Morphological cues in the comprehension of relative clauses by Greek children with specific language impairment and typical development: A comparative study

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Abstract
Purpose: This study investigated the effect of morphological case and number marking on the comprehension of relative clauses by Greek children with Specific Language Impairment and Language Age controls.
Method: An agent selection task and experimental materials consisting of 12 subject and 12 object relative clauses were employed. There were two experimental conditions: The first one manipulated number marking for Noun Phrases and the verb (singular vs plural) and neutralised Case through the use of Noun Phrases with neuter gender, which in Greek is ambiguous between Nominative and Accusative. The second one manipulated case and included Noun Phrases marked for morphological case.
Result: The Language Age controls performed better on the comprehension of object relative clauses with case manipulation than on those with number, unlike the children with Specific Language Impairment, who performed at the same level on the comprehension of relative clauses with number and case manipulation.
Conclusion: The children with Specific Language Impairment did not make efficient use of the morphological case cues in object relative clause interpretation. We argue that deficient use of case cues in object relative clause interpretation is due to difficulties in rapid interpretation of case information in these demanding structures.

Keywords: Specific Language Impairment (SLI), morphology, syntax

Introduction
Recent studies on children with Specific Language Impairment (SLI) reveal that the acquisition of relative clauses is particularly vulnerable for these children. A number of cross-linguistic studies have intensively investigated the production and comprehension of relative clauses in SLI (Adani, Forgiarini, Guasti, & van der Lely 2013; Bence & Lukacs, 2008; Delage, Monjauze, Hamann, & Tuller, 2008; Friedmann & Novogrodsky, 2007; Frizelle & Fletcher, 2013; Håkansson & Hansson, 2000; Riches, Loucas, Baird, Charman, & Simonoff, 2010; Spanoudis, Papadopoulou, & Natsopoulos, 2010; Stavrakaki, 2001a, b, 2002; Zachou, 2013, among others). The results of these cross-linguistic studies revealed a robust pattern of performance, with sentences containing embedded object relative clauses being more impaired than those containing embedded subject relative clauses.

While both subject and object relatives are complex syntactic structures, object relatives are more complex than subject relatives. In particular, object relatives require longer movement of a Noun Phrase (NP) which is moved (in both subject and object relatives) from its original position to the beginning of the clause. In semantically reversible object relatives, this movement puts the moved NP into non-canonical order, namely, Object Verb Subject (OVS). In the position of the moved NP, a trace/gap is left behind (Chomsky, 1981, 1995; Chomsky & Lasnik, 1993). The NP in the main clause modified by the relative clause is called ‘head NP’. Examples of a subject and object relative sentence are shown in (1a) and (1b) below, respectively, with the movement depicted by an arrow and the trace by an underscore. In these examples, the head NPs are underlined while the subscript j indicates co-reference between the trace/gap, the head NP and the relative pronoun ‘who’.

We adopted this depiction of relative clauses from Friedman’s work (Friedmann & Haddad-Hanna, 2014).
Different explanations have been put forth to account for the additional syntactic complexity of object relative clauses. Most of them centralise the role of non-canonical word order as well as the role of long ‘movement’ and ‘transfer’ properties from the object position to the head NP of the clause (Delage et al., 2008; Friedmann & Novogrodsky, 2007; Friedmann, Belletti, & Rizzi, 2009; Stavrakaki, 2001a, b, 2002; Thompson & Shapiro, 2007; Thompson, Shapiro, Kiran, & Sobecks, 2003).

Despite the large number of studies that have investigated the production and/or comprehension of relative clauses in SLI from a syntactic viewpoint and the diverse hypotheses developed to account for the findings, little has been known about the effect of other non-syntactic, but still linguistic, factors on the syntactic processing of relative clauses. Notably, in addition to the syntactic processes, namely the syntactic movement of the NP to the sentence initial position, required for the interpretation of relative clauses, morphological features, such as number marking for nouns and verbs as well as case marking for nouns, may also influence performance on relative clause interpretation. For example, in Italian, in which post-verbal subjects are allowed, number marking for nouns and verbs is essential in object relative clause interpretation, as shown in the example in (2) below. That is, the plural marking on leoni (lions) and inseguono (chasing) indicates that the lions are doing the chasing rather than the singular cavallo (horse).

