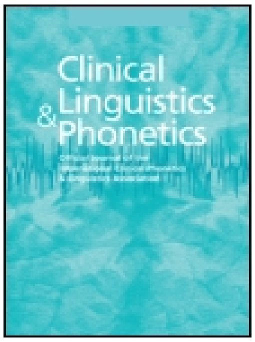

Clinical Linguistics & Phonetics

ISSN: 0269-9206 (Print) 1464-5076 (Online) Journal homepage: https://www.tandfonline.com/loi/iclp20

Non-word repetition in Dutch children with (a risk of) dyslexia and SLI

Elise de Bree, Judith Rispens & Ellen Gerrits

Clinical Linguistics & Phonetics, November–December 2007; 21(11–12): 935–944

informa healthcare

Non-word repetition in Dutch children with (a risk of) dyslexia and SLI

ELISE DE BREE[1], JUDITH RISPENS[2], & ELLEN GERRITS[3]

[1]*University of Utrecht,* [2]*PI Research/Free University Amsterdam, and* [3]*University Hospital Maastricht, The Netherlands*

(Received 1 April 2007; accepted 29 May 2007)

Abstract

It has been proposed that poor non-word repetition is a marker of specific language impairment (SLI), and a precursor and marker of dyslexia. This study investigated whether a non-word repetition deficit underlies both disorders. A group of Dutch preschool SLI children and children at familial risk of dyslexia, as well as school-going groups of SLI and dyslexic children were presented with a non-word repetition task. The results showed that the SLI and the (at-risk of) dyslexia groups performed more poorly than the control children. Furthermore, with the exception of one child, all preschool SLI children scored significantly below the mean of the preschool control group, suggesting that non-word repetition performance is a marker of SLI. Approximately half of the at-risk group were poor performers, which was expected on the basis of the familial risk factor of the at-risk group. The results show that a non-word repetition deficit is attested early in life and underlies both dyslexia and SLI.

Keywords: *Specific language impairment, dyslexia, at-risk studies, non-word repetition, phonological processing*

Introduction

During the last decades, evidence has accumulated that a relationship exists between language and reading deficits. This relationship has been demonstrated in specific language impairment (SLI), which is characterized by problems with grammatical, phonological, lexical-semantic and pragmatic aspects of language, despite normal non-verbal IQ (Leonard, 1998). Approximately 40–60% of children with SLI display reading difficulties (Catts, Hu, Larrivee, & Swank, 1994; McArthur, Hogben, Edwards, Heath, & Mengler, 2000). A relationship between oral and written language difficulties has also been found in developmental dyslexia, a failure in reading and spelling despite conventional instruction, adequate intelligence, and socio-cultural opportunity. The average population risk of dyslexia is around 3–10%. However, the risk of first-degree relatives of individuals with dyslexia is estimated around 40%, suggesting a familial component to the disorder (Gilger, Pennington, & DeFries, 1991). Children with dyslexia do not only experience problems

Correspondence: Elise de Bree, Utrecht Institute of Linguistics OTS, Utrecht University, Trans 10, 3512 JK Utrecht, The Netherlands. E-mail: elise.debree@let.uu.nl

ISSN 0269-9206 print/ISSN 1464-5076 online
DOI: 10.1080/02699200701576892

with decoding written language, but also with aspects of oral language (Bar-Shalom, Crain, & Shankweiler, 1993; Catts, 1993; Joanisse, Manis, Keating, & Seidenberg, 2001; Rispens, Roeleven, & Koster, 2004). Furthermore, oral language problems have been observed in children with a familial risk of dyslexia, before the onset of reading instruction (Scarborough, 1990; Gallagher, Frith, & Snowling; 2000; van Alphen et al., 2004; Rispens, 2004; Koster, Been, Krikhaar, Zwarts, Diepstra, & van Leeuwen, 2005).

