatical morphology are widely documented in children with specific language impairment (SLI) in many languages¹. Ample attention has been devoted to examining problems with verb morphology, especially with tense and agreement morphemes, and there are studies on the grammatical encoding of aspect as well (e.g.,

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¹Following current practice, we use the term 'specific language impairment'. However, we recognize, as do other scholars, that these children with SLI often show subtle weaknesses in nonlinguistic processing tasks and, as a group, may be somewhat slow in their motor development. Nevertheless, language constitutes their most conspicuous difficulty.

Fletcher, Leonard, Wong, & Stokes, 2005). The severity of problems with verb morphology seems to be dependent on language type: the grammatical marking of tense and agreement has been shown to be extremely difficult for English-speaking children with SLI (e.g., Rice & Wexler, 1996, 2001; Bedore & Leonard 1998), but it is relatively easier in languages with a rich system of morphemes (Spanish, Italian, Hebrew, Hungarian e.g., Bortolini et al. 1997; Bedore & Leonard, 2001; Leonard, Caselli & Devescovi, 2002; Leonard & Dromi 1994; Lukács, Leonard, Kas, & Pléh, 2009).

Much less is known about noun morphology in SLI. This may be because the majority of studies on SLI have focused on English and, in this language, verb morphology problems appear to be more striking than errors in noun morphology. However, in recent years, studies of SLI in languages with a rich noun morphology have begun to appear. Hungarian – the focus of the present investigation – is one such language. The present investigation examines the use of case markers by children with SLI speaking Hungarian. This language is an agglutinative language where multiple suffixation is possible. Studying case marking in Hungarian-speaking children with SLI is motivated by several factors. First, one of the earliest case studies of language impairment in Hungarian by Vinkler and Pléh (1995) identified case marking as a problematic area, and thus a potential marker of language impairment in Hungarian. The child examined by Vinkler and Pléh often substituted target suffixes with a more frequently occurring suffix (e.g., replacing the instrumental with the accusative). Second, Hungarian as an agglutinative language with a rich case morphology offers a unique opportunity for testing sensitive areas within noun morphology generally and within case marking more specifically. Third, accounts of grammatical deficits in SLI have devoted relatively little attention to case morphology and, as will be seen, this attention has focused on but one type of case, leaving much unexplained. For these reasons, we examined the use of case markers in spontaneous speech and in an elicited production task in Hungarian children with SLI. We also compared knowledge of case markers both in their spatial/semantically transparent and nonspatial/semantically opaque use to compare how function influences the use of the same form in typical development and in SLI.

Case Marking In SLI: Data and Theories

Studies of case marking by children with SLI have largely concentrated on structural case, that is, case assigned by particular positions in the syntactic structure. The widest documentation of problems with structural case in SLI comes from studies of subject pronoun errors by English-speaking children with SLI. These children tend to make more errors than typically developing (TD) peers, but the pattern of error types is the same: they overapply accusative forms for nominative forms (as in **Me drink it all*). In contrast, accusative forms (as in *Mommy hugged me*) are produced mostly correctly (Loeb & Leonard, 1988, 1991; Leonard, 1982; Leonard, 1995; Schütze, 1997; Clahsen et al., 1997, Wexler et al., 1998, Radford & Ramos, 2001). Subject case-marking in English is often suggested to correlate with the development and marking of subject-verb agreement in typical development and in SLI as well. Indeed, Wexler et al. (1998), in their formulation of the Agreement and Tense Omission Model (ATOM), suggest that case marking difficulties of children with SLI are a corollary of their primary deficit in the use of tense and agreement marking of the verb. That is, in English, nominative case is licensed by the presence of the

functional category of Agreement (AGR); when this functional category is not projected, nominative case is not possible and the default case (which is accusative in English) is selected.

The overapplication of the accusative is not observed in every language: Clahsen (1991) documents errors in German-speaking children with SLI, for whom the majority of errors consisted of substitutions of the nominative for the accusative and dative forms in NPs and pronouns (but other substitutions also occurred). However, in German, unlike English, the default case is nominative, not accusative.

Although errors of nominative case were the most prominent among German-speaking children with SLI, the fact that case errors in accusative and dative contexts were observed prompted to Clahsen (1991) to propose that these children have a broader agreement deficit account – one that adversely affects not only subject-verb agreement, but also the assignment of other types of case (see also Roberts & Leonard, 1997). Later studies of German by Clahsen and his colleagues (Eisenbeiss, Bartke, & Clahsen, 2005; Rothweiler & Clahsen, 1994) have led to a modification of the original agreement deficit account of SLI. These investigators compared performance on structural (nominative and accusative) and lexically bound case marking in children with SLI and controls matched for mean length of utterance (MLU). Children with SLI tended to mark structural case (nominative and accusative) correctly, but they incorrectly overapplied these to other lexically bound cases such as the obligatory dative. For example, **helf den Frau* was produced, where instead of the accusative (and masculine) *den* determiner the correct choice would have been the dative *der* (correct: *helf der Frau* ‘helps the woman’). Another example was **ich bin kalt*, where the nominative pronoun was incorrectly used instead of the dative experiencer (correct: *Mir ist kalt* ‘I’m cold’). In spite of frequent substitution errors, children with SLI were not selectively impaired on lexical case either: they performed at the same level as their MLU controls. So German children with SLI did not show an impairment of either structural or lexical case relative to their MLU controls, although they had relatively low scores on agreement marking. The authors concluded (modifying the previous general agreement deficit account including case) that these results argue against a broad agreement deficit and support models of SLI that propose a syntactic deficit in subject-verb agreement and not in areas of grammar such as case or tense marking.

An important set of data comes from Turkish, a language that is similar to Hungarian in that case marking and not word order is the core marker of grammatical functions. Results from monolingual and bilingual children with SLI suggest that in Turkish, noun morphology is more vulnerable than verb morphology. Çavu (2009) tested structural and semantic case-marking in Turkish bilingual children with SLI and did not find difficulties with structural (dative and accusative) case (in line with Eisenbeiss et al., 2005). She also points out that the bilingual SLI group produced utterances with fewer semantic case (semantic dative, locative, genitive, ablative) contexts, but they did not make more errors than TD children when they used these case forms. Results of De Jong, Çavu and Baker (2010) from Turkish-Dutch bilingual children suggest that bilingual children with SLI have greater problems with noun morphology in Turkish (case marking, accusative: 56% correct) than with verb morphology (89% correct). Rothweiler et al. (2010), also found case marking

deficits in four successive-bilingual Turkish German children with SLI, but impairments of verb morphology were also evident. Importantly, regardless of whether they have deficits in verb morphology, children with SLI who speak Turkish seem to have problems in the area of case marking.

