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Research Report

Subject–verb agreement and phonological processing in developmental dyslexia and specific language impairment (SLI): a closer look

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Abstract

Background: Problems with subject–verb agreement and phonological (processing) skills have been reported to occur in children with specific language impairment (SLI) and in those with developmental dyslexia, but only a few studies have compared such problems in these two groups. Previous studies have claimed a causal relationship between phonological processing deficits and morphosyntactic problems.
Aims: The following questions were addressed in this study: (1) Are children with developmental dyslexia and SLI comparable in the level of sensitivity to subject–verb agreement, phonological awareness, and non-word repetition? (2) Are children with developmental dyslexia and SLI comparable in their performance profiles on tasks tapping subject–verb agreement, phonological awareness, and non-word repetition? (3) Are deficits in phonological processing skills related to morphosyntactic deficits?
Methods & Procedures: Forty-five children (mean age=8;6 years) with developmental dyslexia, SLI and typically developing children participated. The sensitivity to subject–verb agreement, phonological awareness, and non-word repetition was measured.
Outcomes & Results: Both the children with dyslexia and with SLI made more errors than the control children on the subject–verb agreement task, with the children with dyslexia scoring significantly better than the children with SLI. Similarly, the children with SLI and dyslexia both performed more poorly on the phoneme-deletion task than the control group. Both clinical groups performed

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more poorly on the non-word repetition task than the control children, with the children with dyslexia outperforming the children with SLI. In all three tasks differences in performance profiles were found between the children with developmental dyslexia and SLI. Across all three groups non-word repetition was correlated with morphosyntactic sensitivity.

Conclusions: The results show similarities between the performances of children with SLI and dyslexia on tasks tapping subject–verb agreement, phonological awareness, and non-word repetition: they scored more poorly than typically developing children. Qualitative analyses revealed, however, differences in the error patterns on all three tasks. Associations between non-word repetition and sensitivity to subject–verb agreement were found, suggesting that problems with phonological processing impact on morphosyntactic skills.

Keywords: specific language impairment (SLI), developmental dyslexia, phonological processing, grammatical impairment.

What this paper adds

What is already known on the subject?

Children with developmental dyslexia and specific language impairment (SLI) experience language problems. This study directly compares performances on tasks tapping morphosyntactic and phonological (processing) skills to gain insight in the relation between the two syndromes and to find a common source that accounts for the problems with morphosyntactic skills.

What this study adds?

Children with developmental dyslexia and SLI have more problems with tasks tapping morphosyntactic and phonological processing skills than typically developing children. However, the patterns of errors differ between the two groups, which may be the result of differences in phonological working memory.

Introduction

Specific language impairment (SLI) and developmental dyslexia are both syndromes in which language development is compromised. Typically, children with SLI experience particular problems with morphosyntactic information, such as tense and subject–verb agreement marking (Leonard 1998, Wexler *et al.* 1998, Norbury *et al.* 2001). Another marker of SLI is severe difficulty with repeating non-words (in particular longer non-words) and sentence recall, indicating a deficit in phonological working memory skills (Gathercole and Baddeley 1990, Bishop *et al.* 1996, Botting and Conti-Ramsden 2001). Children with SLI have also been found to have problems with phonological awareness: the ability to segment a word into its phonemes (Bird *et al.* 1995, Goulandris *et al.* 2000, Raitano *et al.* 2004). Furthermore, around 50% of the population with SLI experiences profound word-decoding deficits (McArthur *et al.* 2000).

Developmental dyslexia is also strongly associated with poor phonological (processing) skills. It has become clear that children with developmental dyslexia have profound difficulty with tasks tapping phonological awareness, indicating that dyslexia is related to the phonological component of language (for reviews, see Castles and Coltheart 2004, and Vellutino *et al.* 2004). In addition, many studies have demonstrated verbal memory difficulties in developmental dyslexia resulting in poor non-word repetition or sentence recall (Jorm 1983, Rack 1994). Recent studies, however, also report weaknesses in oral language domains outside that of phonology. Problems with tense marking have been found in spoken language (Joanisse *et al.* 2000), as well as a decreased sensitivity to subject–verb agreement (Rispens *et al.* 2004). Apparently, the language problems of children with SLI and developmental dyslexia show a strong resemblance: the same type of problems are observed in the two clinically distinct groups. The current study has been undertaken to compare directly oral language skills in children with developmental dyslexia and SLI, with a particular focus on morphosyntactic and phonological processing.