2. Fammi vedere il cavallo che inseguono i leoni.
   Show me the horse that chase the lions.
   ‘Show me the horse, that the lions are chasing.’

Furthermore, in Greek, another language allowing post-verbal subjects, case marking is essential in object relative clause interpretation, as shown in the example in (3) below. Here, the post-verbal subject is marked for nominative case, clearly indicating that elefantas (elephant) is doing the pushing.†

3. Dixe mu tin agelada pu sprohni o elefantas.
   Show me the-ACC cow-ACC that is pushing
   the-NOM elephant-NOM.
   ‘Show me the cow, that the elephant is pushing.’

Notably, morphological case marking is also essential for the interpretation of simple structures (i.e. not derived by movement) in Greek, as subjects can appear in either pre-verbal or post-verbal position. Consider the examples (4a) and (4b) below.

(4a) O elefantas sproxni tin agelada
   The-NOM elephant-NOM is pushing the-ACC cow-ACC
   ‘The elephant is pushing the cow’

(4b) Sproxni o elefantas tin agelada
   Is pushing the-NOM elephant-NOM the-ACC cow-ACC
   ‘The elephant is pushing the cow’

Turning back to the SLI literature, we point out that the morphological features of number and case per se have received a lot of attention. Specifically, research findings concerning the acquisition of number marking for verbs indicate difficulties, especially for English speaking children (Leonard, 1998/2014). Despite these difficulties, the children with SLI are not completely unable to control number marking (Rice & Oetting, 1993). Cross-linguistic studies of children speaking languages with rich inflection have shown that number is not a clinical marker for SLI (Leonard, 1998/2014). As far as Greek is concerned, which is the language of interest in this study, while pre-schoolers with SLI show selective difficulties in acquiring verb inflection, school-age children with SLI show mastery of number marking on the verb (Stavrakaki, 2005, for a review; Stavrakaki, Chrysomallis, & Petraki, 2011). In this respect number marking cannot be taken as a feature being persistently impaired in these children.

With respect to case, most of the research findings from cross-linguistic studies indicate difficulties with case marking, especially by pre-school children with SLI (for English, Waxler, Shutze, & Rice, 1998; for Hungarian, Lukács, Kas, & Leonard, 2013; for Greek; Stavrakaki, 1996; Tsimpli, 2001) or incorrect case employment (overextension errors) (Eisenbeiss, Bartke, & Clahsen, 2005/6). In contrast, age-appropriate performance on case marking by school age Greek children with SLI in spontaneous speech was reported by Stavrakaki, (2001a, 2005). While all the above-mentioned studies focused on case in simple syntactic contexts produced mainly in spontaneous speech and narrative samples, production data from wh-question elicitation indicated that school age children with SLI, speaking Greek, showed difficulties with correct case assignment in complex syntactic structures, in particular wh-questions. More specifically, the difficulties concerned the nominative case marking of post-verbal subjects in object wh-questions (Stavrakaki, 2006; Zachou, 2013). To interpret these findings, Stavrakaki (2006) argued that the obligatory case checking operations may be optionally activated in complex syntactic structures, such as object wh-questions, in SLI grammar.

Unlike production, the effect of morphological features on the interpretation of complex structures...
by children with SLI has not been systematically studied until now. We suggest that studying the effect of morphological features, case and number in particular, on complex structure interpretation, such as relative clauses, can shed light on the interaction of different linguistic sub-domains, namely morphology and syntax, in relative clause interpretation in SLI. In this way, we tease apart the role of specific linguistic processes in the SLI deficit manifestation. By so doing, our study investigates the role that each linguistic domain, like morphology and syntax, plays in complex sentence interpretation in SLI.

Relative clauses in Greek

Relative clauses (RCs) in Greek are introduced either by the complementiser _pu_ (= that) or by the relative pronoun _o opios_ (= who-masculine-nominative-singular), marked for gender, case and number (Holton, Mackridge, & Philippaki-Warburton, 1997). In this study, we focus on relative clauses with _pu_, as _o opios_-relatives are not frequent in Greek (Varlokosta, 1998).

In Greek subject relatives, the head occupies the object position of the main verb and the gap is in the subject position (OS relatives). See the example in (5) below in which the head in Greek is underlined while the gap position is shown by an underscore.