Lukács, Leonard, and Kas (2010) tested knowledge of accusative forms (together with plurals) in noun morphology in Hungarian-speaking children with SLI. There was no evidence of a special difficulty marking the accusative in SLI, and when children made simplification errors in forms where multiple suffixation was required (plural+accusative), the children were more likely to produce the accusative only, suggesting that structural case marking is not impaired in Hungarian SLI.

Although not a study of either children with SLI or case marking, Friederici's (1982) results might also be relevant to our questions. She tested knowledge of German prepositions in their semantic versus syntactic function in patients with aphasia, and found that in Broca's aphasia prepositions that appear in their spatial or semantic use were easier to produce than prepositions that only have a syntactic function (even if they have the same form), while she found the reverse pattern in Wernicke's aphasia. Based on Friederici's observations, we would expect to find the pattern observed in Broca's aphasia to characterize SLI performance: suffixes in their spatial meaning should be easier than suffixes that only have a syntactic function. Friederici (1982, pp. 251-252) argues that "The German language allows for investigation of the processing of structural and semantic information using the *same form* of a closed class item by only varying its functional role. For example, a preposition can be used, first, as a lexical preposition, that is, as a freely substitutable form of a preposition that bears at least some semantic information [...] Second, the same form can also be used as an obligatory preposition that is lexically dependent on the preceding verb, that is, the verb is subcategorized for a particular preposition. [...] These obligatory prepositions bear virtually no semantic meaning by themselves, but are nonetheless a structural requirement."

The same is true in other languages, including English prepositions and, most relevant to our study, Hungarian case markers.

Most accounts of the grammatical deficits of SLI appear to be silent with regard to distinctions such as that made by Friederici (1982). The Representational Deficit for Dependent Relations (RDDR) account proposed by van der Lely and her colleagues (van der Lely, 1994; van der Lely & Stollwerck, 1997) proposes that children with SLI have a broad syntactic computational deficit that leads to weaknesses in structure-dependent relationships. This account has since been expanded and is termed the Computational Grammatical Complexity Hypothesis (CGC, Marshall & van der Lely, 2007). According to this expanded account, children with SLI have a deficit in structural complexity that extends beyond syntax to include morphology and phonology as well. The CGC hypothesis also argues that not all kinds of dependent relations are expected to be impaired in SLI, only complex ones involving movement chain formations. To test the predictions of CGC and contrast them with those of other theories, Stavrakaki and van der Lely (2010) tested production and comprehension of clitics and anaphors in Greek-speaking children with SLI, and found that

SLI performance was only significantly worse with object clitics. Object clitics solely rely on syntactic dependencies for their interpretation (as opposed to pronouns with an independent inherent semantic reference). Importantly, children with SLI performed well on anaphors, which are similar to object clitics in that they are non-salient and they rely on syntactic information, but they only require a core grammatical operation of feature checking within spec-head agreement, and not complex dependencies requiring movement. However, it is not clear whether this assumption of a structural complexity deficit applies to non-structural case suffixes that are dictated by the characteristics of the verb.

One account that allows for a distinction between semantically based and non-semantically based forms in SLI is the morphological richness account proposed by Leonard and his colleagues (Leonard, 1998, pp. 255-257; Leonard, Sabbadini, Leonard, & Volterra, 1987; Dromi, Leonard, Adam, & Zadunaisky-Ehrlich, 1999). According to this account, children with SLI have a limited processing capacity and devote their limited processing resources to the dominant features of the language they are acquiring. In English, children with SLI devote resources to word order and remaining resources are devoted to grammatical morphology. However, in a morphologically rich language (especially when word order is not rigid), resources are devoted first to grammatical morphology. This state of affairs means that differences between children with SLI and typically developing peers in the use of grammatical morphology will be smaller in a morphologically rich language than in a morphologically sparse language.

However, given the limitations in processing capacity in children with SLI, the benefits of a rich morphology will have limits. Grammatical morphemes with relatively transparent functions will be acquired first, placing morphemes with less transparent functions at risk for being processed incompletely due to limited resources. As a result, it will take a greater number of encounters with these less transparent forms before children with SLI acquire them. As will be seen, this distinction between transparent and opaque functions of morphemes has particular relevance in Hungarian.

Case Morphology in Hungarian

In a non-configurational language like Hungarian, where word order is relatively free, morphology is the core marker of grammatical functions. Hungarian has a very rich system of suffixes both in the verbal and the nominal paradigm. Suffix combinations are possible and frequent; the order of suffixes within a word is fixed. Theoretically, there are 756 different forms in which a noun can appear, taking all possible suffixes and their well-formed combinations into account. If the nominative is assumed to have a 0 case marker, there are 18 cases. Case suffixes can combine with the plural and with possessive markers, in a fixed order: the case marker is always word-final, and all nouns have to end in a case marker. Like most suffixes, case markers can have several allomorphs and the choice of the allomorph is determined by the stem and the rules of vowel harmony: the suffix agrees with the stem vowels in frontness (and in some cases in roundness as well)².

²Further details of Hungarian morphophonology are not discussed here; the interested reader is referred to Siptár and Törkenczy (2000) for details. Also, we do not discuss the agglutinative versus fusional elements of the paradigms, as we do not focus on suffix combinations, and the target suffixes in our study are homogeneous in this regard.

In line with Chomsky's (1981) distinction between structural and lexical case and earlier proposals for other languages, Kiefer (2000) and Bartos (2000) describe the nominative, the accusative and the dative as syntactic (or structural) cases (assigned by particular positions of the sentence structure), and all the others as lexical (assigned by lexical specifications of predicates) or inherent (associated with specific thematic roles) cases. Under this approach, the cases we examine in the study presented below are all lexical or inherent cases. None of these cases require agreement with a *grammatical* feature of any other element in the sentence. All of them require agreement with semantic (of both the verb and the case-marked noun in the case of spatial meanings) or lexical (of the verb in the case of nonspatial meanings) features of other elements. Some syntactic accounts of non-structural cases propose a further distinction between lexical and inherent cases. Woolford (2006) argues that there are lexical cases, which are truly irregular and selected by individual verbs, and the more regular inherent cases. This subdivision within non-structural cases is justified by licensing differences, according to Woolford: lexical Case is restricted to themes or internal arguments (licensed by V inside the VP proper at vP structure), while inherent Case only appears with external arguments (licensed by so-called little/light verbs above the VP proper at vP structure).