Direct comparisons of linguistic performance between children with dyslexia and SLI on the same tasks have not been undertaken often. Carroll and Snowling (2004) compared children with speech difficulties with children with a familial history of dyslexia and found that the groups displayed similar patterns of impairment with respect to speech processing, phonological learning, and awareness. Van Alphen *et al.* (2004) carried out a study including children at familial risk for dyslexia, SLI and age-matched controls (age ranging from 36 to 42 months) investigating grammatical morphology, speech perception, phonological processing, and phonological awareness. The children at risk for dyslexia generally scored half way between the control and the SLI groups, leading the authors to conclude that children at risk for dyslexia resemble children with SLI, but that they are less severely affected. These data provide important information about the relationship between developmental dyslexia and SLI. However, as the authors note, no analysis of the data was made informing about the pattern of performance of the two clinical groups. It may be the case that even though the net results on the tasks of the children at risk for dyslexia and SLI differ from the controls, that the nature of the errors is substantially different between the two clinical groups.

The current study investigates whether and how children with developmental dyslexia and SLI differ in their sensitivity to subject–verb agreement in spoken language, and in their performance on phonological tasks measuring phonological awareness and verbal working memory. These language areas have been chosen as they have been repeatedly shown to be vulnerable in both dyslexia and SLI.

In addition to comparing performances between the three groups, the paper will also investigate whether the performances on the different tasks are associated with each other. Limitations in processing capacity have been suggested to interfere with oral language abilities, including the development of the morphosyntactic system (Leonard 1998, Montgomery 1995, 2000, Norbury *et al.* 2001, 2002, Hayiou-Thomas *et al.* 2004). Montgomery (1995, 2000) showed in a number of experiments that off-line sentence comprehension in SLI is related to working memory. Montgomery suggests that the limitations in processing capacity interfere with storing information while listening to sentences that hinder constructing a full interpretation of a sentence. Other studies examined the relation between phonological working memory and morphosyntactic skills. For instance, Norbury *et al.* (2001) found in their study with SLI and typically developing children a relation between phonological working memory and the ability to mark verbs for tense, which led the authors to conclude that processing capacity limitations play an important causal role in morphosyntactic deficits. The current study will investigate whether a relation exists between phonological working memory and subject–verb agreement in the sample of children.

Methods

Subjects

Three groups of age-matched children were formed: 17 children with developmental dyslexia (mean age 103 months; ten boys, seven girls), 11 children with SLI (mean age 101 months; eight boys, three girls), and 17 typically developing children (mean age 104 months, nine boys, eight girls). The children with developmental dyslexia were either diagnosed with dyslexia by an educational psychologist or were in the middle of the formal diagnostic procedure, and were selected for this study on the basis of a discrepancy between IQ and reading level. Three subtests of the Dutch WISC-R were used to estimate verbal and non-verbal IQ: 'similarities', in which children are asked why concepts are related to each other; 'vocabulary', a measure of expressive vocabulary; and 'figures', a timed test in which children are presented with pieces of a jigsaw puzzle that they were asked to construct. The scores on the WISC-R subtests are scaled with a mean score of 10 and a standard deviation (SD) of 3. A scale score of 7 is a statistical cut-off point below which one speaks of poor performance. All children demonstrated at least average performance on these tasks (similarities: mean 13.07, range 9–19; figures: mean 11.36, range 8–15; and vocabulary mean 10.92, range 9–14).

