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Developmental Dyslexia and Sensitivity to Rhymes : A Perspective for Remediation

Elisabeth DEMONT

Introduction

- 1 Developmental dyslexia is defined as the failure to acquire age appropriate reading skills in spite of adequate educational resources in otherwise normally developing children. The field of dyslexia research is dominated by the phonological deficit explanation which Stanovich (1994) summarized quite succinctly: "Most cases of reading disability arise because of difficulties in the process of word recognition. These difficulties are, in turn, due to deficiencies in processes of phonological coding whereby letter patterns are transformed into phonological codes. The precursor to the phonological coding difficulty appears to be a deficit in segmental language skills sometimes termed phonological awareness or phonological sensitivity" (p. 585).
- 2 Phonological awareness deficits in dyslexia have been documented by many researchers in many languages (Goswami, 2000 for a succinct review). The term phonological awareness covers various phonological segments (syllable, onset-rime, phoneme) and several manipulations. The phoneme level is of critical importance for understanding the alphabetic principle (see Snowling, 2000 for a recent review of the field). Indeed, learning to read an alphabetic orthography requires the child to set up a system of mappings between the letter strings of printed words and the phonemic sequences that comprise spoken words. So, acquiring the ability to bring the phonemes to consciousness is a critical step in learning to read. A strong link has been drawn between reading difficulties and deficits in phonological skills. One hypothesis that has been put forward to explain the reading difficulties of dyslexic children is that they come to the task of learning to read with poorly specified phonological representations (*e.g.* Colé & Sprenger-Charolles, 1999; Curtin et al., 2001; Joanisse et al., 2000; Mayringer & Wimmer, 2000; Metsala, 1999; Pennington et al., 2001). There is evidence that difficulties with phonemic awareness predict subsequent reading problems. However,

from the perspective of reading acquisition, it has been argued that literacy experience is crucial for the development of phonological awareness and there is some evidence that exposure to alphabetic literacy may affect phonological processing more generally. Thus, the representation of phoneme-level information is thought to develop with the acquisition of literacy, because the feedback provided by graphemic information helps the child to represent segmental information at the phonemic level. It follows that the phonological deficits that are marked among dyslexics may be a consequence as much as a cause of their failure to learn to read.

- 3 In summary, a strong case has been made for a link between phonological awareness and alphabetic literacy acquisition (for an extensive review, see Ehri et al., 2000; Gombert, 1992). On the other hand, studies of the development of phonological skills show that young children do not experience any difficulty in manipulating phonological units larger than phonemes. While preliterate readers show poor awareness of phonemes prior to being taught to read, they can show a certain representation of phonological segments corresponding to syllables or rimes. Moreover, children's global sensitivity to these larger units is a predictor of children's success in learning to read (e.g. Bryant et al., 1990; Duncan et al., 1997).
- 4 It is nonetheless regrettable that reading disabilities and phonological awareness have usually been treated in somewhat global terms. The present study aims to determine whether the cause of dyslexia is general impairment at the level of phonological representations whatever the phonological units or is an exclusive impairment at the phonemic level. The primary purpose of this article is to compare the phonological awareness of dyslexics with that of normally achieving readers using a traditional word reading level match in order to determine whether dyslexics differ from normal readers in their pattern of relative strengths and weakness in the cognitive processes thought to underlie reading.

MethodParticipants

- 5 19 dyslexic children were recruited from a special school for dyslexics. At the time of first participation, they were about 10;3 years old and had started their 1st year in this special school (Table 1). They had no speech or articulatory problems or neurological deficits and presented with more than three years' delay in reading fluency assessed with Lefavrais's *Alouette* test (1967). At the first test point, they were matched for reading level with 25 average first-grade readers (mean age 6 years 6 months). Non-verbal intelligence was assessed with the Raven's Progressive Matrices (1981) which located the two groups at the 90th centile. All were predominately from middle-class homes.
- 6 All children were tested on two occasions separated by 8 months with a battery of phonological awareness and reading abilities tasks.

Phonological awareness tasks

- 7 The phonological awareness tasks required the child to identify phonological segments of different sizes within individual words. Each task consisted of two practice items with corrective feedback and eight experimental items without further feedback.

Phonological oddity tasks

- 8 These tasks required the child to classify spoken words on the basis of subsyllabic units, rhyme or onset. The child had to select from four monosyllabic words one word which lacked a sound in common with the other three. In the *rhyme oddity task*, three words shared a rhyme unit not present in the fourth (e.g. **noire-poire-robe-foire**); in the *onset*

oddity task, three words shared a common onset (e.g. **cl**ou-bruit-clan-clé). In a third set, a *final oddity task*, three words shared a word-final phoneme not present in the fourth (e.g. tâ**che**-bû**che**-ric**he**-pour). The order of the odd word was systematically varied so that it occurred equally often in each position. Scoring was based upon the number of correct items.