Although application of this linguistic subdivision for Hungarian case markers awaits further study, it is true that even within the group of 'lexical' or 'inherent' cases, the selection of a case marker may be determined by one of two different processes in Hungarian, very much like the selection of prepositions in English or German. First, the choice of suffix may be governed directly by the idiosyncratic lexical specifications of the predicate. In this instance, the case marker 'loses' its spatial meaning, as in example a) below. The other process involves indirect selection, where the predicate subcategorizes for an obligatory or optional argument of a certain thematic type, which may be marked by one of a set of suffixes (it constrains the path type of the suffix: whether it should be a Goal, Static or Source suffix). The choice of suffix from within this set is determined by the properties of the noun host (constraining the spatial relation type of the suffix: whether it is going to be a Container, Surface or Neighborhood suffix), see example b) below.

a. *Pisti tanult a balesetb* l

Pisti learned the accident-FROM.

Pisti learned from the accident.

b. *Az oroszlán megszökött a ketrecb* l.

The lion escaped the cage-FROM.

The lion escaped from the cage.

While in sentence a), the elative suffix is selected on the basis of idiosyncratic lexical specification of the verb, in sentence b) semantic restrictions of the verb and the noun cooperate: the verb *megszökök* 'escape' only requires that the noun have a Source-type suffix. This information combines with the specifications by the noun *ketrec* 'cage' which is a container, unambiguously specifying the elative as the right suffix choice.

Predictions of Different Accounts of SLI

Relatively few accounts have provisions for predicting the status of lexical or inherent case in children with SLI. Clahsen (e.g. Eisenbeiss, Bartke, & Clahsen, 2005) modified his account to emphasize subject-verb agreement limitations, and Rice and Wexler's (1996, 2001) account focuses on tense and subject-verb agreement. The computational grammatical complexity hypothesis may be relevant to lexical or inherent case, but thus far van der Lely and her colleagues have not yet outlined how such a weakness would be treated in their account.

On the other hand, the morphological richness account has provisions for expecting a milder deficit in case use by children with SLI acquiring Hungarian relative to those acquiring a morphologically sparse language. Furthermore, and, importantly, within Hungarian, children with SLI should lag behind their typically developing peers to a greater degree in their use of those case markers with relatively opaque functions than in their use of case markers with relatively transparent functions. As operationalized in the present study, we assume that suffixes expressing spatial meanings would be relatively transparent, and hence less problematic, and suffixes expressing nonspatial meanings would be more opaque and reveal larger differences between children with SLI and their typically developing peers.

We tested this hypothesis in two studies, applying different methods. In Study 1, we analyzed corpora of narrative language samples from children with SLI and two groups of typically developing children: one group matched on chronological age and the other on vocabulary size; Study 2 was an elicited production task disguised in the form of a sentence repetition task with masked inflections.

Study 1: Analysis of narratives

Method

Participants—We analysed narrative samples from 16 children with SLI. All 16 of these participants met exclusionary and inclusionary criteria for SLI. Each child had normal intelligence (above 85 on the Raven Coloured Progressive Matrices; Raven *et al.*, 1987), passed a hearing screening, and had no history of neurological impairment. Each child in the SLI group scored at least 1.5 SDs below the mean for his or her age on two or more of four language tests administered, two of which assessed receptive skills, and two evaluated expressive skills. The receptive tests were the Hungarian standardizations of the Peabody Picture Vocabulary Test (PPVT) and the Test for the Reception of Grammar (TROG). The expressive tests were the Hungarian Sentence Repetition Test, and a nonword repetition test.

The Hungarian adaptation of the PPVT is modeled closely after its English equivalent (Dunn & Dunn, 1981; Csányi, 1974). The Hungarian adaptation of the original TROG (Bishop, 1983) has been standardized for the age range 4 to 12 years, and is in press.³ The test

³We are grateful to Professor Dorothy Bishop for providing us with the TROG for this purpose. To date, 600 typically developing children have been tested as part of the standardization process. The scores of the children with SLI in this study were compared against the values obtained for the typically developing children participating in the standardization. TROG has a discontinue procedure after 5 blocks are failed, but this discontinue rule was not followed either in the standardization or in testing children in this study.

assesses the children's understanding of grammatical forms in increasing difficulty. It consists of 20 blocks, each with 4 items of the same grammatical construction (e.g., sentences with comparatives, postmodified subjects and embedded clauses). The child must point to a picture (from an array of four pictures) that matches the sentence spoken by the experimenter. A block is scored as complete if the child responds correctly to all four pictures in the block. We used both the number of blocks correctly completed (max. 20) , and the number of items correctly answered (max. 80).

The Hungarian Sentence Repetition Test (*Magyar Mondatutánmondási Teszt* (Kas & Lukács, in preparation) contains 40 sentences, distributed evenly across five types of grammatical constructions. These are simple Subject-Verb-Object (SVO) sentences, simple OVS sentences, and complex sentences containing SS relative clauses, SO relative clauses, and OS relative clauses. The sentences vary in length from 8 to 15 syllables within each type. The task is to immediately and accurately repeat each sentence presented by the experimenter. Accuracy is measured in terms of the number of correctly repeated sentences.

The nonword repetition test (Racsmány et al., 2005) consists of 36 nonwords ranging from one to nine syllables in length. Four nonwords are used for each length. All nonwords conform to the phonotactic patterns of Hungarian. The particular phonological sequences used in the nonwords do not reflect the frequency distribution of Hungarian phoneme sequences. However, sequences that are articulatorily difficult for speakers are not employed. The child is asked to repeat each nonword. The child's score is defined as the length at which the child successfully repeated at least two of the four nonwords.

We compared results of the SLI group to two control groups matched individually to the children with SLI: a group matched on chronological age and gender (hereafter, the CA group), and a group matched on receptive vocabulary raw scores (Peabody Picture Vocabulary Test) and gender. Vocabulary controls were chosen to test whether case marking deficits in SLI (if they exist) exceeded children's vocabulary limitations. These children scored above -1SD on each of the four language tests. Hereafter, these children are referred as the vocabulary control (VC) children. Details of the groups are shown in Table 1.