Two standardized tests were administered to measure reading level to ascertain the status of developmental dyslexia: the Real Word Test (RWT; Brus and Voeten 1973); testing word recognition, in which children were asked to read aloud a list of words as accurately but also as fast as possible in a 1-min time limit; and the Pseudo Word Test (PWT; Van den Bos *et al.* 1994), testing word decoding, in which pseudo-words were presented and children were asked to read these aloud as accurately and as fast as possible in a 2-min time frame. The RWT and the PWT are scaled in the same way as the WISC-R, and all children scored below 7 indicating poor performance (Table 1). To make sure that none of the children with developmental dyslexia could also be classified as SLI, criteria for inclusion were no history of referral to a speech and language therapist, no enrolment in a speech and/or language training programme and at least an average score on the vocabulary task of the WISC-R.

Table 1. Age and scores on the non-verbal ability task 'incomplete drawings' and reading tasks (scale scores) and the standard deviations (SD) of the three groups

Variable	Specific language impairment (SLI) (SD)	Dyslexia (SD)	Control (SD)
Age (months)	101 (3.8)	104 (7.7)	104 (5.9)
Incomplete drawings	10.9 (1.7)	11.9 (2.7)	12.1 (2.35)
Pseudo-word decoding (PWT)	7.4 (3.7)	3.9 (1.3)	12.0 (2.8)
Real word recognition (RWT)	6.1 (2.8)	3.0 (1.5)	12.0 (2.8)

The children with SLI were selected by their speech and language therapists and attended special schools for children with speech and language impairments. They were diagnosed based on formal Dutch standardized language tests, assessing expressive and receptive oral language skills, morphosyntactic skills and vocabulary. All children scored at least 1.5 SD below the norm in at least two of these areas. They had normal non-verbal IQs as measured by Dutch standardized IQ tests (WISC-R and RAKIT). Their reading skills were assessed with the RWT and the PWT. Six of the 11 children scored lower than 7, indicating subnormal performance on word decoding and recognition (Table 1).

The control group contained children with at least average reading skills as assessed by the RWT and the PWT. Only children who demonstrated normal progress in school were included. None of the control children had a history of speech and language problems, nor a referral to a speech and language therapist, nor a history of reading and writing problems. Table 1 presents an overview of the details of the participants.

In addition to age the participants of the three groups were matched on a measure of non-verbal ability (the subtest 'incomplete drawings'[1] of the WISC-R): non-verbal ability: $F(2, 44)=0.79$, $p=0.46$; age: $F(2, 44)=1.13$, $p=0.33$ (Table 1). The children with dyslexia and controls were furthermore roughly matched on socio-economic status and educational experience: the control children were from the same classrooms as the children with dyslexia. The children with SLI went to specialized schools in the same areas as the typically developing children and the children with dyslexia.

Materials

Subject–verb agreement

The grammaticality judgement task included 60 grammatical and ungrammatical sentences which were matched on length and grammatical structure. A control condition was added to see whether children were able to make meta-linguistic judgements, independent of morphosyntactic sensitivity. To this end, ten phrase-structure violations were included in which a noun was omitted from the prepositional phrase (PP). For the subject–verb agreement condition, three types of ungrammatical variations on the Dutch inflectional paradigm were constructed:

- First person singular inflection instead of third person, e.g.: *<u>de leuke clown maak</u> een grapje* (ten items) versus *<u>de leuke clown maakt</u> een grapje* (ten items) (*the funny clown make a joke versus the funny clown makes a joke).
- Plural inflection instead of third person singular, e.g.: *<u>de leuke clown maken</u> een grapje* (ten items) versus *<u>de leuke clown maakt</u> een grapje* (*the funny clown make a joke versus the funny clown makes a joke).
- Third person singular inflection instead of plural inflection, e.g.: *<u>de leuke clowns maakt</u> een grapje* (ten items) versus *<u>de leuke clowns maken</u> een grapje* (ten items) (*the funny clowns makes a joke versus the funny clowns make a joke).

The control condition included sentences with a noun missing from a PP, e.g. **de jongen heeft <u>in de gespeeld</u>* (ten items) (*the boy has in the played).

Across the trials, correct and incorrect sentences were pseudo-randomized and divided over two blocks. The order in which the blocks were presented was varied.

