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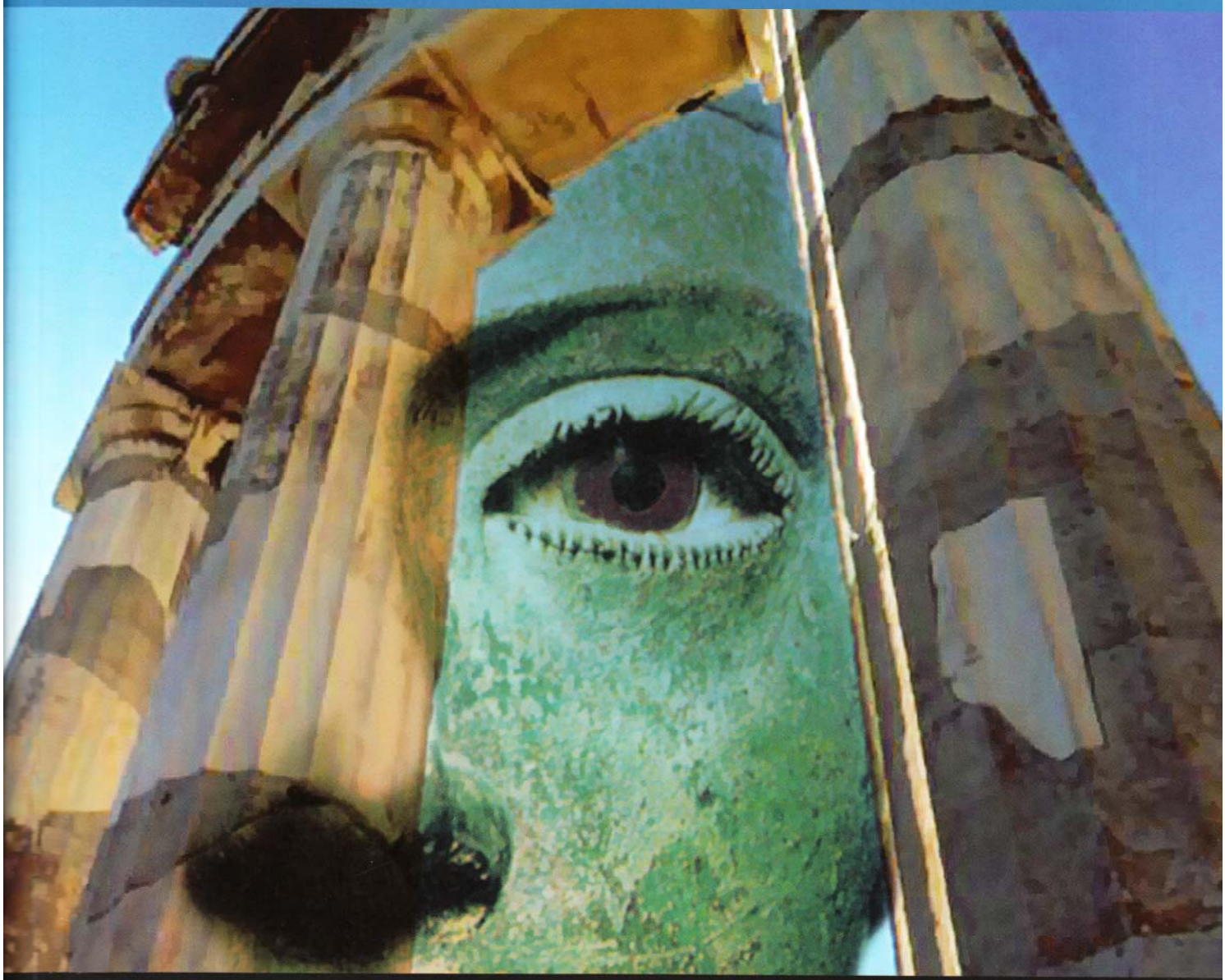

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Acquisition of Literacy skills in children with Specific Language Impairment: A Longitudinal Investigation in French

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Abstract

This study examined the link between phonological development and literacy acquisition in the case of children with Specific Language Impairment (SLI). A sample of 20 beginning-reader French-speaking children with SLI participated in our longitudinal study. Their performances on phonological awareness were evaluated at three points in time over 2 ½ years, Time 1 (T1), Time 2 (T2) and Time 3 (T3). Their oral language was evaluated at T2 and T3, while at T3 we also evaluated their literacy skills. According to our results, at T3 none of the children showed any delay at phonological awareness, yet the literacy skills of the majority of them were significantly below average compared to normally developed children. At T3 our entire sample presented significant improvement in their utterances as well. We argue about the existence of a reciprocal influence between the early language deficit and the later literacy development of children with SLI. Children with SLI improve significantly their oral language outcomes due to explicit instruction of written language; however their phonological representations seem to remain flawed and this reflects on literacy tasks that demand a high level of phoneme manipulation.