It has been proposed that both dyslexia and SLI are characterized by a phonological processing deficit (Kamhi & Catts 1986; Bishop & Snowling 2004). Phonological processing skills are often measured by administering a non-word repetition task. Children and adolescents with SLI show pronounced difficulties with non-word repetition (NWR) (e.g. Kamhi, Catts, Mauer, Apel, & Gentry 1988; Dollaghan & Campbell, 1998; Ellis Weismer et al., 2000; Goulandris, Snowling, & Walker, 2000; Conti-Ramsden, Botting, & Faragher, 2001; Conti-Ramsden, & Hesketh 2003, but see Stokes, Wong, Fletcher, & Leonard, 2006, for different findings with Cantonese SLI children), even when their overt language difficulties have resolved (Bishop, North, & Donlan, 1996, Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998). Despite the heterogeneous language profiles within groups of SLI, the population is homogeneous in its non-word repetition performance. This has led to the proposal that poor NWR is a clinical marker for language impairment (Bishop et al., 1996; Dollaghan & Campbell, 1998; Conti-Ramsden et al., 2001; Tager-Flusberg & Cooper, 1999, but see Catts, Adlof, Hogan, & Ellis Weismer, 2005, for a different viewpoint).

Similarly, children with dyslexia, as well as preschool children with a risk of dyslexia have been found to obtain lower scores on NWR compared to their age peers and generally speaking, a non-word repetition deficit appears to be present in dyslexic populations, even into adolescence and adulthood (e.g. Kamhi et al., 1988; Bruck, 1992; Pennington & Lefly, 2001; Roodenrys & Stokes, 2001; Ramus et al., 2003; Carroll & Snowling, 2004). Thus, this deficit could be a precursor of dyslexia as well as a marker of literacy difficulties. Such an interpretation is accommodated within the prominent hypothesis that proposes that dyslexia is the result of an underlying phonological processing deficit (e.g. Vellutino, Fletcher, Snowling, & Scanlon, 2004).

Some comparisons between NWR abilities in dyslexic and SLI populations have been made and have consistently found poor results in both groups (Kamhi & Catts, 1986; Kamhi et al., 1988; Goulandris et al. 2000; Scheltinga, van der Leij, & van Beinum, 2003; Catts et al., 2005), with the dyslexic groups generally outperforming the children with SLI (but see Catts et al., 2005, who found the reverse). These results suggest that poor NWR characterizes both dyslexia and SLI. The present study investigates whether poor NWR performance is attested in a group of school-going dyslexic and SLI children, as well as in preschool children with SLI and children at familial risk of dyslexia. A comparison between preschoolers with SLI and a risk of dyslexia and a comparison between preschoolers and school-going children has not been reported before.

Recently, Carroll and Snowling (2004) presented a study on children with a familial risk of dyslexia and children with speech impairment (not SLI). One of their findings was that 4–6-year-old children with a speech impairment and children at risk of dyslexia performed more poorly on NWR than their age-matched controls, with the at-risk children performing better than the speech-impaired group. Carroll and Snowling's study thus suggests an overlap between a speech-impaired (not SLI) and an at-risk group in terms of NWR. It will be investigated here whether young children with SLI are also characterized by poor NWR and whether poor NWR is a precursor of literacy difficulties in at-risk children.

The deficit in NWR of children with SLI and dyslexia is especially apparent in non-words consisting of four and five syllables relative to shorter non-words (Snowling, 1981; Montgomery, 1995, Bishop et al., 1996). This so-called word length effect has not been studied for children at-risk of dyslexia. In this study it will be investigated whether a word-length effect surfaces for the children with (a risk of) dyslexia and children with SLI in comparison with the control groups. In other words, it will be analysed whether these groups are affected more severely by increasing length of non-words than the control groups.

In sum, the aim of this paper is to evaluate NWR performance of Dutch preschool and school-going children with SLI, children with dyslexia, and children at-risk of dyslexia to assess whether a NWR deficit is present.

Method

Participants

Six groups of children were recruited: children who are at a familial risk of dyslexia, children with dyslexia, preschool and school-going children with specific language impairment, and preschool and school-going control children without language and reading disorders. They were divided in a preschool (111 children) and a school-going (47 children) group. Table I presents an overview of the details of the participants.