The test sentences were pre-recorded by a female native speaker of Dutch and were stored on a laptop computer. They were played back to the children via headphones. The child was instructed to press one of two keys of the laptop computer when s/he realized the sentence was good or bad. A sticker with a frowning face on one of the keys indicated an incorrect sentence, a sticker with a smiling face a correct sentence.

Responses were classified as correct or incorrect. In addition, A' values were computed for the subject–verb agreement condition which adjust the judgement scores for a possible bias of subjects to accept sentences rather than to reject them. The A' values can be interpreted as scores on a two-alternative forced choice task: 'which of these two sentences is grammatical?' For example, an A' value of 0.8 can be interpreted as a score of 80% correct when the child was asked to select one of two sentences on its grammaticality. The formula as described in Linebarger *et al.* (1983) was used to calculate these scores:

$$A' = 0.5 + (y - x)(1 + y - x)/4y(1 - x),$$

where y is the correct judgements of grammatical sentences ('hits'); and x is the incorrect judgements of ungrammatical sentences ('false alarms').

Phonological tasks

Phonological awareness. A phoneme deletion task was developed to assess phonological awareness. Thirty words were presented to the child who was asked to repeat the word without a specified sound (e.g. can you say '*vlo*' (flea) without the /v/?). The sound that had to be omitted was either the first phoneme of a consonant cluster (ten items) in the onset position, C_1 (e.g. '**s**tem'), the second phoneme (ten items) of a consonant cluster in the onset position, C_2 (e.g 'b**l**oes') or the last phoneme of a consonant cluster in the coda position, C_{final} (ten items; e.g. 'har**k**'). The score was the number of words repeated back correctly; the maximum score was 30.

Non-word repetition. The task reported in Van Alphen *et al.* (2004) was used. This task contains 16 non-words that consist of two to five syllables in length: each syllable length is tested with four items and the task starts with three practise items. The syllables in the non-words and the non-words as a whole are not Dutch lexical items, but they conform to the Dutch phonotactic rule system. The items were spoken aloud by a female native speaker of Dutch and were recorded on a computer. The non-words were played back to the subject on a laptop computer via headphones. Repeated presentations of the items were not allowed. The responses of the subjects were recorded on audiotape and were transcribed after the testing session. The score was the number of items repeated back correctly. In addition, the mean number of phonemes repeated back correctly for each syllable type (two to five syllable words) was counted.

Procedure

The tasks were administered individually in a quiet room at school, or in a room at the dyslexia research centre at the university. They were spread over two sessions that lasted around 30–45 min each.

Table 2. Scores and standard deviations (SD) on the experimental tasks

Variable	Specific language impairment (SLI) (SD)	Dyslexia (SD)	Control (SD)
Subject–verb agreement type 1[a]	0.59 (0.15)	0.89 (0.08)	0.96 (0.04)
Subject–verb agreement type 2[a]	0.53 (0.28)	0.92 (0.04)	0.97 (0.03)
Subject–verb agreement type 3[a]	0.55 (0.25)	0.88 (0.13)	0.95 (0.06)
Subject–verb agreement all[a]	0.56 (0.18)	0.90 (0.07)	0.96 (0.03)
Control condition	90% (11%)	97% (7%)	97% (7%)
Phonological awareness[b]	19.18 (8.61)	18.41 (7.04)	26.71 (13.24)
Non-word repetition raw score[c]	4.18 (1.25)	8.24 (2.08)	10.12 (1.99)

[a]Scores are represented in A' values.
[b]Maximum score is 30.
[c]Maximum score is 16.

Results

Table 2 presents an overview of the results.

Grammaticality judgement task

Table 2 shows the mean A' values of the three agreement conditions and the percentages correct on the control condition. All children were relatively successful on that last condition, indicating they were able to judge sentences on their grammaticality.