Introduction

Specific language impairment (SLI) is commonly acknowledged when oral language lags behind other areas of development for no apparent reason (Leonard, 1998). By definition, the children in question have normal hearing and intelligence, suffer no neurological dysfunction and have sufficient opportunities to learn language, yet they learn to talk relatively late. Some of their basic linguistic characteristics are production of immature speech sounds, fewer utterances than expected for their age and intelligence, limited vocabularies and use of basic grammatical structures. In brief, children with SLI experience important difficulties in understanding and/or in producing spoken language and are usually impaired in one or more linguistic aspects (phonology, morphology, syntax). For the purposes of the present study, SLI was defined as impaired language (below 1SD from the mean) in the context of normal nonverbal abilities (a standard score of 80 or above).

At present there is considerable evidence that the term SLI does not refer to a homogenous group of children and as such should not be treated as a unitary construct. For over 40 years studies of children with SLI have been trying to determine the deficit nature of these children. However, its' causes are being still hotly debated, ranging from non-linguistic deficits in auditory perception and in general processing to high-level deficits in grammar. Recently, Ziegler et al. (2005), testing children with SLI under different conditions of stationary and fluctuating masking noise, found that their basic temporal and spectral capacities are relatively sparse· hence, concluded that the deficit must be due to an inefficient mapping of acoustic information onto phonetic features at a central (postcochlear) conversion stage.

Although children with SLI constitute a heterogeneous group, it has been made clear that phonology is among the areas of language adversely affected in many of them. Indeed, children with SLI exhibit significant difficulties in phonological processing and phonological awareness (Bortolini & Leonard, 2000). As for the grammatical deficits that are typical in SLI they are often considered to be the sequel of impaired speech perception rather than their cause. Joanisse and Seidenberg (2003) explored the hypothesis that this perceptual deficit specifically affects the use of phonological information in working memory, which in turns leads to poorer than expected syntactic comprehension.

The exact nature of the impairment as long as the extent to which it can explain the full range of language problems in children with SLI still remain the subject of considerable debate. However, the main bulk of research in recent literature contains evidence that due to their difficulties in oral language, children with SLI are at risk for literacy problems, the majority of them evolving as poor readers, even those who have overcome their oral language difficulties (Catts et al, 2002). Since most of the education is largely dependent on the ability to read, any difficulties in

this area could cause a wider disruption. In our studies, we adopted the psycholinguistic perspective which provides an explanation on why children with SLI often have associated literacy problems evolving from poor readers to dyslexics (Stackhouse & Wells, 1997; 2001). As we already mentioned, children with SLI face difficulties in sound discrimination and categorization and in manipulating the phonemes of their language. Stackhouse and Wells, argue that impaired speech perception interferes with the development of phonological representations, which in turn affects spelling and reading abilities.

The essence of the psycholinguistic model is the assumption that children establish a speech processing system (input, lexicon and output) from implicitly manipulating oral language. However, this system is also the foundation for the subsequent literacy development. In the case of children with SLI, impaired speech perception will affect the construction of phonological representations, provoking boundaries to literacy development. The early and premature phonological representations are of great importance in the first stages of word recognition, when the stored orthographic representations are still very restricted. During this early stage, children rely massively on their phonological representations in order to decode words. If the phonological representations are vague and inaccurate, due to impaired speech perception, children are bound to face significant difficulties in the decoding procedure.

One of the most robust findings emerging from research across languages is the existence of a causal connection and of a reciprocal influence between a child's phonological awareness and his / her literacy development (Bishop & Snowling, 2004). A number of longitudinal studies, most of them conducted with English-speaking SLI children show that they are at high risk for reading difficulties, even if their oral language no longer seems to be deficient. Catts et al. (2002) conducted an epidemiological study involving 328 kindergartners with language impairments. At each time point, children were assessed on tests of phonological awareness, letter identification, word identification, word attack and reading comprehension. According to their results, approximately 50% of their sample was considered to have significant reading difficulties after 2 or 4 years of schooling.