Procedure—We elicited narrative language samples using Mayer's (1969) Frog Story. All participants were tested individually in a quiet room. Children were allowed to go through the pages of the picture book first, and were then prompted to tell the story in their own words. Neither questions nor directives were given during the task to promote continuous narratives from the children.

Measures—Several measures were counted in the samples of each child: the total number of case marker suffixes (tokens), the number of different case markers (types) and the total number of case marking errors (note that nouns in the nominative do not have an overt suffix; therefore, we did not include nominative case in the scoring). Two kinds of case marking errors were differentiated: (i) omission of a case marker in an obligatory context, and (ii) substitution of an obligatory case marker with another. Erroneous case marking was only considered as a substitution or an omission when the verb frame requiring a specific case marker was fully identifiable.

Results

Because of the relatively large number of case marker types in Hungarian, the number of tokens of any particular type was small, often zero. Therefore, instead of analysing case marker types separately we only analysed group effects on the total numbers of case marker tokens, types and errors. First, we examined whether vocabulary level and general length differed among groups. According to a one-way ANOVA there were no significant differences among groups in the total number of words, $F(2, 45) = 2.14$; *n. s.* and the total number of nominative nouns, $F(2, 45) = .40$; *n. s.* Thus, general length and vocabulary did not differentiate the groups.

Next, we compared the groups' productions of case marker suffixes and different case markers. We compared the performance of children with SLI with the CA and the VC group in a one-way multivariate ANOVA conducted on the total number of case marker suffixes (tokens) and on the number of different case markers (types). Multivariate tests showed a significant main effect of Group, $F(4, 88) = 3.20$, $p < .05$, $\eta_p^2 = .127$. Univariate tests revealed significant effect of Group for both the total number of case marker suffixes (tokens), $F(2, 45) = 4.37$, $p < .05$, $\eta_p^2 = .163$, and the number of different case markers (types), $F(2, 45) = 6.22$, $p < .01$, $\eta_p^2 = .217$. Bonferroni-corrected pairwise comparisons (post-hoc tests) showed that children with SLI only differed from the CA group in both respects, that is, they used a significantly smaller number of case marker suffix tokens and also a smaller number of different case markers (types) than the CA group, while they did not differ from the VC group in either respect.

Finally, we analysed the grammaticality of children's use of case markers by comparing the number of case marking errors among the groups. A one-way ANOVA conducted on the number of case marking errors showed no significant differences, $F(2, 45) = .52$, *n. s.* The main results for the different measures in the three groups are presented in Table 2.

Summary of results from the narrative analysis

In a narrative task, children with SLI used significantly fewer case marked nouns (case marker tokens) and fewer different types of case marker suffixes than their age-equivalent peers. However, comparisons with younger children with the same level of receptive vocabulary showed no such difference: children with SLI used the same number of case marked nouns (tokens) and the same number of different case markers (types) as typically developing children matched on vocabulary. Their level of accuracy of case marker production was comparable to vocabulary control children, with very few case marking errors observed. Thus, in the narrative task, the overall case marking performance of children with SLI matches levels expected based on their vocabulary size.

Study 2: Elicited production with masked inflections

Method

Participants—Ninety two children participated in the second study. Forty-six children met the criteria for SLI and 46 were developing language in a typical manner. Children with SLI were recruited in two age groups. The younger group consisted of 17 participants, ranging in

age from 4;10 to 7;2 ($M = 6;0$), the older group consisted of 29 children ranging in age from 7;11 to 11;4 ($M = 9;10$). The younger participants were selected from two special kindergarten classes for children with language impairment. The older participants were selected from two special schools for children with language impairment. All 46 children with SLI met exclusionary and inclusionary criteria for SLI described in Study 1.

The 46 typically developing children were selected for two vocabulary control groups (VC) matched individually on receptive vocabulary raw scores (based on their raw scores on the PPVT, and criteria described in Study 1 above). Seventeen of the children (younger VC group) were matched according to PPVT raw scores with the younger SLI group (ranging in age from 3;3 to 6;2 ($M = 5;1$)). The remaining 29 children (older VC group) were matched according to PPVT scores with the older SLI group, and ranged in age from 4;4 to 8;2 ($M = 6;3$). It can be seen that these two groups of VC children overlapped in age; for this reason the designation ‘younger’ and ‘older’ should be read as ‘matched to the younger’ and ‘matched to the older’, respectively. A VC child was considered a match if his or her PPVT raw score was within 4 points of the PPVT raw score of a child in the SLI group. Means and ranges for age, PPVT raw score, nonword repetition span, TROG raw score and Sentence Repetition raw score for the four groups are provided in Table 3.

Procedure—We employed a structured elicited production task in which children were instructed to repeat sentences spoken by a female speaker, heard from a loudspeaker. The sentences were digitized, with coughs inserted to replace the inflections only, as in the example below, where XXX marks the cough:

Az oroslán megszökött a ketrecXXX.

Target: *Az oroslán megszökött a ketrecb I.*

The lion escaped the cage-FROM.

The lion escaped from the cage.

Since participants heard the whole sentence up to the suffix, including the final noun stem, and they only had to supply the suffix, they could rely on the combined information from the verb and the noun. All sentences were normalized for a length between 8 and 12 syllables. The nouns used with the spatial and nonspatial meanings of the suffixes were different, but they were all 1- to 3-syllable nouns that the children were familiar with. Participants did not have a problem repeating the nouns and verbs or any other unmasked part of the sentence⁴. This method was based on the phoneme restoration effect demonstrated by Warren (1970), which also works at the level of morphemes (e.g., for affixes in Hungarian; see Dankovics & Pléh, 2001). We have already successfully exploited this method in an earlier developmental study as an elicited production method testing knowledge of agreement in Hungarian children with SLI (Lukács et al., 2009) and in testing early morphological productivity in

⁴In our first study using this method (Lukács et al., 2009) we wanted to ensure that the inserted coughs were sufficient to obscure the inflection, and that there were no anticipatory coarticulatory cues on the stem to provide the children with an indication of the inflection that was masked. We asked 15 adult listeners to guess which inflection was used with the stem for all the verb forms with coughs. They guessed correctly on 5.6% of the items, significantly below performance of either group of children on the task. We take these findings as indication enough that the method in general ensures that the stimuli do not contain unintended cues that could lead to correct performance without knowing the appropriate inflection.

young typically developing children (Gábor & Lukács, 2011). Children were tested individually in a quiet room.