Phoneme deletion tasks

- 9 The tasks consisted of eight items from which the initial phoneme was to be deleted (e.g. **g**ris), eight from which the middle phoneme was to be deleted (e.g. **tr**ain) and finally eight items from which the final phoneme was to be deleted (e.g. **m**). The child had to work out what a word would be like without its initial, middle or final phoneme. Scoring was based upon the number of correct responses.

Reading measures

- 10 Word reading: The child was required to read one 16-words list in which eight words were regular (e.g. *porte*) and eight were irregular (e.g. *femme*). Scoring was based upon the total number of regular and irregular words correctly identified.

Non-word reading

- 11 Non-word reading is a good measure of phonological recoding skill, since sublexical level spelling-to-sound correspondences must be invoked. The child was required to read one 16-non-words list in which eight non-words were matched in orthography with regular words (analogous non-words) and eight were not matched (non-analogous non-words, e.g. *loumi*). Analogous non-words (see Goswami et al., 1998; Sprenger-Charolles et al., 1998) were formed by modifying the initial consonant letter of regular words (e.g. *table* vs *mable*). Thus the analogous non-words have the same rhyme as the words from which they are derived. Scoring was based upon the total number of analogous-non-words and non analogous-non-words correctly identified.

Statistical analysis

- 12 Dyslexic and beginning reader performances were compared for each cognitive measure separately using ANCOVA with non-verbal intelligence as the covariate and session as the repeated-measures variable.

Results

- 13 Means and standard deviations on phonological and reading measures are displayed in Table 1.

Table 1

Means and standard deviations for each of the phonological and reading measures (out of 8)

	First session			Second session		
	Dyslexics	Normal readers		Dyslexics	Normal readers	
Class	1 st year (1)	1 st grade		2 nd year (1)	2 nd grade	
Chronological age (years)	10;3	6;6		11;1	7;2	
Reading age (years)	6;8	6;8		6;11	7;4	
Alouette score	63.21 (4.58)	57.40 (4.00)		82.21 (5.96)	103.80 (5.19)	
PHONOLOGICAL AWARENESS MEASURES						
Rhyme oddity task	5.10 (.44)	4.80 (.38)	ns	5.89 (.37)	5.76 (.32)	ns
Onset oddity task	4.36 (.47)	2.96 (.41)	*	4.42 (.49)	4.88 (.42)	ns
Final oddity task	3.63 (.37)	2.56 (.32)	*	3.68 (.41)	4.00 (.36)	ns
Initial phoneme deletion	2.95 (.60)	3.44 (.52)	ns	3.44 (.52)	4.60 (.40)	*
Medial phoneme deletion	4.32 (.69)	4.08 (.61)	ns	3.84 (.62)	5.68 (.54)	*
Final phoneme deletion	4.53 (.46)	4.24 (.40)	ns	4.16 (.46)	5.24 (.40)	ns
READING MEASURES						
Regular word reading	6.58 (.33)	7.04 (.29)	ns	6.89 (.26)	7.44 (.22)	ns
Irregular word reading	2.68 (.36)	1.20 (.32)	**	4.21 (.48)	5.08 (.42)	ns
Analogous non-word reading	5.63 (.44)	6.44 (.39)	*	5.84 (.35)	6.76 (.30)	*
Non-analogous non-word reading	4.53 (.47)	5.48 (.42)	*	4.84 (.37)	6.48 (.32)	*

Note. (1) 1st year or 2nd year at special school - * $p < .05$; ** $p < .01$

Phonological awarenessPhonological oddity tasks

- 14 The comparisons of mean scores for each test separately on analysis of variance showed a Group by Session interaction for the onset oddity test [$F(1,41)=3.90$; $p < .05$] and for the final oddity test [$F(1,41)=6.71$; $p < .01$] but no significant interaction for the rhyme oddity test [$p > .10$]. Post-hoc inspection (Newman Keuls) of these significant interactions revealed that, although the dyslexics performed better than the younger readers in the first session, there was no group effect in the second session. This was due to the fact that the beginning readers' performances increased significantly between the two sessions, whereas those of dyslexics did not.

Phoneme deletion tasks

- 15 Again, session interacted significantly with group in the comparison for the initial phoneme deletion task [$F(1,41)=4.5$, $p < .05$] and for the medial phoneme deletion task [$F(1,41)=4.02$, $p < .05$] reflecting the fact that the performances of the dyslexics did not improve between the two sessions, while those of the reading age controls did. So at the second test point, the dyslexic children exhibited a lower performance on the phonemic awareness tasks than the younger beginner readers, even though they both started with a similar performance at the first session.