Studies of the reading outcomes of children with SLI have also been trying to specify the factors that seem to differentiate those with good reading outcomes from those with poor. Bishop and Adams (1990) were the first to argue that the major factor related to reading outcomes was the persistence of the language impairment. In particular, they reported that 4-year-old children with SLI who continued to have language problems at 5 ½ years had poor reading achievement at 8 ½ years, whereas those who had resolved their language problems did not. On the basis of these findings Bishop et al. proposed the 'critical age hypothesis', considering the age to which phonological problems persisted as an important factor. However, according to other studies, the relationship between oral and written language impairments is more complex than the results cited above. Scarborough & Dodrich (1990) argue that sometimes early recovery in language may be illusory and the language problems may resurface in elementary school years in children deemed to have outgrown these problems.

In contrast to the large amount of evidence about the reading skills of children with SLI, the development of spelling skills has attracted much less attention. Nevertheless, the development of spelling skills poses more of a challenge to children than learning to read, especially in an opaque orthography, such as French. We should note that French is an alphabetic language with simple syllabic structure and deep orthography, containing orthographic inconsistencies and complexities, multi-letter graphemes, context dependent rules, irregularities and morphological effects. In other words, the correspondences between phonemes and graphemes are not highly predictable in French. It is well established that children's ability to learn how to spell is influenced by a variety of skills, such as phonological awareness, knowledge of grapheme-phoneme correspondences and reading. It has also been acknowledged that phonological skills are critical to spelling and could be considered as a good predictor of later literacy development (Caravolas, Hulme & Snowling, 2001). Children with weak phonological skills will do poorly on tests of orthographic processing because they have failed to develop appropriate mappings between phonology and orthography.

The main objective of our study was the investigation of the language and literacy skills of children with SLI attending primary school. We, therefore, conducted a 2½ ys longitudinal study with French-speaking school-aged SLI children. The goal of this follow-up investigation was to study children with SLI as they develop their literacy skills, in order to examine 1) the role of explicit instruction of written language, through the development of phonological awareness, to the resolution of oral language difficulties and 2) the repercussions of the early language deficit on literacy acquisition.

Method

Participants

Participants were 20 French-speaking monolingual children (14 boys and 6 girls) diagnosed with SLI at the inter-disciplinary services of Hospitals Lyon-Sud and Debrousse, Reference Centers of the Rhone-Alps area in Lyon, France. The foremost criterion by which we selected our participants was that they had a history of expressive and/or receptive language delays (significant discrepancy between VIQ and PIQ, according to the Wechsler Scales), having neither hearing nor visual difficulties. Among them, only children who had a PIQ score (WPPSI-R or WISC-III scale) superior or equal to 80 were recruited (mean PIQ = 100.85, *SD* = 16.3) and only those who at T1 attended the appropriate to their chronological-age school class. Of the

20 children of our initial sample, 11 of them were seen three times and 9 of them two times[1].

From these 20 children we identified two subgroups, according to the class they followed at T1. These consisted of a subgroup A of children at kindergarten (n = 8, mean age 5;3, SD = 4.48) and of a subgroup B of children attending Grade 1 (n = 12, mean age 6;2, SD = 3.08). We should note that at T2 a child (ClG) of subgroup B had to repeat her G1 and at T3 the number of children who repeated a class increased to 4 (DL, JoL, BM and ClG).

At T1 and T2 we also recruited a control group (n = 20) matched at age, sex and PIQ in order to compare our samples phonological skills. At T3 both verbal and nonverbal skills were assessed by an extensive battery of standardized formal tests which provided us the possibility to compare our sample with a large control group.

Materials

Oral language development We administered a test of Grammatical Closure (TCGR-C, Deltour, 2002), which comprises a series of images, presented in couples. A target phrase is given for the first image that the participant is required to complete according to the second image. The test includes 52 items giving a maximum of 52 points. The obtained raw scores were converted to age of development (AD) equivalents.