We used a stimulus design that was originally developed to test the use of spatial language without the confounding factor of spatial cognition (Lukács et al., 2007). The target sentences included spatial and nonspatial meanings of all suffixes. Each of 9 suffix types was represented by 3 sentences, for a total of 27 sentences (see Table 5 for examples). Spatial case markers can be viewed from two perspectives. First, they can be viewed from the perspective of Path type (Goal, Source, and Static). Second, they can be viewed from the perspective of Relation type (Surface, Container, Neighborhood) (Table 4). Path type and Relation type descriptors derive from the different uses when the case markers are used in the spatial sense. However, nonspatial markers also pattern in the same way based on formal grounds. Specifically, when a prefix associated with container/goal is present, a Container/Goal case suffix is required even though a literal spatial relationship is not involved (e.g. *Ella teljesen beleásta magát T. S. Eliot költészetébe.*– Ella completely into-dig-3SgPastDef herself-Acc T. S. Eliot poetry-Poss-Illative, ‘Ella completely immersed herself in T. S. Eliot’s poetry’). In our detailed analysis of performance patterns, we examine the results from both the perspective of Path type and of Relation type, for both spatial and nonspatial meanings.

Scoring—Although children were asked to repeat the entire sentence they heard, given our focus on case marking, only the suffixes on the nouns were scored as correct or incorrect. All correct answers were given a score of 1, incorrect answers were scored as 0. Correct answers included target suffixes, and also included some deviations from target answers. That is, with some sentences and structures two suffixes may be in free variation (or in some cases dialectal variation) with the meaning of the structure preserved (*A mamut hasonlít az elefántra* vs. *elefánthoz*. ‘The mammoth resembles the elephant’, where elephant-ONTO and elephant-TO are both acceptable). Substitutions that resulted in a slight change in sentence meaning relative to the target were also accepted, provided that the child’s sentence described the situation appropriately (*A katona hátralepett a kaputól* vs *kapuból*. ‘The soldier stepped back from the gate’ where both gate-FROM and gate-OUT OF are acceptable).

Results

Two sets of analyses were performed, to accommodate the fact that Path type and Relation type represented two different dimensions that could not be combined in a single analysis due to too few items for each Path type – Relation type permutation.

Analyses Employing Path Type

Correct scores were first analysed in a 2 (Group: SLI, VC) $\times$ 2 (Age) $\times$ 2 (Suffix meaning: Spatial, Nonspatial) $\times$ 3 (Path type: Static, Source, Goal) design. All four main effects were significant: Group, $F(1, 88) = 28.79, p < .001, \eta_p^2 = .247$; Age, $F(1, 88) = 14.05, p < .001, \eta_p^2 = .137$; Suffix meaning, $F(1, 88) = 89.30, p < .001, \eta_p^2 = .504$; and Path type $F(2, 176) = 28.60; p < .001, \eta_p^2 = .24$. There were three significant two-way interactions: Suffix meaning $\times$ Group, $F(1, 88) = 6.79, p < .05, \eta_p^2 = .72$; Suffix meaning $\times$ Age $F(1, 88) = 5.92,$

$p < .05$, $\eta_p^2 = .063$; and Suffix meaning $\times$ Path type, $F(2, 176) = 14.45$; $p < .001$, $\eta_p^2 = .141$. However, these interactions were subsumed by two significant three-way interactions: Suffix meaning $\times$ Group $\times$ Age: $F(1, 88) = 3.97$, $p < .05$, $\eta_p^2 = .043$; and Suffix meaning $\times$ Path type $\times$ Age: $F(2, 176) = 3.74$; $p < .05$, $\eta_p^2 = .041$.

The main effects reflected differences that were quite straightforward. The VC children were more accurate than the children with SLI; older children were more accurate than younger children, and Spatial meanings were more accurate than Nonspatial meanings. Pairwise comparisons for Path type revealed that Goal suffixes were more accurate than Source suffixes which, in turn, were more accurate than Static suffixes. However, a more complete understanding of these findings requires inspection of the observed interactions. We focus here on the two three-way interactions.

Because both three-way interactions involved Group, we examined the effects for each age level separately. When the Suffix meaning $\times$ Group $\times$ Age interaction was broken down by age level, we found that Suffix meaning and Group interacted only in the younger children, $F(1, 32) = 5.69$, $p < .05$, $\eta_p^2 = .151$. Within this younger group, the advantage of Spatial meanings over Nonspatial meanings was present in both the SLI and TD groups, but stronger among the children with SLI, $t(28) = 4.05$, $p < .001$ than among the TD children, $t(28) = 3.76$, $p < .01$.

We also examined the Suffix meaning $\times$ Path type $\times$ Age interaction in greater detail by computing the effects for each age level separately. The interaction of Suffix meaning and Path type was significant in the younger group, $F(2, 64) = 8.76$, $p < .001$, $\eta_p^2 = .215$, as well as in the older group, $F(2, 112) = 6.53$, $p < .01$, $\eta_p^2 = .105$. For the younger children, when the suffixes had a Spatial meaning, Goal suffixes were marginally easier than both Source and Static suffixes ($p < .10$ for both). When the suffixes had a Nonspatial meaning, Goal and Source suffixes did not differ, and they were both more accurate than Static suffixes ($p < .001$). For the older children, when the suffixes had a Spatial meaning, performance on Goal suffixes was superior to performance on Static suffixes ($p < .01$). There was a tendency for Goal suffixes to be more accurate than Source suffixes, but the difference did not reach significance ($p = .156$). Source and Static suffixes did not differ. When the suffixes had a Nonspatial meaning, Goal suffixes were more accurately produced than Source suffixes ($p < .05$), which, in turn, were used more accurately than Static suffixes ($p < .05$).

Analyses Employing Relation Type

As noted earlier, separate analyses for Path type and Relation type were required. For the latter, we performed an ANOVA with a 2 (Group: SLI, VC) $\times$ 2 (Age) $\times$ 2 (Suffix meaning: Spatial, Nonspatial) $\times$ 3 (Relation type: Container, Surface, Neighborhood) design. Because Group, Age, and Suffix meaning did not differ from the analyses employing Path type, we do not repeat these significant main effects here. We limit our presentation to new effects and interactions that surfaced as a result of including Relation type.