A repeated-measures analysis of variance (ANOVA) with group as the between-subject variable and the three subject–verb agreement conditions as the within-subject variables revealed a significant group effect ($F(2, 42)=57.3$, $p<0.001$), but no main effect of type of violation ($F(2, 84)<1$, $p>0.4$), nor an interaction between group and type of violation ($F(4,92)<1$, $p=0.4$). Therefore, a mean score of all three types of agreement violations was calculated (Table 2). Post-hoc tests (Games–Howell, as data were skewed with the control children performing at ceiling level, while the dyslexic and SLI groups were not) showed that the control children outperformed the children with dyslexia ($p<0.008$) and SLI ($p<0.001$), and that the children with dyslexia outperformed the children with SLI ($p<0.001$). Note that the mean A' value of the group with SLI was 0.56, indicating that their group performance did not exceed chance-level ($t(10)=1.0$, $p=0.31$). The group of children with dyslexia and the controls performed well above chance-level.

Even though the mean score of the SLI group indicated chance-level, two children from the group with SLI demonstrated the ability to detect agreement violations, attaining overall A′ values over 0.80 and another child from this group showed a high discrimination ability on at least one of the three agreement conditions, demonstrating at least some sensitivity to agreement morphology.

Results of phonological tasks

Phonological awareness

The mean scores for all three groups are displayed in Table 2. Deletion of phonemes was tested in three different positions, C_1, C_2, and C_{final} (Figure 1). A repeated

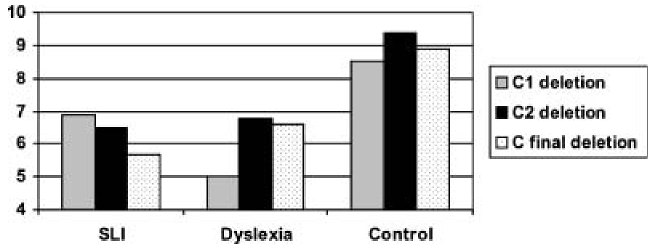

Figure 1. Items correct on the phonological awareness task for the three groups.

measures analysis with group as the between-subjects variable and position as the within-subjects variable showed that there was a main effect of group ($F(2, 42)=8.3$, $p=0.001$). Games–Howell tests showed that the children with developmental dyslexia and SLI made significantly more errors than the controls (subjects with dyslexia: $p<0.001$; SLI: $p<0.05$), but that there was no difference between the children with dyslexia and with SLI ($p=0.97$). There was no overall significant influence of position ($F(2, 84)=2.3$, $p=0.1$), but there was a significant interaction between position and group ($F(4, 88)=2.5$, $p=0.05$). Within-subject contrasts showed that the interaction reflected a difference on the performance on C_1 and C_{final} between the three groups ($p<0.05$). Errors for the control children and children with dyslexia were most frequent for deletion of an initial phoneme. In contrast, the children with SLI made most errors on C_{final} deletion and had least difficulty with the deletion of the first phoneme of a consonant cluster in the onset.

Non-word repetition

Table 2 displays the mean scores correct. A one-way ANOVA confirmed an overall difference between groups ($F(2, 42)=33.6$, $p<0.001$), and Games–Howell tests showed that the children with dyslexia performed more poorly than the controls ($p<0.03$), but better than the children with SLI ($p<0.001$).

A repeated measures analysis of phonemes repeated correctly showed a main effect of group ($F(2, 42)=29.7$, $p<0.001$), a main effect of word length (the longer the word, the more errors), $F(3, 126)=96.1$, $p<0.001$, and an interaction between group and word length ($F(6, 126)=7.8$, $p<0.001$). This reflects the fact that the group with SLI showed a sharp decrease in phonemes repeated back correctly at a word length of four syllable words, whereas the performance of the group with dyslexia started to drop at a word length of five syllables (Figure 2).

Correlations between the tasks

Table 3 displays the correlations between the performances on all three measures. All the participants were included in the correlations to avoid loss of power due to the relative small subgroups. As can be seen, all results were intercorrelated except for the measure of C_1 deletion with non-word repetition (raw score) and morphosyntactic sensitivity.