Phonological awareness

Phoneme deletition: We used a forced-choice task in which the participants were required to delete the initial sound from the beginning of a spoken word and give the remaining sound sequence. At T1 and T2 the stimuli were 18 words presented in pictures and named by the examiner (ex. /boeuf/, [beef], /oeuf/, [egg]). The child is required to choose the target word designed in a picture, among three others, 2 phonological (ex. /banc/, [bench], /neuf/ [new, nine]) and 1 semantic distractor (ex. /viande/ [meat]). At T3 we used the standardized phoneme deletition subtest of ODEDY'S (Jacquier-Roux, Valdois & Zorman, 2002). The stimuli were 10 words given orally and the participants are required to pronounce the remaining word or non-word.

Phoneme blending: For this task administered only at T3 children were required to use the initial sounds from the beginning of two spoken words (e.g. /bonne/, /année/) to produce a syllable (/ba/). The stimuli are 10 pairs of words from the phoneme blending subtest of the ODEDY's. One point was awarded for each correct syllable produced, giving a maximum of 10 points.

Literacy Skills As a measure of the child's current reading attainment we administered two subtests of the K-ABC test (Kaufman & Kaufman, 1993), the reading/decoding (R/D) and the reading/understanding (R/U) subtest. The raw scores were converted to age of development (AD) equivalents.

Word Recognition: The R/D subtest of the K-ABC measures the participant's ability to accurately pronounce French printed words. The stimuli were 38 printed single words.

Comprehension: The K-ABC R/U subtest comprises a series of short phrases (1 to 20 words) that the child is required to read one by one (either aloud or silently) in order to perform the order given by the phrase presented (ex 'Eat', 'Show me how you drink a glass of milk').

Spelling: We administered the spelling subtest of the 'BREV' that comprises a series of 10 words and non-words. In this task, children were asked to spell single words and single non-words and a series of words presented in a sentence context. Table 1 displays the tests administered over the course of this investigation.

Table 1: Summary of the tasks administered.

Task	*T1*	*T2*	*T3*
Oral language			
Grammatical closure		***x***	***x***
Phoneme deletition	***x***	***x***	***x***
Phoneme blending			***x***
Literacy skills			
Reading/Decoding			***x***
Reading/Understanding			***x***
Spelling			***x***

Procedure

In all three times participants were assessed individually over a single session (~1 h) that took place at their home, including breaks so as to avoid fatigue. All measures had a small number of demonstration items in which the examiner provided feedback regarding the correctness of the participant's response.

Results

Oral language development

According to the results we obtained at T2 and T3, the sample of this study (n = 11) diminished significantly, z=-2.5, p=0.013 (Wilcoxon Signed-Rank Test) the discrepancy between their chronological age (CA) and their age of development (AD) at T3. In other words, their skills on oral language at T3 are much closer to the skills attended according to their CA than they are at T2. Only for a single participant (DL) the discrepancy has increased at T3. Figure 1 displays the discrepancy between CA and AD for each participant at T2 and T3. The results of this study are compatible to our hypothesis according to which explicit instruction of written language has eventually a positive effect on oral language development as well. Further analyses indicated that 54.5% of our participants no longer

[1] At T2 9 children were not seen due to lack of parental motivation. However, at T3 we were able to examine our entire sample.

seem to present SLI characteristics if we sustain oral language development as the single criterion (AC-AD < 6 months). On the contrary, 27% of our participants continue at T3 to show a significant discrepancy of more than 2 years between their CA and their AD.

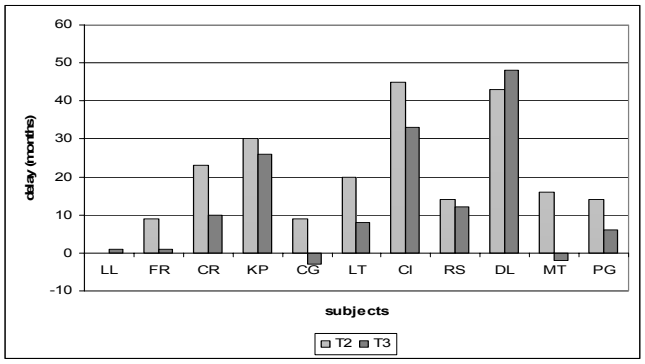

Figure 1: Delay at oral language development (AC-AD) at T2 and T3 for each of the participants.