The *preschool group* included a group with familial risk of dyslexia (n=57, 19 girls, 38 boys, mean age 4;4 (SD=3 months)). They were recruited through calls in local newspapers and parent magazines. For children to be included in the at-risk group, at least one parent had to be dyslexic. The parent's dyslexic status was established through a Dutch dyslexia test battery (see van Alphen et al., 2004). To minimize inclusion of children whose dyslexic parents had a background of language impairment, a questionnaire was sent out to all parents, ascertaining absence of severe speech and language difficulties in childhood. IQ was measured through four of the six subtests of a non-verbal IQ test for young children (SON-R; Snijders, Tellegen, & Laros, 1988). Mean IQ for the at-risk group was 111.6 (SD=14.9).

Children with SLI (n=22, three girls, 19 boys, mean age 4;7 (SD=5 months)) were found through schools that provide full-time specialized teaching to children with speech and language problems. The criteria of inclusion in the SLI group were a language impairment diagnosed by a speech and language therapist on the basis of standardized

Table I. Participant characteristics.

Group	Age	Gender		IQ
		girls	boys	
Preschool				*SON-R*
Control	4;5 (3 months)	15	16	117.3 (4.2)
At-risk	4;4 (3 months)	19	38	111.6 (15)
SLI	4;7 (4 months)	3	19	103.0 (11)
School-going				*WISC*
Control	8;8 (6 months)	8	9	12.1 (2.35)
Dyslexic	8;8 (7 months)	8	10	11.9 (2.74)
SLI	8;5 (4 months)	3	8	10.6 (1.89)

Dutch language tests, at least average non-verbal IQ, measured by educational specialists as part of the review process in school, and absence of any neurological deficits. Mean IQ for the SLI group was 103.0 (SD=11.2).

The control children (n=31, 15 girls, 16 boys, mean age 4;5 (SD=3 months)), matched on chronological age of the two clinical groups, were recruited via day-care centres in the vicinity of Utrecht. Mean IQ of the control group was 117.3 (SD=14.2). The parents of the control children reported no oral or written language problems within the family.

There was a significant difference of IQ for the three groups ($F(2, 102)=5.9$, $p=.004$) with the SLI group performing more poorly than the control group ($p=.002$). Therefore, analyses will include IQ as a covariate. There was also an effect of age ($F(2, 107)=9.89$, $p<.001$), with the SLI group being significantly older than the at-risk group ($p=.005$).

The *school-going children* included 18 children with developmental dyslexia (mean age 8;8; eight girls, 10 boys). These children were either diagnosed with developmental dyslexia by educational specialists or were in the process of being formally diagnosed. They were selected for this study if they showed a delay of at least 1.5 years compared to the reading level of average-reading children with the same age and school grade, measured through a standardized test of speed and accuracy of reading (AVI, Van den Berg, 1991). In order to confirm their reading problems, two tasks were presented to the children tapping word recognition: Real Word Test (RWT; Brus & Voeten, 1972) and word decoding: the PseudoWord Test (PWT; Van den Bos, Spelberg, Scheepstra, & de Vries, 1994). In the RWT children were asked to read aloud a list of words as accurately but also as fast as possible in a one minute time limit. In the PWT pseudo-words were presented and children were asked to read these aloud as accurately and as fast as possible in a two-minute time frame. These scores are scaled with a mean score of 10 and a standard deviation of 3. A scale score of 7 is a statistical cut-off point below which one speaks of poor performance. All children scored below 7, indicating a scaled score of at least one standard deviation below the mean.

All but one of the school-going children attended main-stream primary schools. All children demonstrated at least average performance on non-verbal and verbal tasks of the Dutch version of the intelligence test battery WISC-R (Van Haasen et al., 1986). None of the children had a history of speech and language therapy, nor were they currently enrolled in a speech and language training programme. Some children received remedial teaching, specifically focused on their reading and or spelling problems.