Reading abilitiesReading age

- 16 The Group by Session interaction [$F(1,41)=8.64$; $p < .01$] is striking in showing that the reading-age controls show the expected increase in reading age in the eight months between the two sessions, whereas the improvement in the dyslexics' reading is only three months.

Word reading

- 17 The three-way interaction between Group, Word, Session is significant [$F(1,41)=4.46$; $p < .05$]. This reflects the fact that, whereas the dyslexics performed at the same level than

the reading age controls on regular word reading in the two sessions, a different pattern was observed for irregular word reading. Indeed, although the dyslexics performed better on irregular words (2.68 out of 8) than the first-grade children (1.20) in the first session, there was no difference between the groups in the second session (respectively, 5.08 and 4.21). This reflected the fact that the beginning readers' performances on irregular words improved more than those of the dyslexics.

Non-word reading

- 18 Whatever the session, the dyslexics were found to read non-words with lower accuracy than the beginning readers [$F(1,41)=5.76$; $p<.05$]. On the other hand, the three-way interaction between Group, Nonword, Session [$F(1,41)=4.60$; $p<.05$] is striking in showing that only the beginning readers' performance improved significantly (rising from 5.48 to 6.48 out of 8), whereas the dyslexics did not improve (4.53 in the first session vs 4.84 in the second session). Finally, the normal readers appeared to read more analogous non-words only in the first session, whereas the dyslexic children appeared to significantly better at reading the analogous non-words than the non-analogous non-words in the two sessions. So because the dyslexics exhibited rather accurate analogous non-word reading, they seem to use an analogy strategy for reading more accurately.

Discussion

- 19 At the first test point of this study, the dyslexics were matched for reading level with younger beginning readers and were studied at two points using various phonological and reading tasks. The longitudinal observation of the same children was a key feature of our study and allowed us to determine the development of phonological awareness skills in dyslexic children in comparison with beginning readers. Several results may be underlined.
- 20 Firstly, both groups of children seem to be using a decoding strategy in reading as a regularity effect is apparent in their word reading. Nevertheless, a nonword reading deficit is uncovered amongst the dyslexics suggesting that their use of a decoding strategy is less efficient than younger normally achieving children matched on reading age. The low efficiency with which the dyslexic children read non-words is consistent with the phonological deficit explanation of dyslexia which affects learning to read *via* impaired acquisition of grapheme-phoneme correspondences. It was emphasized that a non-word cannot be read through a direct match with a representation previously stored in lexical memory. So for dyslexic children, it can be ruled out that the non-word reading difficulty is due to insufficient knowledge of grapheme-phoneme correspondences even after four years of tuition and intensive remediation. This leads to difficulties in the reliable recognition of non-words or new words.
- 21 Secondly, when we started testing, the dyslexic children performed at the same level or even greater level of accuracy than the reading age controls on phonological tasks. So, we postulate that their performance on these tasks reflects the profits of special education. On the other hand, their superiority on phonological oddity tasks seems to us to be due to the high mnemonic component of these tasks that could penalize the youngsters. Afterwards, the longitudinal observation showed that the beginning readers' performances increased significantly between the two sessions, whereas those of the dyslexics did not. For the phoneme tasks and for the two phoneme versions of the oddity tasks (onset and final), the dyslexic children do not improve in the second session despite intensive remediation at this level. So, the phonological awareness is

hardly developing at all in the dyslexic children, even though it does develop in the controls. Clearly the specialised remediation is helping the dyslexic children to some extent at Session 1 but this disappears at Session 2 when the normally developing children have caught up. Hence the dyslexics are showing specifically phonemic deficits in terms of the developmental design. In other words, the persistence of the phonemic deficit in spite of the remediation suggests that difficulties with phonemic representation appeared to be at the core of reading disabilities.