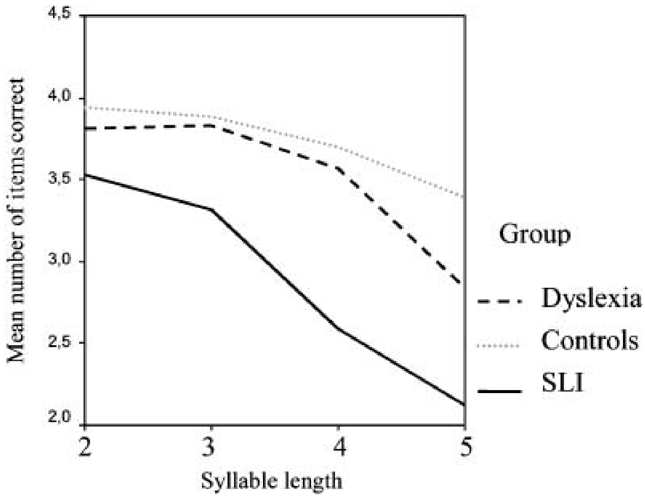

Figure 2. Mean number of items repeated back correctly of the non-word repetition task in relation to the number of syllables of the non-words.

Discussion

This research was undertaken to compare directly performances quantitatively and qualitatively between subjects with dyslexia and SLI on tasks tapping subject–verb agreement, phonological awareness, and non-word repetition. Based on previous research, it was hypothesized that children in the two clinical groups would perform more poorly than those in the control group on all three tasks. Indeed, the results indicate that the groups of children with dyslexia and SLI were outperformed by the control children. These results thus corroborate other findings that developmental dyslexia is not restricted to literacy problems, or phonological problems, but that weaknesses in the morphosyntactic domain can also be found.

Another main aim of this study was to compare the performance profiles between the two clinical groups. Even though the results indicated that the children with SLI and dyslexia showed weaknesses in the same areas, further scrutiny of the data also revealed differences in the performance patterns between the two clinical groups. For instance, the subject–verb agreement data indicated that both clinical groups performed more poorly relative to the typically developing children. However, an important difference in the score profiles is that the children with

Table 3. Correlations between non-word repetition, phoneme deletion in three positions and sensitivity to subject–verb agreement

	Non-word repetition (NRT)	C1 deletion	C2 deletion	C final deletion
C1 deletion	0.14			
C2 deletion	0.45**	0.58**		
C final deletion	0.35*	0.55**	0.76**	
Subject–verb agreement	0.62**	0.21	0.40**	0.51**

**$p<0.01$; *$p<0.05$.

dyslexia were aware of the (un)grammaticality of agreement morphology, albeit significantly less so than the control group. In contrast, the group of children with SLI scored at-chance level which may reflect insensitivity to agreement morphology. Even though this score is a group mean, only two of the 11 children scored above-chance level, whereas all of the children with dyslexia scored above-chance level, which demonstrates that the group means are relatively representative for the individual abilities. It cannot be the case that the poor performance of the children with SLI was triggered by an overall problem with grammaticality judgements as they showed to be capable of making meta-linguistic judgements in the control condition. The present findings corroborate with those of the study of Wulfeck *et al.* (2004) in which children with SLI of 7–8 years old (slightly younger than the present group) scored at chance-level on the subject–verb agreement condition comparable to our conditions (A' level of 0.56).

The analysis of the non-word repetition task also displayed differences between the clinical groups. Children with SLI were affected more by word length than the children with dyslexia: the performance of the SLI group started to deteriorate when the non-words consisted of four syllables, whereas repetition ability declined dramatically in the group with dyslexia in the case of the five-syllable items.

The performance profiles on the phonological awareness task that tapped phoneme deletion at three positions within a word also showed dissimilarities. Both children with SLI and dyslexia scored overall more poorly on this task than the typically developing children. However, they differed in their pattern of performance. The children with dyslexia performed poorest on the condition where consonants in word-initial position had to be deleted, comparable with the control group. In contrast, the children with SLI had most trouble with deleting consonants in word-final position, and least with the consonants in word-initial position. Both groups made several types of errors, such as no omission of the target phoneme and omission of the complete consonant cluster, but no consistent error pattern was found.