Phonological awareness development in relation to literacy development

In order to assess our samples' (n = 20) deviancy from normal development on the tasks of phoneme deletion (Ph.D.), phoneme blending (Ph.B.) and spelling (S) we used a modified *T*-test (Crawford et al. 2004) based on the mean and *SD* of the controls and the control sample *N* (we used standardized measures). The scores that fell below $p < .05$, one tailed[2], were considered statistically significant and were taken as an indication that the participant has a deficit on the task in question. Table 2 displays the raw scores at T1 and T3 on Ph.D, Ph.B and S for each participant.

On the contrary, raw scores on reading tasks, R/D and R/U, and oral language (TCGR-C) were converted to AD equivalents, where only delay of more than 6 months was considered as significant. Figure 2 displays the prevalence of children showing delay on word recognition (R/D task), comprehension (R/U task) and oral language (TCGR-C task) at T3. We, then, compared the deviant scores on phonological tasks with the literacy skills for each participant. Our goal was to highlight plausible persistent deficits in phonological awareness and their effect on literacy acquisition. The results we obtained, lacking strict regularity, seem to underline by large the heterogeneity of SLI children.

Table 2: Individual raw scores on phoneme deletition (Ph.D.), phoneme blending (Ph.B.) and spelling (S)

	Ph.D.(T1)	Ph.D. (T3)	Ph.B. (T3)	S. (T3)
RS	**4***	4	8	**5.5****
DL	**3***	6	3	**2*****
JoL	**2****	2	3	**3*****
MT	5	2	3	6,5
JL	**4***	10	7	7,5
GM	6	7	2	7
FG	5	6	5	7,5
PG	6	7	6	**4.5****
LL	**5****	9	6	**4****
AP	**4****	6	7	**3*****
FR	**4****	10	7	**3.5****
NM	8	7	**3***	**4****
CR	**4****	9	7	**4****
CN	**5****	7	7	**5***
KP	**2*****	8	4	**3*****
CG	10	10	7	**4.5****
GB	**4****	7	10	5,5
BM	**4****	4	6	**3*****
LT	11	6	10	**5***
ClG	**5****	5	0	**4****

* $p < .05$; ** $p < .01$; *** $p = .001$.

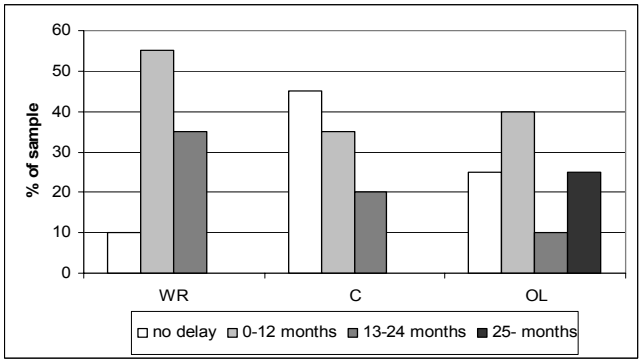

Figure 2: Prevalence of children showing delay on word recognition (WR), comprehension (C) and oral language (OL) at T3.

However, there seem to be two undeniable facts about T3· On the one hand, our entire sample presents non-deviant skills on phonological tasks and on the other hand 91% of it presents a significant difficulty on spelling, even children who no longer present any delay at phonological awareness. As far as reading skills are concerned, 35 % of our sample presents an important delay of 13 to 24 months in the R/D task. However, the R/U skills of our sample are better, with 45% of them presenting no delay. We could therefore, wonder if they use semantic access instead as it is often suggested being the path used by dyslexics. Finally, 35% of our sample continue to present an important delay of 13 to more than 25 months on their oral language, even after 2 (group A) or 3 (group B) years of schooling. Over all, our

2 We used one-tailed tests as it is the tool mostly recommended in single-case research; as Crawford et al. 2004 suggest 'they are more powerful and are legitimate given that the possibility of enhanced performance in the patient can be discount except in very rare and highly specific circumstances' (p. 754).

results corroborate with those obtained in Anglo-Saxon longitudinal studies of SLI children, according to which SLI children are at risk for literacy problems.