The same holds for all the following examples.

5. Dixe mu _ti mainmu_ pu_, _pleni tin arkuda_
   Show me the-ACC monkey-ACC that is washing _the-ACC bear-ACC_
   ‘Show me the monkey, that is washing the bear’

Contrarily, in object relatives both the gap and the head are in object position (OO relatives). See the example in (6) below.

6. Dixe mu _ti mainmu_ pu_, _pleni i arkuda_
   Show me the-ACC monkey-ACC that is washing _the-NOM bear-NOM_
   ‘Show me the monkey, that the bear is washing’

In Greek, besides number marking, noun phrases (NPs) in masculine and feminine gender are marked for morphological case, as shown in the examples in (5) and (6) above. The verb in the embedded clause is also marked for number, namely singular in sentences in (5) and (6), as are the NPs, but the post-verbal NP is morphologically case marked for accusative case in (5), a subject RC, and for nominative case in (6), an object RC. Thus, in spite of the fact that in (5) and (6) the order is NVN, we can disambiguate toward a subject or an object RC through morphological case.

In contrast, NPs in neuter gender do not show overt morphological case distinction, hence they are ambiguous between nominative and accusative case, as in Greek post-verbal subjects are allowed, unlike English. Therefore, relatives with NPs in neuter gender can be either interpreted as subject or object relatives. See the example in (7) below.

7. Dixe mu _to alogo_ pu_, _kiniga to liontari_
   Show me the horse-NEUTER that is-chasing _the-lion-NEUTER_
   ‘Show me the horse, that is chasing the lion’
   ‘Show me the horse, that the lion is chasing’

In the absence of case marking, singular or plural number agreement on the verb in addition to singular or plural marking on the noun (e.g. 8a, 8b) can successfully distinguish between a subject and an object RC, as shown in the examples below.

(8a) Dixe mu _to alogo_ pu_, _kiniga ta liontaria_
   Show me the horse-NEUTER-SING that is-chasing the lions-NEUTER-PL
   ‘Show me the horse, that is chasing the lions’

(8b) Dixe mu _to alogo_ pu_, _kinigun ta liontaria_
   Show me the horse-NEUTER-SING that are-chasing the lions-NEUTER-PL
   ‘Show me the horse, that the lions are chasing’

Whether a language expresses the morphological features of case and number varies cross-linguistically. For instance, the morphological feature of number is expressed both in English and Greek, although the two languages differ in inflectional richness. In contrast, the morphological feature of case is available in Greek, but not in English. The next question is, thus, whether the cross-linguistic variation in morphological feature marking in relative clauses has significant acquisition effects for both typically-developing children and children with SLI.

The interaction between morphology and syntax in (a) typical relative clause acquisition

Cross-linguistic differences in the acquisition of relative clauses were recently investigated by Guasti, Stavrakaki, and Arosio (2008, 2012). These researchers observed an acquisition discrepancy between Italian and Greek. Specifically, 6-year-old Italian children show a low level of performance on object relative clauses with post-verbal subjects (Adani, 2011; Arosio, Adani, & Guasti, 2009; Ciccarelli, 1998; Guasti, 2007), while the Greek children perform high or even near ceiling at the ages of 4 and 5 (Stathopoulou, 2009; Stavrakaki, 2001a, b; Varlokosta, 1997; Varlokosta, Neranzini, & Papadopoulou, 2015).

Furthermore, Guasti and collaborators compared directly the performance of 5-year-old monolingual Greek-speaking and Italian-speaking children on the comprehension of (i) subject and object relatives in Greek in which NPs were marked for the overt morphological feature as well as relatives in which NPs were not marked for morphological case (and
appeared in neuter gender) and number was manipulated on NPs and verbs and (ii) subject and object relatives in Italian with number manipulation only as morphological case marking is not available in this language. The results indicated that Greek and Italian children exhibited similar performance in the non-case marked condition. In addition, Greek-speaking children comprehended better those object relative clauses in which NPs were overtly marked for morphological case than those that were not. The researchers attributed the increased accuracy scores for object relative clauses by Greek speaking children compared to their Italian chronological age peers to the overt morphological case marking of the post-verbal subject in Greek. Specifically, they assumed, following Fodor and Inoue (2000), that all children (Greek and Italian) initially hypothesise a subject relative analysis for object relatives and perform a re-analysis when they receive information at the disambiguating point on how to repair their analysis. Guasti et al. (2008, 2012) argued that disambiguation by case (and not number) offers clear information on how to ‘repair’ the structure, which was originally analysed as a subject relative. The repairing mode exploits overt morphological case marking for mapping between arguments and surface syntactic positions.