The main effect of Relation type was significant, $F(2, 176) = 14.69$, $p < .001$, $\eta_p^2 = .143$. In addition, there was a two-way interaction of Suffix meaning $\times$ Relation type, $F(2, 176) =$

41.83; $p < .001$, $\eta_p^2 = .322$, as well as a three-way interaction of Suffix meaning X Relation type X Group, $F(2, 176) = 9.86$; $p < .001$, $\eta_p^2 = .101$.

The Suffix meaning X Relation type X Group interaction was examined further by testing the effects on the SLI and VC groups separately. For the VC children, the effect of Relation type was significant both when the suffixes conveyed a Spatial meaning, $F(2, 90) = 20.24$ $p < .001$, $\eta_p^2 = .310$, and a Nonspatial meaning, $F(2, 90) = 4.41$ $p < .05$, $\eta_p^2 = .089$. Similar results obtained for the SLI group. The Relation type effect was seen for both Spatial, $F(2, 90) = 30.88$; $p < .001$, $\eta_p^2 = .407$, and Nonspatial meanings, $F(2, 90) = 4.95$; $p < .01$, $\eta_p^2 = .099$.

Given the effects for Relation type, we employed pairwise comparisons to determine how the three Relation types might have differed. For VC children, when the suffixes had a Spatial meaning, Surface and Container relations were significantly easier than Neighborhood relations ($p < .001$ in both cases). When the suffixes had a Nonspatial meaning, Surface relations were easier than Container relations ($p < .01$) and Neighborhood relations ($p < .05$) but the latter two did not differ. For children with SLI, when the suffixes conveyed a Spatial meaning, the pattern was similar to that of VC children: Surface and Container relations were expressed more accurately than Neighborhood relations ($p < .001$ in both cases), while for Nonspatial meanings, Surface and Container relations did not differ, but both were expressed less accurately than Neighborhood relations ($p < .01$ in both cases).

Summary of results of analysis of correct responses

The VC group showed a significantly larger overall proportion of correct responses than the children with SLI. Older children showed a better performance than younger children within both SLI and VC groups. Sentences with suffixes in their spatial meanings were easier for both SLI and VC children, older and younger, with a bigger advantage for spatial items in the younger SLI than younger VC group. Performance along Path type differed significantly, but it showed largely the same pattern across the SLI and VC groups, older and younger: Goal suffixes were easiest, followed by Source suffixes, while children found sentences with Static suffixes the most difficult. Path type affected Spatial and Nonspatial meanings differentially: the effect was stronger for Nonspatial suffixes than for Spatial suffixes, and the pattern was also different. For Spatial suffixes, Goal was easiest, while Static and Source did not differ. For Nonspatial meanings, younger children found Goal suffixes easier than Static suffixes which they found easier than Source suffixes. For older children, there was no difference between Goal and Source suffixes, which they found easier than Static suffixes.

The effect of Relation type was stronger in younger than in older children, but did not differ between VC and SLI groups. Overall, Surface and Container relations did not differ, but performance on both was significantly better than on suffixes coding Neighborhood relations. Contrary to the path effect pattern, Relation type had a stronger effect on Spatial than on Nonspatial suffixes, where there was also a difference between groups, with children with SLI showing a stronger effect. For Spatial meanings, Surface and Container relations did not differ, and they were both easier than Neighborhood relations for both the VC and

SLI groups. With Nonspatial meanings, VC children found Surface relations easier than both Container and Neighborhood relations, which did not differ. Children with SLI found Surface and Container relations equally more difficult than Neighborhood relations.

Error analysis

The great majority of errors were commission errors, i.e. children tended to use another suffix in place of the target form instead of omitting the suffix or producing other answers. This was true for all groups except for the older SLI group, where only a little more than half of the responses were substitutions with another suffix. For more detailed analysis of error patterns, we only analyzed commission errors further; results are shown in Table 7.

As Table 7 shows, children in all groups mostly substituted target suffixes with another one of the 9 suffixes under investigation,⁵ and the majority of these substitutions were near-miss errors sharing either Path type or Relation type with the target suffix. From within the 2 dimensional (Path type X Relation type) matrix of the 9 spatial suffixes, for each target suffix, there are 4 that are errors on only one dimension (2 agreeing in path type but differing in relation type, and 2 agreeing in relation type and differing in path type), and 4 that differ from the target on both dimensions, so the chance of producing an error on only one dimension by selecting one of the 9 suffixes at random is 50% (4/8), which is greatly exceeded by the actual percentages in all 4 groups. As the distribution of same Path type versus same Relation type errors within errors on only one dimension shows (last two rows of Table 6), the majority of responses showed the correct Relation type but incorrect Path type.

Table 7 shows the distribution of errors between Spatial and Nonspatial targets (adding up to 100% in every case). While the difference between the ratio of substitution errors for Spatial and Nonspatial target suffixes did not differ greatly, there were some more specific differences. Suffix substitutions with errors on both dimensions were more common with Nonspatial targets, as was replacing the target suffix with the accusative. Errors sharing the Relation type with the target suffix (thus, constituting an error of Path type) were more frequent with Spatial targets.

General Discussion

The purpose of this investigation was to determine whether Hungarian-speaking children with SLI have difficulty with non-structural case marking, and, if so, whether the difficulty is comparable for Spatial and Nonspatial meanings conveyed by these markers. In Study 1, we used the *The Frog Story* task (Mayer, 1969) to elicit narratives from the children. Analysis of narratives showed that children with SLI have problems with case marking, although this deficit was not manifest in the number of case marking errors (relative to either chronological age-matched or vocabulary controls). Differences were seen in the total number of case marked nouns and the number of different case marker suffix types, but only relative to age-equivalent peers, not to younger children with the same level of receptive

⁵Note that here the term 'spatial suffix' does not specify whether it was used in its spatial or nonspatial meaning; rather, it is shorthand for the 9 cases examined in the study.

vocabulary. Their accuracy levels were comparable to both age and vocabulary controls, all producing very few case marking errors. This pattern of results suggests that although case marking is problematic for Hungarian children with language impairment relative to age-matched peers, case marking performance in spontaneous language production is largely influenced by lexical abilities and that the acquisition of the case marking system of Hungarian does not pose *selective* difficulties for children with SLI.

