READING POTENTIAL AND DYSLEXIA

by
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The phonological deficit hypothesis, viz. that children's phonological deficits are the main cause of dyslexia and poor reading comprehension, has several critical deficiencies, especially from a pedagogical viewpoint. By directing our attention to the true reading potential of dyslexic children, we see that the effect of phonological deficit on reading acquisition may not be so great as many researchers have assumed. For, by properly defining reading potential as Listening Comprehension x (1 - Written Word Comprehension x Written Language Integration), reading potential can be equated with degree of dyslexia; similarly for educational potential. Furthermore, by decomposing Listening Comprehen-sion into Spoken Word Comprehension and Spoken Language Integration, we can account for the main thrust of the phonological deficit hypothesis. Thus, in this view, coupled with an ideal meaning-based reading program, we can predict that dyslexic children will learn to read based on their degree of reading potential.

Introduction

The phonological deficit hypothesis maintains that the main cause of dyslexia is an impairment at the level of phonological repre-sentation. This view has predominated in the field of dyslexia research (e.g., Frith 1997; Liberman and Liberman 1990; Snowling 2000; but see Wolf and Bowers 1999). However, inspection of this hypothesis reveals several defects especially from an educational viewpoint. First, we review such problems involving the two standard definitions of dyslexia. We then direct our attention to the basic fact that the essence of reading is to extract meaning rather than sound from print, thus minimizing or rendering almost irrelevant the effect of phonological deficit on reading acquisition. This is done by highlighting the reading potential of dyslexic children.

Reading Potential

Reading potential has been basically defined as listening comprehen-sion minus reading comprehension (cf. Sticht and James 1984). One important educational implication of reading potential is the promotion of meaning-oriented reading instruction, e.g., Doman's (1965) seven-step program, Johnston et al.'s (1995) book-experience approach, and Steinberg's four-phase program (Steinberg 1982; Steinberg, Nagata, and Aline 2001), all of which emphasize meaning with no explicit phonic instruction given to children. The goal of learning to read is to extract meaning from print on the basis of listening comprehension; this is the fulfillment of reading potential. In this way, the education of dyslexic children becomes more concrete and tractable.

Problems with the Phonological Deficit Hypothesis

The phonological deficit hypothesis is based on the finding that a lack of phonological awareness occurs with failure in reading. Phonological awareness is defined operationally by measurements of various metalinguistic tasks such as speech segmentation, phoneme synthesis, phoneme deletion, rhyming, and phoneme reversal tasks. Evidence that dyslexic children and poor readers are not good at these metaphonological tasks has accumulated (e.g., Bradley and Bryant 1983; Fox and Routh 1980; Frith 1985; Liberman and Liberman 1990; Snowling 2000; and Treiman and Baron 1981).

Given such findings, the phonological deficit hypothesis has been formulated, claiming that awareness of phonemes, the minimum linguistic unit, affects understanding of a written text, the maxi-mum linguistic unit. There must be a long causal chain to mediate between these variables. To date, adherents of the phonological deficit hypothesis have not yet formulated the necessary causal chain. (It should be noted that although bottleneck effects may be a quick answer here, the questions as to how bottom-up and top-down processes interact with each other and what sub-skills are interrelated remain open.)

Phonological awareness seems to help the learning of associations between written words and words spoken by others. How might children acquire such associations in the course of reading acquisition? Let us consider the views of one phonological deficit advocate, Frith (1985). Frith offers a three-phase developmental model for normal English-speaking children. The initial phase of this model is characterized as logographic reading, whereby children can instantly recognize familiar words, capitalizing on salient graphic features as important cues. The second phase is called an alphabetic reading stage, where children acquire and use knowledge of individual phonemes and graphemes, and their correspondences. The third phase involves the instant analysis of words into orthographic units (e.g., morphemes) without phonological conversion.

Frith claims that logographic failure is rare, but that most dyslexic children fail to make a smooth transition from the initial logographic phase to the second alphabetic phase. According to Frith and others, dyslexics fail because they have phonological deficits. They call this view the phonological deficit hypothesis. Given the afore-mentioned findings supporting a correlation between phoneme awareness and reading achievement, this hypothesis might seem plausible, even though correlation does not imply causation. Liberman and Liberman (1990) go so far as to state that 'of all possible tests, the kind that measures some aspect of phonological awareness is the best single predictor of reading achievement' (p. 64).

However, the phonological deficit hypothesis has some serious weaknesses. The hypothesis may be valid only if one or both of the following assumptions are granted: (1) that phonological awareness is a prerequisite to reading, and (2) that children with phonological deficits are best taught with a phonology-based reading method.