Recent cross-linguistic studies on German and Italian children offered further support for the hypothesis that the morphological feature of case can significantly impact on the syntactic comprehension of relative clauses (Arosio, Yatsushiro, Forgiarini, & Guasti, 2012). Specifically, object relative clauses disambiguated by case elicited higher performance than object relative clauses disambiguated through number agreement on NPs and verb (and neuter case on NPs).

In addition to these cross-linguistic studies, a recent study on English SLI by Adani et al. (2013) tested the effect of morphological features on SLI comprehension of relative clauses and found that both typically-developing and SLI participants showed greater accuracy for object relative sentences with dissimilar number features (i.e. one singular, one plural) on the head noun and the embedded Determiner Phrase. Further evidence for the role of morphological cues in syntactic comprehension in individuals with SLI has been offered by a study with Greek speaking individuals (Stavrakaki, 2001a, b), which nevertheless has not been designed to test the effect of morphological features on syntactic comprehension. In particular, Stavrakaki studied relative clauses with clitics and showed that children with SLI reached the same level of performance on OO relative clauses (with object clitics) including NPs without morphological case (in neuter gender) and on OO relative clauses (without object clitics) including NPs with morphological case. Thus, she observed that neither the presence of object clitics nor of the morphological case cue in OO relatives contributed to any significant improvement in SLI performance. However, these results do not clearly show the effect of case on the syntactic interpretation of object relative clauses, as an additional variable, namely ‘presence of an object clitic’ was included in RCs with NPs without overt morphological case. Notably, the role of clitic is highly ambiguous as it is not clear whether its presence can either impede or facilitate the syntactic comprehension (Stavrakaki, 2005, for a review of the literature; Stavrakaki & van der Lely, 2010; Varlokosta, 2002).

Concluding, a few recent studies have raised the question of inter-relation between different linguistic sub-components in complex sentence comprehension. Some of them indicate a significant facilitatory effect of morphological features (case or dissimilar number marking) on the comprehension of relative clauses by typically-developing children or children with SLI. The effect of morphological features and especially case marking on complex sentence comprehension deserves further exploration, especially in languages which allow overt morphological marking (such as Greek) in children with a developmental language disorder. Such an investigation can contribute to the better understanding of how different linguistic sub-levels (syntax vs morphology) interact in complex sentence interpretation by individuals with language impairment. To this purpose, we designed the present study.

The present study

The present study exploits the morphological properties of Greek and systematically investigates the effect of a number marking and morphological case marking on the comprehension of subject and object relative clauses by children with SLI. With respect to the number marking relative to case marking, we do not expect any facilitatory effect in children with SLI. Current research indicated no facilitatory effect of number marking for Greek typically-developing children on object relatives (Guasti et al., 2008, 2012) and, therefore, we do not anticipate a facilitatory effect for children with SLI. However, based on previous findings showing significant difficulties of children with SLI in object relative clauses, we expect lower performance for these children on relatives with number marking compared to typically-developing children. Unlike number marking, morphological case marking proved a crucial factor for the improvement of performance of typically-developing children on the comprehension of object relative clauses (Guasti et al., 2008, 2012). We, thus, suggest two possible outcomes for children with SLI. First, overt morphological case marking will have a significant facilitatory effect on the comprehension of relative clauses by children with SLI. If this is the case, it is highly plausible that children with SLI suffer from a syntactic and not a morphological deficit that can be alleviated by the use of
overt morphological case. Alternatively, overt morphological case marking will not have any significant facilitatory effect on the comprehension of relative clauses by the children with SLI. If this is the case, then there are two possible interpretations. Children with SLI may suffer from a broad morphosyntactic deficit that prevents them from exploiting overt morphological case information both in simple and complex sentence interpretation. This would result in comprehension difficulties appearing indiscriminately for sentences with different syntactic complexity. Otherwise, the children with SLI may not necessarily suffer from a morphological deficit concerning overt case marking, but simply be unable to rapidly integrate the morphological information while processing a complex syntactic structure. This would result in comprehension difficulties selectively appearing in structures with increased syntactic complexity, such as object relative clauses.