Eleven children with SLI (mean age 8;5; three girls, eight boys) were recruited from special schools for children with specific language impairment. Selection criteria were similar to the preschool SLI children. Their reading skills were assessed with the RWT and the PWT. Six of the 11 children had standard scores lower than 7, indicating subnormal performance on word decoding and recognition.

The chronological age control group contained 17 children (mean age 8;8; eight girls, nine boys) with at least average reading skills as assessed by the AVI test. Only children who demonstrated normal progress in school were included. All children had standard scores higher than 7 on the RWT and the PWT, indicating normal word recognition and decoding. 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.

The participants of the three school-going groups were matched on age and a measure of non-verbal ability: the subtest "incomplete drawings" of the WISC-R in which an incomplete figure is presented. The children were asked to indicate what was missing in that picture. There were no differences in non-verbal ability ($F(2, 44)=1.3$, $p=.29$) and age

(F(2, 44)=1.13, p=.33). 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 special schools in the same areas as the typically developing children and the children with dyslexia.

Tests and procedure

Non-word repetition task. A Dutch NWR task was created on the basis of the NWR task of Dollaghan and Campbell (1998). The children heard pre-recorded non-words through a CD player played over a loudspeaker. For the preschool children, NWR was elicited through pictures of fantasy animals, whereas the older children only heard the non-word. Every word was introduced by a beep to ensure children's attention. The task contained three practice items and 16 pseudo-words that were two to five syllables in length (e.g. /ji'nus, wa'fɛɪsin/), with four items for each non-word length. The items are presented in the appendix. The non-words were presented pseudo-randomly with the restriction that the syllable length of two successive non-words was always different.

Data analysis. The children's repetitions were transcribed phonetically. Percentages phonemes correct (PPC) per non-word were calculated. For the preschool children, phoneme acquisition measured through a picture-naming task was taken into account. If a child showed <75% correct of a phoneme on this naming task, this phoneme was not counted as incorrect when scoring the NWR.

Repeated measures with Group as between-subjects factor and PPC per non-word length as within subjects-factor were conducted. Greenhouse-Geisser statistics are reported when corrections for asphericity of the data were required.

IQ scores were taken as a covariate to ensure it did not have a confounding effect on NWR performance. For the preschool group, IQ data were absent for one control, four at-risk, and four SLI children and therefore these children were omitted from the analysis. The IQ test was presented to the children in a demanding test session, in which several speech and language skills, as well as IQ were assessed. These nine children failed to complete the IQ test due to time constraints. It should be noted, however, that results with and without IQ as covariate (and thus with and without the nine children) showed similar results.

Results

Preschool children

The mean PPC per non-word length for the preschool and school-going groups are presented in Table II.

For the *preschool children*, a two-way repeated measures ANOVA with Group (Control, At-risk, SLI) as between-subjects factor, and Percentage Phonemes Correct per non-word length (ppc2, ppc3, ppc4, ppc5) as within-subjects factor demonstrated a significant main effect for Group (Group (F(2, 97)=23.4, p<.001) and PPC per non-word length (F(3, 321)=5.37, p=.001), as well as an interaction between Group and PPC per non-word length (F(6, 321)=2.59, p=.018). Games-Howell (to correct for unequal variances) post-hoc analyses confirmed that all three groups differed significantly from each other

Table II. Percentages Phonemes Correct (PPC) (standard deviation) according to non-word length (2, 3, 4, 5 syllables non-words) and group.