Discussion

The main findings of the present study can be summarized as follows. The first one, largely suggested by our data is that children with SLI eventually improve their utterances and develop their phonological skills through the acquisition of grapho-phonemic correspondences (GPC) and the development of literacy skills. According to our results, our entire sample after 2 or 3 years of schooling showed no delay compared to normally developed children on phonological awareness, being able to handle phonemes sufficiently on metaphonological tasks. Moreover, 91% of our sample decreased significantly the discrepancy between their AD and their CA at their utterances. However, according to our study 45% of our sample continues to exhibit a delay of more than 6 moths in oral language development (8 to 48 months).

The reason why we evaluated the level of phonological awareness using the deletition task is that such tasks rank highly among phonological awareness tasks in predicting reading achievement (Torgessen et al, 1994). At T3 we proposed a second phonological task to explore a bit further the metaphonological skills of our sample. Recent research has consistently shown that the acquisition of GPC improves the phonological skills of children, and consequently their level of phonological awareness. The acquisition of the alphabetical code contributes significantly to the sensitivity of children with SLI on the phonemic aspects of their language. However, it seems of great importance to highlight the fact that although our sample seems to have acquired over time a certain level of phonological awareness, their skills remained mostly task-specific. In other words, they seemed unable to generalize the use of this knowledge to tasks other than phoneme deletition and phoneme blending, such as reading and spelling that require a high level of phoneme manipulation.

The second most important finding of our study is related to the difficulties that children with SLI exhibit on reading (word identification and comprehension) and spelling. Recent literature provides evidence that certain children with a history of SLI in spite of a clear improvement of their language impairment have difficulties learning to read and tend to be rather poor readers. This type of results is awaited if we make the assumption that there is a causal connection between oral language development and literacy acquisition, independently of the direction of influence. Eventually, a certain number of SLI children after 2 or 3 years of normal schooling present a level of phonological skills close to the standard. Thus, we could expect literacy skills in line with their phonological skills since the second ones seem to be of great importance for the acquisition of reading· yet this is not the case.

To go further, one can also wonder about the potential of children with SLI to truly take advantage of the explicit instruction of written language as it is at present provided. The metaphonological skills that emerge due to explicit instruction will specify the representations stored in the lexicon· yet one does not find the attended repercussions in tasks requiring a spontaneous activation of the phonological representations such as spelling for example. We argue, that the early phonological representations developed due to oral language exposure do indeed become better specified during literacy acquisition. However, they somehow preserve the traces of the early deficit, and this is regularly documented in literacy tasks. In other words, although the phonological representations seem to have approached normal levels of specification, the manipulation of them remains overdrawn. We, therefore, conclude that although in some cases of SLI children the speech problem may seem to have resolved, yet the underlying phonological processing problem persists and interferes with later literacy development.

Conclusion

In the light of the above we would argue that reality is set between two positions: a minimum level of phonological awareness is important for the acquisition of literacy skills; literacy acquisition helps the child develop his phonological awareness. An efficient system of phonological coding, which allows good performances in all kinds of phonological tasks improves both oral and written language. Any default in the system of speech processing will have repercussions in the development of written language. As a consequence, children with a history of SLI are bound to develop less precise phonological representations, which is consequently reflected on literacy skills.

Our results have consistently shown that a history of SLI seems to be an important factor for literacy difficulties, agreeing with those obtained in Anglo-Saxon longitudinal studies. However, at the same time they raise a number of questions concerning the exact nature of the deficit and its repercussions that seek to be tested in future studies. It is important to highlight the issue of the heterogeneity SLI children which is present throughout our study. The variety of performances observed in our study in all five variables oral language, phonological awareness, reading, comprehension and spelling are attributable to the great heterogeneity of the disorder. Due to the relatively limited sample of participants of our study we did not take into consideration any inter-individual variables during the discussion of our results. Although our research has documented the relationship between language impairment and literacy difficulties, it has not clearly specified the exact nature of this association. Factors responsible for the lack of specificity include the relatively small size of participant sample and the limited consideration of subgroups of children with SLI.

The importance of factors such as the acquisition of the grammatico-syntactic rules and the expansion of the vocabulary has already been discussed in literature. As far

as our study is concerned it would have been interesting to measure the vocabulary of our participants and to examine its role on language and literacy development. The pursue of longitudinal studies on SLI children beginning-readers will eventually define our comprehension of the nature of the early phonological deficit and its repercussions on literacy acquisition in order to eventually be able to propose effective means of instruction of literacy and phonological skills.

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