Method

Participants

Eighteen Greek speaking children with SLI (seven females) aged 5;6–8;1 participated in the study. Information on the participants with SLI is provided in Table I.

The children with SLI were recruited from centres for language-impaired children in two cities of Northern Greece (Thessaloniki and Larissa) and were receiving speech and language therapy services at the time of testing. All of them fulfilled the standard criteria for SLI (non-verbal IQ > 85, as measured by WISC-III for the school-age children; all children were at school-age, except one, whose non-verbal IQ, as measured by the means of the Raven’s Coloured Progressive Matrices (Raven, 1947, 1981), indicated performance within the pre-school range (score 13; percentiles 25–50). Their verbal abilities were assessed on the basis of the production of morphosyntax and the sentence repetition sub-part of the Diagnostic Verbal IQ Test for preschool children (DVIQ, Stavrakaki & Tsimpli, 2000). The production of morphosyntax sub-part assesses various linguistic abilities, including correct marking of the plural number for NPs and past tense for verbs, the production of sub-ordinate clauses, as well as the production of pronouns and an adjective (marked for the correct case, gender and number). The sentence repetition sub-part assesses the ability of accurate repetition of simple and complex sentences. The SLI children’s raw scores indicated performance within the pre-school age range of typically-developing children. Specifically, each child with SLI was matched to two typically-developing children on the basis of her/his language age (LA); hence there were 36 participants aged 4;6–6;5 (Mean CA = 5;4; SD = 0.62) who constitute the language age (LA) control group for the SLI group. All typically-developing children were recruited from kindergarten schools in Thessaloniki and Larissa.

Experimental conditions

Our experiment includes two conditions. In the first one (number manipulation), we tested the comprehension of Object-Subject (OS-NUMBER) and Object-Object (OO-NUMBER) relatives with number disambiguation on the verb and noun, but without overt case marking on NPs. These were neuter gender nouns for which nominative and accusative case are morphologically identical and, thus, of no help in setting apart subject from object RCs.

In the second one (case manipulation), we tested comprehension of Object-Subject (OS-CASE) and Object-Object (OO-CASE) relatives with overt case marking on NPs (and no number difference between the two NPs). Specifically, NPs displayed unambiguous nominative or accusative case and, thus, an object relative was signalled by the presence of an embedded post-verbal subject marked with overt nominative case.

Materials

For each condition (number manipulation and case manipulation), we constructed six pairs of two types of clauses (subject relatives and object relatives) each introduced by the lead-in ‘Show me’. Each pair, associated to one picture, included a subject-extracted relative clause and an object-extracted relative clause, with the embedded subject in the post-verbal position. Examples for the first condition are in (9) and (10) and for the second in (11) and (12). In these examples, the head in Greek is underlined and the gap position is shown by an underscore.

The complete set of experimental sentences is presented in Appendix B available online at http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1048826, while a picture sample is shown in Appendix C available online at http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1048826.

First condition: Number manipulation

9. To alogo, pu_ j kiniga ta liontaria
   The horse-NEUTER-SING that is chasing
   the lions-NEUTER-PL

‘The horse, that _, is chasing the lions’
10. To alogo, pu *kinigun* ta lontaria
   The horse-NEUTER-SING that are chasing the lions-NEUTER-PL
   ‘The horse that the lions are chasing’

Second condition: Case manipulation

11. Ti *mamímu*, pu *pleni* tin arkuda
   The-monkey-FEMININE-ACC that is washing the-bear-FEMININE-ACC
   ‘The monkey that is washing the bear’

12. Ti *mamímu*, pu *pleni* i arkuda
   The-monkey-FEMININE-ACC that is washing the-bear-FEMININE-NOM
   ‘The monkey that the bear is washing’

Procedure

Children heard 12 experimental sentences per each of the two conditions; that is, a total of 24 experimental sentences (6 pairs × 2 types of sentences), 12 subject and 12 object RCs and, thus, they saw 12 pictures in total. In addition to the experimental sentences and pictures, there were 15 fillers per each condition (sentences and pictures) presented in a pseudo-randomised order: Five of these sentences were subject RCs with intransitive verbs (*Show me the little bird that is flying*), five were subject and five were object questions (*Which chicken is chasing the turtles*? or *Which monkey are the children hitting*?). The materials were tested in two sessions (the average time between session was 11 days; range 7–16). We did not present the same picture, once associated with a subject RC and once with an object RC, on the same day.