Age group	Group	Mean PPC	PPC2	PPC3	PPC4	PPC5
Preschool	Control	80.4 (7.1)	91.9 (6.7)	88.4 (7.3)	78.0 (8.9)	71.4 (12.3)
	At-risk	70.3 (10.9)	84.9 (11.1)	78.1 (13.3)	68.5 (12.7)	59.4 (15.2)
	SLI	57.7 (10.8)	79.1 (14.0)	65.8 (14.5)	53.4 (11.2)	45.9 (14.7)
School	Control	92.4 (2.9)	98.5 (2.9)	96.9 (3.7)	92.2 (7.5)	84.8 (9.8)
	Dyslexic	85.6 (7.2)	95.3 (4.7)	95.4 (4.8)	89.1 (7.4)	71.9 (15.9)
	SLI	68.4 (11.5)	88.2 (10.8)	82.7 (14.5)	65.0 (12.5)	53.9 (13.0)

($p<.001$). The interaction reflects the finding that PPC decrease was steeper in the SLI group than in the at-risk and control group.

Furthermore, to establish whether poor NWR characterizes the SLI and at-risk group, we calculated how many children in all three groups performed more than 1 standard deviation below the mean PPC of the control group. There were 6/31 (19%) "poor performers" in the control group, 32/57 (56%) in the at-risk group, and 21/22 (95%) in the SLI group. With respect to the at-risk group, the 32 poor performers might be the children who will develop reading difficulties at school age. Note that approximately 40% of this group is hypothesized to be dyslexic and around 60% is expected to develop normally. The poor performance of a subgroup within the at-risk group suggests that poor NWR could be a precursor of dyslexia. The findings further indicate that poor NWR is a marker of SLI, as only one child with SLI (just) scored above the cut-off score.

A similar repeated measures analysis was conducted for the *school-going children* with Group and PPC per non-word length (two, three, four, and five syllable words). This analysis revealed a main effect of PPC per non-word length, ($F(3, 120)=4.04$, $p<.05$), indicating that the longer a word, the more errors were made. In addition, there was a main effect of Group, ($F(2, 40)=26.1$, $p<.001$), and an interaction between Group and PPC per non-word length, ($F(6, 120)=6.7$, $p<.01$). The interaction reflects the fact that the group with SLI showed a sharp decrease in phonemes repeated back correctly at a target length of four syllable words, whereas the performance of the group with dyslexia started to drop at a word length of five syllables. Games-Howell post-hoc tests showed that the control group outperformed the two clinical groups ($p<.02$) and that the children with dyslexia performed better than the children with SLI ($p=.001$).

Discussion

The present study shows that preschool and school-going children with (a risk of) dyslexia and SLI have more difficulty with repeating non-words relative to their typically developing peers. Furthermore, the young and older SLI groups showed poorest non-word repetition (NWR) performance. The current NWR results support the assumption that poor NWR is a marker of language impairment (Bishop et al., 1996; Conti-Ramsden et al., 2001). Furthermore, the dyslexic group performed significantly more poorly on the NWR task than the control group and around half of the at-risk group performed more than one standard deviation below the mean of the preschool control group. On the basis of these findings it can be argued that NWR performance is also a marker and a precursor of literacy problems. However, in order to substantiate this assumption we have to wait and see which of these at-risk children actually develop dyslexia. Nevertheless, these results underline that

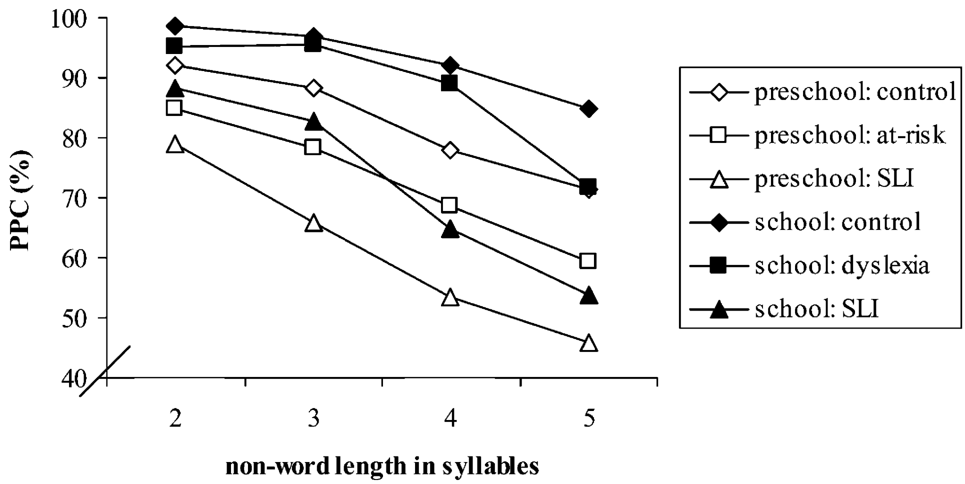

Figure 1. Mean percentages phonemes correct per non-word length per group.

non-word repetition is associated both with reading difficulties as well as overt language problems.