This difficulty with deletion of the onset of a syllable for the typically developing and dyslexic children may arise from a strong preference for a filled onset position. Descriptions of preferences of syllabic structure have long included the observation that some languages only allow syllables with the CV structure, whereas there are no languages permitting only a VC type syllable (Blevins 1995). In other words, a syllable with an unfilled coda position is less marked than a syllable with an unfilled onset position. A Dutch study conducted on the acquisition of syllable types showed that the onset position is filled from the start of language acquisition, and that the coda position is learned later (Levelt *et al.* 2000). Thus, the pattern of performance of the control children and the children with dyslexia is expected based on acquisition data and on the idea of ‘markedness’ of syllable structures: it seems most marked to leave an onset position empty in a syllable. A task demanding just that may therefore conflict with the preference of a filled onset position and trigger errors. The performance pattern of the children with SLI is therefore quite unexpected as they prefer an unfilled onset position relative to the coda position.

It may be that the limitations in phonological working memory interfered with the ability to manipulate the final consonant, more so than omitting the first or second consonants. The correlations between non-word repetition and the three sections of the phonological awareness task confirm this suggestion: a C final deletion moderately correlated with non-word repetition, just like a C2 deletion, but a C1 deletion was not associated with non-word repetition. The correlations thus seem to suggest that the performance pattern of the children with SLI (most trouble with a C final deletion) is related to their problem with phonological working memory.

Another aim of the present study was to investigate the relation between phonological working memory skills and morphosyntactic performance that had been observed in other studies. Hayiou-Thomas *et al.* (2004) found that sensitivity to past tense deteriorated in typically developing children when processing capacity was stressed by lengthening the experimental sentences. Norbury *et al.* (2001) showed that tasks tapping phonological working memory skills such as sentence recall and non-word repetition were significantly correlated with marking verbs for tense in a sample of children with SLI, hearing impairment and typically developing children, and concluded that processing capacity limitations may play an important role in morphosyntactic skills. Likewise, the present study found a significant correlation between the overall performance on non-word repetition and the grammaticality judgement task ($r=0.62$) underscoring the idea that morphosyntactic deficits may stem from a problem with phonological working memory.

In sum, different error profiles on tasks tapping subject–verb agreement, phonological working memory, and phonological awareness were demonstrated for children with SLI and developmental dyslexia. These differences may be related to a difference in severity of the phonological working memory problems that are encountered, demonstrating that a quantitative difference in one domain between groups of children can result in different error profiles in other domains.

Bishop and Snowling (2004) discuss commonalities between the two syndromes and propose in their so-called quadrant model that dyslexia and SLI share a deficit in phonological skills, but that children with SLI have additional cognitive impairments that account for their language problems. The present data fit this quadrant model as they show that impaired phonological (processing) skill are a key deficit in both dyslexia and SLI, but that there are, however, differences in the profiles between the two clinical groups as the children with SLI demonstrate little sensitivity to agreement morphology and display a different error pattern on the phoneme deletion task relative to the children with dyslexia. However, the data also suggest that a difference in severity of the phonological processing impairment may explain these differences rather than assuming qualitatively different cognitive profiles between the two groups. More research on the impact of phonological working memory on other language areas in children with SLI and dyslexia is needed in order to understand the relation between developmental dyslexia and SLI.

The main limitation of this study is that the described relation between non-word repetition and sensitivity to subject–verb agreement is based on a correlation. This means that no inferences can be made on the causality of the association. Longitudinal studies or training studies are needed to ascertain the assumptions that were made on the direction of the association. Furthermore, the measure that was used to test subject–verb agreement may be quite demanding in terms of phonological working memory, which may partly account for the strong correlation between the two measures. Other tests are needed to investigate the relation between phonological working memory and morphosyntactic skills.

Despite these limitations, the findings of the present study underline observations made in previous studies that children with dyslexia and SLI have problems in the same language areas: they scored more poorly than typically developing children on a phonological awareness task, a non-word repetition task, and a task tapping sensitivity to subject–verb agreement. However, qualitative analyses also revealed differences in the error profiles between the two groups of children which may have been brought about by the differences in phonological working memory between the two groups.

Note

1. In this task, a drawing was presented of an incomplete figure. Children were asked what was missing in the picture.

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