Each participant was tested individually by trained experimenters and the second author of this paper. Prior to running the experimental task, we tested participants on a verb comprehension task aiming at ensuring that participants understood the verbs of the main experiment. The experimental task started with a training session aiming at familiarising participants with the comprehension of RCs. For the main experiment we used an agent selection task (see Adani, 2008, for details; see also De Vincenzi, 1991) employed also by Guasti et al. (2008, 2012). In this task, participants were presented with pictures including three characters on one sheet of paper; each character was first named; then a sentence including an RC was uttered and the participant had to point to the one character, involved in an action, either as an agent or as a patient, matching the heard relative clause. Consider Appendix C available online at http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1048826 for a picture sample. In this picture, there is one elephant on the right and one on the left and one camel in between them. The child was asked to point to the character described by one of the relevant sentences (*Show me the elephant that is chasing the camel* or *Show me the elephant that the camel is chasing*) in Appendix B available online at http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1048826. The correct answer involved pointing either to the character on the right or to the one on the left, depending on whether the sentence heard is an object or a subject relative. Calculation of accuracy scores included the correct responses, i.e. those responses matching the sentence heard.

Result

Table II shows the percentages of correct responses of SLI and control participants. The first two columns report the correct responses for *subject* and *object* relative clauses, collapsing together the two manipulations (case and number). The last two columns display the correct responses as a function of manipulation (number or case). In this case, we collapsed together subject and object relative clauses.

More detailed analysis is presented in Table III, in which the accuracy scores for each relative clause type are shown.

We performed statistical analysis on the data presented in Table II. In particular, we performed a three-way ANOVA with Group (SLI group vs LA controls), Relative Type (Subject vs Object) and Manipulation (Case vs Number) as variables. In addition, we performed planned comparisons with

| Participants | Subject relatives Mean (SD) | Object relatives Mean (SD) | Manipulation by NUMBER Mean (SD) | Manipulation by CASE Mean (SD) |
|--------------|-----------------------------|-----------------------------|---------------------------------|-------------------------------|
| SLI group    | OS-NUMBER: 80.55 (13.09) + OS-CASE: 78.24 (18.61) | OS-NUMBER: 43.05 (8.69) + OO-CASE: 60.88 (18.77) | OS-NUMBER: 61.11 (11.43) + OO-CASE: 65.51 (15.83) | OS-CASE: 62.50 (12.86) + OO-CASE: 73.61 (21.03) |
| LA controls  | OS-NUMBER: 78.24 (18.61) + OS-CASE: 78.24 (18.61) | OS-NUMBER: 60.88 (18.77) + OO-CASE: 60.88 (18.77) | OS-NUMBER: 65.51 (15.83) + OO-CASE: 65.51 (15.83) | OS-CASE: 73.61 (21.03) + OO-CASE: 73.61 (21.03) |

*OS-NUMBER: Object–Subject relatives with number manipulation.
   OS-CASE: Object–Subject relatives with case manipulation.
   OO-NUMBER: Object–Object relatives with number manipulation.
   OO-CASE: Object–Object relatives with case manipulation.
Comprehension of relative clauses by Greek children with SLI

Table III. Accuracy scores (%) for each relative clause type.

|            | OS-NUMBER | OS-CASE | OO-NUMBER | OO-CASE |
|------------|-----------|---------|-----------|---------|
| SLI group  | 81.48 (13.87) | 79.63 (14.64) | 40.74 (13.06) | 45.37 (15.97) |
| LA controls| 76.85 (20.42) | 79.63 (23.94) | 54.19 (24.68) | 67.59 (20.29) |

Table III reveals significant within-group differences for OO-CASE relatives and OO-NUMBER relatives for LA controls (Wilcoxon test, \( p = 0.004 \)), but not for SLI participants (Wilcoxon test, \( p = 0.403 \)). In contrast, no significant within-group differences were found for both groups between OS-CASE relatives and OS-NUMBER relatives (for SLI: Wilcoxon test, \( p = 0.720 \); for LA controls: Wilcoxon test, \( p = 0.294 \)). These findings indicate that case selectively affects the comprehension of OO relatives by LA controls.