The expectation that a more severe word-length effect would be present for both the (risk of) dyslexia and SLI than the control groups was not borne out completely. A steeper percentages phonemes correct decrease was found for the preschool and school-going SLI children for the four-syllable non-words, as well as the dyslexic children for five-syllable non-words relative to the control groups, but it was absent for the at-risk group. However, the last result is difficult to interpret due to the heterogeneity of this subgroup: approximately 40% of this group is hypothesized to be dyslexic and around 60% is expected to develop normally. The mixed population of the at-risk group may therefore obscure a possible word-length effect of the "true" children with dyslexia at a pre-reading age.

Word-length effects are typically interpreted as indications of the severity of the deficit: the lower the number of syllables a child can repeat, the more affected the phonological processing skills. The results of this study may therefore indicate that children with SLI have more pronounced difficulties with phonological processing skills (note that this is different from *phonological awareness*) than children with dyslexia. This finding can be accommodated in the proposal of Bishop and Snowling (2004) who argue that both SLI and dyslexia are characterized by a phonological processing deficit, but that they are nonetheless distinct disorders, with the children with SLI having additional cognitive deficits explaining their pronounced oral language problems. Future research will establish if and how the language profiles of these children with SLI and with (a risk of) dyslexia differ (van Alphen et al., 2004; Rispens & Been, 2007). Furthermore, there is a considerable debate about what exactly determines NWR performance. Processes that have been hypothesized to play a role in NWR are speech perception and production, short-term memory and vocabulary. More research is needed to identify the locus of breakdown for children with SLI and dyslexia in NWR. A preliminary conclusion is that NWR can be used to detect language and reading problems, even if these problems are not overt yet, as is the case in preschool children at-risk of dyslexia.

Acknowledgements

The present study was part of the project "Early language development in Specific Language Impairment and dyslexia: A prospective and comparative study", as well as the project "Identifying the core features of developmental dyslexia: a multidisciplinary approach". It was supported by the Netherlands Organization for Scientific Research (NWO, nr. 360-70-030), the Utrecht institute of Linguistics OTS, and the University of Groningen. The authors wish to extend their gratitude to the children, parents, and schools who participated in this study and to our collaborators, Petra van Alphen, Pieter Been, Jan de Jong, Carien Wilsenach, Marjolein van Woudenberg, and Frank Wijnen.

References

Alphen, P. van., de Bree, E., Gerrits, E., de Jong, J., Wilsenach, C., & Wijnen, F. (2004). Early language development in children with a genetic risk for dyslexia. *Dyslexia*, *10*, 1–24.

Bar-Shalom, E. G., Crain, S., & Shankweiler, D. (1993). A comparison of comprehension and production abilities of good and poor readers. *Applied Psycholinguistics*, *14*, 197–227.

Bishop, D. V. M., North, T., & Donlan, C. (1996). Nonword repetitions as a behavioural marker for inherited language impairment: evidence from a twin study. *Journal of Child Psychology and Psychiatry*, *36*, 1–13.

Bishop, D. V. M., & Snowling, M. J. (2004). Developmental dyslexia and Specific Language Impairment: Same or different? *Psychological Bulletin*, *130*, 858–886.

Bruck, M. (1992). Persistence of dyslexics' phonological awareness deficits. *Developmental Psychology*, *28*, 874–886.

Brus, B. Th., & Voeten, M. J. M. (1972). *Een-Minuut Test. Vorm A en B*. Nijmegen: Berkhout Testmateriaal.