- 22 Thirdly, it was found that the dyslexics had little or no difficulties with the rhyme identification and were impaired on the phonemic tasks (the phoneme deletion tasks and the two phoneme versions of the oddity task). This finding indicates that dyslexics experience long-lasting difficulties with the highest level of abstraction, the identification and manipulation of phonemes but no difficulties with the larger units, like rhymes, which can be considered to be salient units (Goswami & Bryant, 1990). The present finding is consistent with the hypothesis that the reading difficulties of dyslexics are being caused by a current deficit in accessing the phonemic level of speech. So dyslexics seem not to acquire complete facility at the phonemic level, despite the fact that remediation is usually directed at this level. It is also necessary to distinguish between processes which have a different cognitive status depending on whether or not they are consciously accessible. Performances achieved in the rhyme detection task might reflect epiphonological processing (Gombert, 1992), *i.e.* an “implicit phonological awareness” according to Seymour et al. (1999). Indeed rhyming ability need not imply conscious knowledge since the children may make judgements on the overall phonological similarity between words (Duncan et al., 1997). In contrast, the performances achieved in the two phoneme versions of oddity tasks and the phoneme tasks might reflect metaphonological processing or an explicit awareness. In consequence to this view, we postulate that dyslexics -like pre-literate children- may develop an implicit awareness of rhyme. Since tuition and remediation in sound-to-symbol correspondences has not been successful for dyslexics, interventions are required to facilitate progress. So an educational implication of our hypothesis is that dyslexics may be better able to benefit from instruction about larger units like rhymes. This might induce the dyslexics to use their implicit knowledge in their attempts at reading and to develop an orthographic analogy strategy for reading new words.
- 23 Finally, from the perspective of reading acquisition, phonological recoding functions as a self-teaching mechanism (Share, 1995) enabling the learner to acquire the detailed orthographic representations necessary for rapid and visual word recognition. In particular, orthographic development may normally be a process which moves forward from mastery of small units towards large units. In dyslexia this development seems not to occur in a normal way. Indeed, our results emphasized that, while dyslexics showed deficits on phonemic awareness compared with children matched on reading level, their word reading abilities -but not their non-word reading- nonetheless improved between the two sessions. This finding seems to provide an evidence for an improvement in their orthographic knowledge. In other words, dyslexics are able to learn to recognize whole words but have difficulty in adopting a small unit phonemic approach. This leads us to wonder about the nature of orthographic strategy development. At present, we postulate that dyslexics’ rhyme awareness underpins orthographic development. In particular, dyslexics might make use of their rhyme sensitivity in order to group words into rhyming families sharing the same

orthographic pattern and to develop an analogy strategy to read new words. In this prospect, the dyslexics' superiority on analogous non-words reading supports our hypothesis that dyslexics could benefit from tuition in an orthographic analogy strategy for reading new words. If so, our interpretation disagrees with Sprenger-Charolles & al.'s (1998) conclusion. Indeed, these authors attribute the advantage for the analogous non-words to the oral lexicon rather than to the orthographic one.

- 24 So, one interesting question is whether a relationship exists between sensitivity to rhymes and the much later emphasis on this structure in orthographic development. Further research, involving training studies, is required to clarify this hypothesis. Evidence for this relationship might be provided by training children on manipulation of rhymes. We postulate that the trained children could increase their rhyming skills and their capacity to group words into rhyming families. In consequence, they might obtain better performances on reading tasks. If this were to be the case, it might then be open to teachers to adapt some of the techniques for investigation of large unit processing in order to gain an understanding of these linguistic units.

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ABSTRACTS

We designed this study as a comparison of the language processes of word recognition skills in dyslexics and beginning readers matched on reading level at two time points. Results from the battery of phonological processing tasks support the findings of previous studies that a phonemic deficit is the dominant cognitive deficit of dyslexics. Another interesting result shows that while the beginners' performances in all tasks increases between the two sessions, this is not the case for dyslexics. At the second test point, they exhibit a lower performance than the younger beginning readers. However, they show an improvement in orthographic knowledge. We postulate that dyslexics' rhyme awareness might underpin orthographic development. If this were the case, it might then be open to teachers to adapt some of the techniques for investigation of large unit processing in order to gain an understanding of the linguistic units.

L'objectif de l'étude consistait à comparer à deux reprises les habiletés phonologiques et la reconnaissance de mots d'enfants dyslexiques appariés initialement sur l'âge lexique à des

enfants apprentis-lecteurs. Les résultats recueillis aux différentes épreuves phonologiques sont congruents avec les conclusions d'études antérieures soulignant que le déficit phonémique est le déficit cognitif majeur des enfants dyslexiques. Un autre résultat intéressant met en évidence que les performances des enfants dyslexiques n'augmentent pas d'une session à l'autre, contrairement à ce qui est observé pour les apprentis-lecteurs. Ils obtiennent ainsi lors de la deuxième session des performances inférieures à celles des normo-lecteurs. Cependant, leurs résultats attestent du développement de leurs connaissances orthographiques. Nous postulons ainsi que les enfants dyslexiques s'appuieraient sur leur sensibilité aux rimes pour développer leurs représentations orthographiques. Si tel est le cas, il serait envisageable d'adapter des techniques de remédiation au niveau des unités plus larges en vue d'améliorer leur compréhension des différentes unités linguistiques.

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Keywords: phonological awareness, developmental dyslexia, reading disabilities, sensitivity to rhymes

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