In addition, the interaction between Manipulation and Group (SLI group vs LA controls) was significant (\( F(1, 52) = 15.67, p < 0.001, \eta^2 = 0.23 \)), as case manipulation contributed only to the improvement in the performance of the LA control group. As pointed out above, performance in the case manipulation condition was significantly higher than the number manipulation condition only for LA controls (Wilcoxon test, \( p = 0.004 \)) and not for SLI participants. In addition, between-group analysis on the data of Table III revealed a significant effect of case from a different angle. In particular, between-group analysis indicated deficit for children with SLI in OO-CASE relatives (Mann-Whitney U-test, \( p < 0.001 \)), which was further confirmed by a large effect size (Cohen’s \( d = 1.22 \)). While a significant between-group difference was found for OO-NUMBER relatives as well (Mann-Whitney U-test, \( p = 0.019 \)) only a medium effect size (Cohen’s \( d = 0.68 \)) was revealed, just highlighting the difficulties that object relatives \( \textit{per se} \) pose for children with SLI.

In contrast, the interaction between Relative Type and Group was not significant (\( F(1, 52) = 1.53, p = 0.221 \)), reflecting the same performance pattern shown by both groups: better performance on subject than object relatives. Within-group analysis on the data presented in Table II confirmed this finding, as significantly better performance on subject than object relatives was found for both groups (Wilcoxon test, \( p < 0.001 \)). Furthermore, the interaction between Relative Type, Group and Manipulation just failed to be significant (\( F(1, 52) = 3.654, p = 0.061 \)), reflecting the highly selective group differences in one only condition; that is, OO-CASE relatives only.

Discussion

This study was set up to investigate the effect of morphological cues, in particular, number and case, on the comprehension of relative clauses by children with SLI and younger typically-developing children aged 4;6–6;5, matched to the SLI individuals on Language Age (LA). The results revealed that the participants with SLI followed the typical pattern of development as they performed better on subject than on object relative clauses. However, they were dissimilar to typically-developing children in that the difference between the subject and object relatives was greater for participants with SLI than for participants with typical development. In addition,
the participants with SLI, as a group, performed lower than younger typically-developing children (aged 4;6–6;5) in interpreting object relatives disambiguated by number. This performance pattern underlines the difficulties that children with SLI have with object relatives. However, the individual analysis showed that just one child with SLI performed 1.5 SD below typical mean and, thus, did not support pathological performance for the majority of children. The medium effect size for the between-group difference in this condition confirms that the participants with SLI are not severely impaired compared to their LA controls, despite the group difference.

As far as the OO-CASE relative clauses are concerned, the group data indicated that the case manipulation impacted only on the comprehension of OO-CASE relative clauses by typically-developing participants, but not by children with SLI. Notably, only the former and not the latter showed a significant performance improvement in this condition. In addition, between-group analysis indicated a large effect size for the significant difference in this condition. Individual analysis revealed significant deficits for seven out of 18 children with SLI in the comprehension of OO-CASE relatives in comparison to younger typically-developing children. Notably, pathological performance on OO-case relatives (1.5 SD below typical Mean) was not exhibited by all children with SLI, reflecting the heterogeneity of this clinical group and their diverse perspectives for language development. However, we would like to stress the fact that the performed comparison was between individuals with SLI and younger typically-developing children. In this respect, any performance below LA expectations, in our view, indicates a significant disability for individuals with SLI. It, therefore, seems that the condition OO-CASE relatives reliably discriminated the SLI group from younger typically-developing children. In this respect our data suggest that at least some of the participants with SLI (almost half in our case), in contrast to typically-developing participants and the rest of the children with SLI, had difficulties with exploiting a morphological feature, namely the feature of case, while performing a syntactic analysis of a particularly demanding structure like object relatives. As pointed out above (see The present study section), this outcome can be interpreted in two different ways. On one view, these children with SLI that performed below their LA counterparts, in addition to their syntactic difficulties with complex structures, suffer from a deficit in case marking and/or interpretation. Indeed, deficits with case marking are widely reported in the SLI literature (Leonard, 1998/2014, for a review). As reported earlier, as far as the Greek children are concerned, deficits with morphological case marking are mainly evident in pre-school children with SLI, while school-age children with SLI do not have problems with case marking in simple sentences (Stavrakaki, 2001a). In addition, independent evidence from SLI studies on Greek indicate comprehension abilities at the level of language matched controls for dislocated structures, e.g. focus constructions, in which NPs were case marked (Stavrakaki, 2001a, 2002, 2005, for a review of the literature). Collectively, these research findings from Greek SLI indicate that morphological case per se cannot impede SLI performance.