Carroll, J. M., & Snowling, M. J. (2004). Language and phonological skills in children at high risk of reading difficulties. *Journal of Child Psychology and Psychiatry*, *45*, 631–640.

Catts, H. W. (1993). The relationship between speech-language impairments and reading disabilities. *Journal of Speech, Language and Hearing Research*, *36*, 948–958.

Catts, H. W., Hu, C-F., Larrivee, L., & Swank, L. (1994). Early identification of reading disabilities in children with Speech-Language Impairments. In R. Watkins, & M. Rice (Eds.), *Specific Language Impairments in Children*. Baltimore, MD: Paul H Brookes.

Catts, H. W., Adlof, S. M., Hogan, T. P., & Ellis Weismer, S. (2005). Are specific language impairment and dyslexia distinct disorders? *Journal of Speech, Language, and Hearing Research*, *48*, 1378–1396.

Conti-Ramsden, G., Botting, N., & Faragher, B. (2001). Psycholinguistic markers for Specific Language Impairment (SLI). *Journal of Child Psychology and Psychiatry*, *42*, 741–748.

Conti-Ramsden, G., & Hesketh, A. (2003). Risk markers for SLI: A study of young language-learning children. *International Journal of Language and Communication Disorders*, *38*, 251–263.

Dollaghan, C., & Campbell, T. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language and Hearing Research*, *41*, 1136–1146.

Ellis Weismer, S., Tomblin, J. B., Zhang, X., Buckwalter, P., Chynoweth, J. G., & Jones, M. (2000). Nonword repetition performance in school-age children with and without language impairment. *Journal of Speech, Language and Hearing Research*, *43*, 865–879.

Gallagher, A., Frith, U., & Snowling, M. J. (2000). Precursors of literacy delay among children at genetic risk of dyslexia. *Journal of Child Psychology and Psychiatry*, *41*, 203–213.

Gilger, J. W., Pennington, B. F., & DeFries, J. C. (1991). Risk for reading disability as a function of parental history in three family studies. *Reading and Writing: An Interdisciplinary Journal*, *3*, 205–217.

Goulandris, N. K., Snowling, M. J., & Walker, I. (2000). Is dyslexia a form of specific language impairment? A comparison of dyslexic and language impaired children as adolescents. *Annals of Dyslexia*, *50*, 103–120.

Joanisse, M. F., Manis, F. R., Keating, P., & Seidenberg, M. S. (2000). Language deficits in dyslexic children: Speech perception, phonology, and morphology. *Journal of Experimental Child Psychology*, *77*, 30–60.

Kamhi, A. G., & Catts, H. W. (1986). Towards an understanding of language and reading disorders. *Journal of Speech and Hearing Research*, *51*, 337–347.

Kamhi, A. G., Catts, H. W., Mauer, D., Apel, K., & Gentry, B. (1988). Phonological and spatial processing abilities in language-and reading-impaired children. *Journal of Speech and Hearing Disorders*, *53*, 316–327.

Koster, C., Been, P. H., Krikhaar, E. M., Zwarts, F., Diepstra, H. D., & van Leeuwen, T. H. (2005). Differences at 17 months: Productive language patterns in infants at familial risk for dyslexia typically developing infants. *Journal of Speech, Language and Hearing Research*, *48*, 426–438.