In Study 2, we employed an elicited production task. VC groups matched on vocabulary size showed a significantly larger overall proportion of correct responses than children with SLI. Older children showed a better performance than younger children within both SLI and VC groups. Sentences with suffixes in their Spatial meanings were easier for both SLI and VC children, older and younger, with a bigger advantage for Spatial items in the older SLI than older VC group. Performance along Path type differed significantly, but showed largely the same pattern across the SLI and VC groups, older and younger: Goal suffixes were easiest, followed by Source suffixes, while children found sentences with Static suffixes the most difficult. Path type affected Spatial and Nonspatial meanings differentially: the effect was stronger for Nonspatial suffixes than for Spatial suffixes, and the pattern was also different. For Spatial suffixes, Goal was easiest, while Static and Source did not differ. For Nonspatial meanings, older children found Goal suffixes easier than Static suffixes which they found easier than Source suffixes. For younger children, there was no difference between Goal and Source suffixes, which they found easier than Static suffixes.

The effect of Relation type was stronger in older than in younger children, but did not differ between VC and SLI groups. Overall, Surface and Container relations did not differ, but performance on both was significantly better than on suffixes coding Neighborhood relations. Contrary to the Path type pattern, Relation type had a stronger effect on Spatial than on Nonspatial suffixes, where there was also a difference between groups, with children with SLI showing a stronger effect. For Spatial meanings, Surface and Container relations did not differ, and they were both easier than Neighborhood relations for both the VC and SLI groups. With Nonspatial meanings, VC children found Surface relations easier than both Container and Neighborhood relations, which did not differ. Children with SLI found Surface and Container relations equally more difficult than Neighborhood relations.

Performance of the SLI group was significantly weaker on Nonspatial items. This pattern suggests a level of language development in SLI where many of the verbs tested here, together with their argument structure containing the suffix, are missing from the lexicon. The dissociation between Spatial and Nonspatial items was smaller in the VC group. Also, we found a bigger group difference for Nonspatial meanings, i.e. for suffix occurrences that have to be lexically learnt one by one for each verb. Accurate performance on Nonspatial items requires the acquisition of argument structures or complex lexical representations of verbs; it seems that it is this aspect of lexical acquisition that is especially difficult in SLI.

Results of the error analysis showed that when children were making an error, they did not resort to using some kind of default case such as the accusative, or to using the most frequent cases, showing that they encoded some part of the suffix representation. For most children, the majority of the errors were substitutions with another of the 9 suffixes tested in

the experiment. For Spatial meanings, errors usually shared either Relation type or Path type with the target suffix. Errors were mostly errors of Path type; this is the information that is encoded in the argument structure of the verb. Spatial relations, determined by the noun, were easier to select. For Spatial meanings, errors on both dimensions (Relation type and Path type) were a minority; this reflects the fact that Spatial meanings semantically code information along two dimensions, combining Relation type and Path type, determined by the noun and the verb, respectively. It is possible that when processing resources are not fully available, only one of these dimensions (mostly the easier one determined by the noun) gets encoded. As suffixes in their Nonspatial meanings are not transparent, they do not combine these two kinds of information from two sources; rather, they represent labels determined only by the verb. For this reason, systematic errors such as selecting only one of the dimensions would not be expected.

Taken together, results from narratives and an elicited production task suggest that case marking performance is more a function of vocabulary size than of grammatical knowledge, and follows the same pattern as in typical development. It would seem, therefore, that similar semantic and pragmatic influences determine case suffix acquisition in typically developing children and children with SLI. These findings argue that there is no selective deficit of case marking per se in Hungarian-speaking children with SLI. As the difficulties can be explained by lack of lexical knowledge, or by semantic complexity and transparency of the suffixes, there is no need to posit a selective case marking deficit. Indeed, the specific pattern with better performance on systematic Spatial than on idiosyncratic Nonspatial items would be difficult to interpret on a selective difficulty account.

As discussed in the introduction, most accounts of grammatical deficits in SLI do not address the issue of lexical and inherent case use. The most recent modification of the agreement deficit account of Clahsen and his colleagues (e.g., Eisenbeiss, Bartke, & Clahsen, 2005) holds that the deficit lies in subject-verb agreement relations. The Rice and Wexler (1996) account focuses on inconsistent projection of the functional category AGR that prevents the licensing of nominative case in a language such as English. The latest version of the account by van der Lely and colleagues (e.g., Marshall & van der Lely, 2007) – that complexity of structure is the source of difficulty – has thus far not been applied to the use of lexical or inherent case by children with SLI.

However, one processing account of the grammatical deficits of SLI – the morphological richness account (e.g., Leonard, 1998, pp. 255-257) – does provide a basis for predicting the major findings reported here. In particular, this account predicts less difficulty with morphology (and thus with case marking) in a morphologically rich language such as Hungarian. Further, although we observed poorer performance by the children with SLI on the elicited production task, performance patterns matched those of typical development with regard to the Spatial-Nonspatial distinction, and the relative difficulty of Relation type and Path type. The finding that the children with SLI found Nonspatial meanings especially difficult relative to typically developing children further supports predictions of this account, as the most vulnerable suffixes are expected to be those that pose a processing difficulty. Suffixes in their Nonspatial meanings are assumed to be difficult to process and acquire because they are semantically non-transparent, not systematically associated with a thematic

role, and vary greatly in their frequency of use. The finding that most errors, especially with Spatial meanings, were errors in which the children could rely on the spatial relation information provided by the noun (thereby getting only the Path type wrong), also suggests difficulties with lexically more complex representations of verbs or integrating lexical information from verbs in the sentence.

As a final remark, we would like to add that discovering deficits that seem attributable to processing difficulty does not imply that diagnostically accurate clinical markers of SLI cannot emerge from these efforts. On the contrary, the discovery of areas of grammar that constitute the greatest processing challenges for children with SLI may prove to be an especially good way of identifying language impairment. Furthermore, the advantage of an approach such as the morphological richness account is that the areas of weakness can be seen through an interaction of a processing capacity limitation and the properties of the particular language being acquired. Such an approach possesses the means of explaining why the potential markers of SLI seem to differ so widely across different languages. We strongly suspect that the potential clinical marker observed in the present investigation – difficulty with case suffixes in their Nonspatial meanings – represents one such example of a problem that emerged as a consequence of processing limitations coupled with special complexity within one part of Hungarian grammar.