As far as the participants of the present study are concerned, their pre-experimental assessment by means of the DVIQ test showed that they performed at ceiling on the correct case assignment to pronouns and an adjective. In addition, they comprehended subject relatives with overt case marking as much as LA controls. However, their performance on subject relatives may not necessarily indicate abilities in decoding case morphemes, as these structures can be easily interpreted via word order cues only (SVO word order). Notably, as far as the SLI performance on OO-CASE relatives is concerned, we would like to stress on the fact that they were able to interpret correctly these sentences in ~45%. This percentage means that the children with SLI were occasionally able to employ case cues to some extent. In our view, this pattern of performance highly suggests that the feature of case is not missing from SLI grammar. It rather indicates that the feature of case is not constantly exploited by SLI individuals. Consequently, we suggest that an interpretation postulating a deficit in the feature of case per se is highly implausible.

Therefore, our claim is that at least some children with SLI are poor at integrating the morphological case information while processing complex syntactic structures, like object relative clauses. Specifically, we assume that in object relative clauses case marking is a strong morphological cue, which imposes re-analysis of an initially hypothesised subject relative by typically-developing children, as suggested by Guasti et al. (2008, 2012).

If this hypothesis is on the right track, the question is why the morphological case helps typically-developing children, but not all children with SLI, despite their successful performance on the production of morphological case. Guasti et al. (2008, 2012) suggested that re-analysis involves checking and re-assignment of the grammatical function of subject to the appropriate thematic role within the sentence. A possible deficit in checking operations (Stavrakaki, 2006) or in theta-role assignment (Friedmann & Novogrodsky, 2007) at the level of complex syntax in SLI cannot be excluded. However, these operations per se are not impaired, otherwise the children with SLI would not be able to produce or comprehend a simple sentence.

It is, thus, highly plausible that some children with SLI fail to perform case checking operations in object relatives or correct theta-role re-assignment under certain circumstances; for example, when syntactic re-analysis of a sentence is required. Assuming that these operations are taking place in real time, we suggest
that the children with SLI show an apparent limitation in fast syntactic re-analysis. In other words, re-analysis is a costly operation as it requires rapid integration of the new information provided by the case feature of the post-verbal subject. Apparently, the children with SLI show deficits in integrating rapidly the case information and providing a structural re-analysis.

As expected, due to the heterogeneous manifestation of language disorders in SLI individuals, some children with SLI are more deficient than others in rapid integration of case information into sentence re-analysis. As far as the sample of our study is concerned, impairment was only observed for less than half of the children.

Concluding, the present study indicates that, in contrast to younger typically-developing children matched to SLI individuals on language age, some participants with SLI show selective deficits in exploiting overt morphological case marking in object relative comprehension. We interpret this deficit in terms of difficulties with rapid integration of case information required for re-analysis of object relatives. We point out that this hypothesis warrants further investigation. We suggest that further on-line experiments should be performed with the same experimental materials on the typically-developing population and individuals with SLI to investigate the effect of case marking on relative clause processing. It is predicted that typically-developing participants will be faster in processing OO-CASE relatives than OO-NUMBER relatives, as they exploit the case cue in RC processing. In contrast, no time difference is expected for (at least) some individuals with SLI between OO-CASE relatives and OO-NUMBER relatives due to their deficient integration of overt morphological case information in RC processing. Future research in the field may provide empirical testing of the above predictions and, thus, further clarification of the effect of morphological features on RC processing.

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Supplementary material available online

Supplementary Appendix A to E available online at [http://informahealthcare.com/do](http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1048826).