Leonard, L. B. (1998). *Children with specific language impairment*. Cambridge, MA: MIT Press.
McArthur, G. M., Hogben, J. H., Edwards, V. T., Heath, S. M., & Mengler, E. D. (2000). On the "specifics" of specific reading disability and specific language impairment. *Journal of Child Psychology and Psychiatry*, *41*, 869–874.
Montgomery, J. W. (1995). Examination of phonological working memory in specifically language-impaired children. *Applied Psycholinguistics*, *16*, 355–378.
Pennington, B. F., & Lefly, D. L. (2001). Early reading development in children at family risk for dyslexia. *Child Development*, *72*, 816–833.
Ramus, F., Rosen, S., Dakin, S. C., Day, B. L., Castellote, J. M., White, S., & Frith, U. (2003). Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. *Brain*, *126*, 841–865.
Rispens, J. E. (2004). *Syntactic and phonological processing in developmental dyslexia*. Groningen: Grodil.
Rispens, J. E., & Been, P. (2007). Subject-verb agreement and phonological processing in developmental dyslexia and SLI: A closer look. *International Journal of Language and Communication Disorders*, *42*, 293–305.
Rispens, J. E., Roeleven, S., & Koster, C. (2004). Sensitivity to subject-verb agreement in spoken language in children with developmental dyslexia. *Journal of Neurolinguistics*, *17*, 333–347.
Roodenrys, S., & Stokes, J. (2001). Serial recall and nonword repetition in reading disabled children. *Reading and Writing: An Interdisciplinary Journal*, *14*, 379–394.
Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child Development*, *61*, 1728–1743.
Scheltinga, F., van der Leij, A., & van Beinum, F. (2003). Importance of phonological skills and underlying processes to reading achievement. *Proceedings of the Institute of Phonetic Sciences*, *25*, 21–30.
Snowling, M. J. (1981). Phonemic deficits in developmental dyslexia. *Psychological Research*, *43*, 219–234.
Snijders, J. T., Tellegen, P. J., & Laros, J. A. (1988). *Snijders-Oomen niet-verbale intelligentie test. Verantwoording en handleiding*. Groningen: Wolters-Noordhoff.
Stokes, S. F., Wong, A. M-Y., Fletcher, P., & Leonard, L. B. (2006). Nonword repetition and sentence repetition as clinical markers of specific language impairment: The case of Cantonese. *Journal of Speech, Language, and Hearing Research*, *49*, 219–236.
Stothard, S. E., Snowling, M. J., Bishop, D. V. M., Chipchase, B. B., & Kaplan, C. A. (1998). Language-impaired preschoolers: A follow-up into adolescence. *Journal of Speech, Language and Hearing Research*, *41*, 407–418.
Tager-Flusberg, H., & Cooper, J. (1999). Present and future possibilities for defining a phenotype for specific language impairment. *Journal of Speech, Language, and Hearing Research*, *42*, 1275–1278.
Van den Berg, R. (1991). *AVI-toetskaarten*. 's-Hertogenbosch: Katholiek Pedagogisch centrum.
Van den Bos, K. P., Spelberg, H. C. L., Scheepstra, A. J. M., & de Vries, J. R. (1994). *De KLEPEL. Een test voor de leesvaardigheid van pseudo-woorden*. Nijmegen: Berkhout Testmateriaal.
Van Haasen, P. P., De Bruyn, E. E. J., Pijl, Y. J., Poortinga, Y. H., Spelberg, H. C. I., VanderSteene, G., Coetsier, P., Spoelders-Claes, R., & Stinissen, J. (1986) *WISC-R. Nederlandse Uitgave* [Dutch-language Edition]. Lisse: Swets & Zeitlinger.
Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D. (2004). Specific reading disability (dyslexia): what have we learned in the past four decades? *Journal of Child Psychology and Psychiatry*, *45*, 2–40.

Appendix

Stimuli of the non-word repetition task

Item	Nr of syllables	Non-word
practice	1	’tus
practice	2	jœy’fot
practice	4	je’mœybovaʊs
trial	2	so’tɛɪf
trial	2	fø’pan
trial	2	wa’dœys
trial	2	ji’nus
trial	3	ju’sewaʊp
trial	3	wa’fɛɪsin
trial	3	sy’taʊmif
trial	3	do’linɛɪf
trial	4	hi’jemytɛɪp
trial	4	be’putamyf
trial	4	py’sudaʊjin
trial	4	to’pøsiwum
trial	5	hipø’sufytem
trial	5	fonɛɪ’wœysutam
trial	5	bawo’vyjizaʊn
trial	5	wyta’mobejœyn