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Table 1
Mean age and receptive vocabulary raw scores (with standard deviations) by language group and age

	SLI	Vocabulary control (VC)	Chronological age control (CA)
Mean age (SD)	6.4 (.7)	5.4 (1.0)	6.3 (.7)
Mean receptive vocabulary score (PPVT, SD)	78.8 (16.5)	79.1 (15.7)	89.3 (11.2)

Table 2

Means (and standard deviations) for total number of words, number of different nominative case nouns, total number of case marker suffixes (tokens), number of different case markers (types) and total number of case marking errors in the narrative samples by group

	SLI	VC	CA
Total number of words	226.56 (107.54)	303.5 (129.98)	307.31 (134.73)
Number of different nominative case nouns	16.2 (9.48)	18.69 (7.15)	17.88 (7.44)
Total number of case marker suffixes (tokens)	19.18a (7.49)	25.56a,c (10.31)	29.12c (10.75)
Number of different case markers (types)	5.88a (1.54)	6.93 (2.11)a,c	8.00c (1.36)
Total number of case marking errors	.38 (.61)	.37 (.81)	.69 (1.40)

(SLI: children with SLI, VC: vocabulary control group, CA: chronological age control group).

Means within a row lacking a common subscript differ significantly, $p < .05$.

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Table 3
Means and ranges for age and PPVT raw score for the four groups

	Age	PPVT raw score	Nonword span	TROG raw score	Sentence Repetition
SLI young	5.97 (4.83-7.16)	74.23 (45-110)	3.26 (0-7)	6.82 (46-73)	9.25 (0-21)
VC young	5.07 (3.25-6.16)	74.29 (48-106)	5.14 (4-7)	66.5 (51-80)	28.42 (11-40)
SLI old	9.84 (7.9-11.33)	9.48 (63-124)	3.51 (0-7)	68.1 (59-78)	25.2 (9-39)
VC old	6.28 (4.33-8.16)	9.93 (62-126)	5.36 (3-7)	69.82 (48-80)	31.5 (16-40)

Table 4
Target suffixes in the Sentence Completion task

	Static	Goal	Source
Container	<i>-ban/ben</i> in Inessive	<i>-ba/be</i> into Illative	<i>-ból/b l</i> out of Elative
Surface	<i>-on/en/ön</i> on Superessive	<i>-ra/re</i> onto Sublative	<i>-ról/r l</i> off Delative
Neighborhood	<i>-nál/nél</i> at Adessive	<i>-hoz/hez/höz</i> to Allative	<i>-tól/t l</i> from Ablative

Table 5
Examples of sentences used in the sentence completion task

	Spatial	Nonspatial
<i>ban/ben</i>	<i>A kismadarak ott vannak a fészekben.</i> The birds are there in the nest.	<i>Kristóf hisz az angyalokban.</i> Kristóf believes in angels.
<i>ba/be</i>	<i>Nagyi elment a templomba.</i> Grandma went to church.	<i>A nagynéni szerelmes a királyba.</i> Auntie is in love with the king.
<i>ból/b l</i>	<i>Az oroszlán megszökött a ketrecb l.</i> The lion escaped from the cage.	<i>A tanárnak elege lett a sajítból.</i> The teacher got tired of the cheese.
<i>on/en/ön</i>	<i>Az autó átment a hídon.</i> The car crossed the bridge.	<i>Ildikó meglep dött az ajándékon.</i> Ildikó was surprised at the present.
<i>ra/re</i>	<i>A kertész felállt a létrára.</i> The gardener stepped up the ladder.	<i>Pisti emlékezett a kirándulásra.</i> Pisti remembered the trip.
<i>ról/r l</i>	<i>A cserepek leestek a tet r l.</i> The tiles fell off the roof.	<i>Mindenki hallott már a delfinekr l.</i> Everybody has heard of dolphins.
<i>nál/nél</i>	<i>A busz megállt a piros lámpánál.</i> The bus stopped at the red light.	<i>A nyúl gyorsabban fut a csigánál.</i> The rabbit runs faster than the snail.
<i>hoz/hez/höz</i>	<i>Péter elment a fogorvoshoz.</i> Péter visited the dentist.	<i>Károly csatlakozott a kiránduláshoz.</i> Károly joined the trip.
<i>tól/t l</i>	<i>Nagyi visszajött az orvostól.</i> Grandma came back from the doctor's.	<i>A húgom nagyon fél a halaktól.</i> My sister is very much afraid of fish.

Table 6
Distribution of different error types as a function of language ability and age (VC: Verbal Control; SLI: Specific Language Impairment)

	VC young	SLI young	VC old	SLI old
Errors (%)	26.76	41.07	19.25	29.7
%Commission errors/all errors	88.27	72.79	82.98	52.12
%Commission errors using one of the 9 suffixes under study/commission errors	7.12	85.90	78.77	77.77
%Errors on only one dimension/ using one of the 9 suffixes under study	72.19	75.57	76.71	78.57
%Same Relation type/ Errors only on Path type	63.47	59.47	71.95	76.82
%Same Path type/ Errors only on Relation type	36.52	4.52	28.04	23.17

Table 7
The distribution of errors between spatial and nonspatial targets (VC: verbal control; SLI: specific language impairment)

		VC young	SLI young	VC old	SLI old
Commission errors using one of the 9 suffixes under study	Spatial	56.88	46.91	51.94	46.07
	Nonspatial	43.13	53.09	48.06	53.93
Commission errors using one of the 9 suffixes under study, error in one dimension	Spatial	66.09	54.74	56.71	52.32
	Nonspatial	33.91	45.26	43.29	47.68
Error only on path type	Spatial	75.34	63.72	59.32	56.90
	Nonspatial	24.66	36.28	4.68	43.10
Error only on relation type	Spatial	5.00	41.56	5.00	37.14
	Nonspatial	5.00	58.44	5.00	62.86
Error on both dimensions	Spatial	28.57	24.56	33.33	18.42
	Nonspatial	71.43	75.44	66.67	81.58
Accusative	Spatial	3.23	3.43	31.58	26.32
	Nonspatial	69.77	69.57	68.42	73.68