Neither of these assumptions is supportable (cf. Miller 1972). Regarding the first assumption, let us consider the cases of some congenitally and profoundly deaf people who become average or above-average readers (e.g., Chincotta and Chincotta 1996; Kelly 1993; Waters and Doehring 1990). In such cases, the effect of phonological processing on reading acquisition is negligible,

because these readers cannot hear speech to any significant degree. Waters and Doehring (1990), in testing deaf children and adolescents educated in oral programs, found that the subjects' ability to use phonological coding was not related to reading achievement, and further that those deaf subjects failed to display the regularity effect on a lexical decision task (i.e., response latencies were the same for phonologically regular and irregular words). Thus, with little or no phonological coding, many deaf people can utilize visual coding. Since many deaf people can utilize visual coding and learn to read well, there is no reason to believe that hearing people (with or without phonological deficits) cannot do the same. Indeed, Cain, Oakhill, and Bryant (2000) reported that both good readers and poor readers obtained comparable scores on phonological awareness tasks such as rhyme production, phoneme deletion, word reversal, and spoonerisms (transposing the initial sounds in a word pair, e.g., Billy sat ∅ silly bat). Also, some case reports of young readers suggest that explicit phonological teaching is unnecessary in learning to read (e.g., Steinberg and Steinberg 1975; Fletcher-Flinn and Thompson 2000). Such readers would have failed most, if not all, phoneme awareness tasks if they had been tested at early stages; nevertheless, they became excellent readers.

These cases of young readers also constitute evidence against the second assumption. For example, in the case of Kimio, the subject of Steinberg and Steinberg (1975), some 200 written words were acquired by the age of two years and six months. In the course of learning many written words, he soon induced grapheme-phoneme correspondence rules even though he was not explicitly taught such rules by his parents. The point here is that the role of phoneme awareness can be small, depending upon characteristics of reading instruction. We will return to this issue later.

We also note that very many logographic words such as Japanese kanji (Chinese type characters) are learned directly in a holistic manner, where the effect of phonological deficits on learning is necessarily at a minimum. Thus, dyslexic children in Japanese can name hundreds of kanji words. There is, therefore, no reason to believe that alphabetically constructed words could not be learned in

the same way as kanji. (Note that a good reader has acquired many sight words which seem to be processed like kanji.) Liberman and Liberman's (1990) statement above would hold only if the children tested were taught reading through a phonics type method; only then could phonic achievement be highly correlated with both phonological awareness and reading achievement.

Are Dyslexic Children Arrested at the Alphabetic Phase?

Let us return to Frith's three-phase developmental model of reading acquisition. We will ask why children generally start with the logographic phase rather than directly engaging the alphabetic phase. The answer obviously is that logographic reading is easy and natural. Such being the case, why should we make children move on to a more difficult and less natural phase, that of alphabetic reading? As a matter of fact, there is no compelling reason to directly teach the alphabetic principle if, as Steinberg (1982) and others have demonstrated, children naturally induce the alphabetic principle through a meaning-based learning method. Unfortunately, teachers and parents shift their children's attention to the alphabetic phase because of their ill-founded belief in the efficacy of phonics.

Liberman and Liberman (1990) believe that reading is not natural and thus is not like speaking. They claim that

> in order to develop speech, the normal child need only be in an environment where language is spoken; reading, on the other hand, almost always requires explicit tuition (p. 55).

However, what if reading does not require explicit tuition or requires it only to a minimum extent? If reading acquisition can be inductive and subconscious, then Liberman and Liberman would have to say that reading is, like speaking, natural, and endorse a whole language method. Again, case studies such as Steinberg and Steinberg (1975) and Fletcher-Flinn and Thompson (2000) are of relevance here. Steinberg and Steinberg, for example, reported a case of a toddler who spontaneously learned written words and

phrases before he began to utter such words and phrases! (See also Doman 1965:124-125; Steinberg et al. 2001:115-118).

Some researchers think that it is easy to teach a few words in a logographic reading manner, but that children would be overwhelmed when they encounter a large number of words. That such is not the case can be apparent when we review the many cases described in Steinberg et al. (2001).

Problems with the Two Current Definitions of Dyslexia

There is much unnecessary confusion in dyslexic education. The main reason seems to lie in the two prevalent definitions of dyslexia, one involving phonological deficit and the other involving intelligence. Unfortunately, both serve to limit success in reading.

Regarding the first definition, Frith (1997) states,

> If we define dyslexia as a phonological deficit regardless of difficulties with written language, then it should exist in many different languages regardless of the writing system, and even in pre-literate societies. However, if we define dyslexia primarily as a problem in the acquisition of written language, then we can probably identify the condition only in alphabetic writing systems (p. 10).

Aside from the validity of this statement, Frith in both definitions implicates phonological deficit as the defining feature of dyslexia. But a phonological deficit, if it is a fundamental problem for reading, must also be one for language in general. If the child has a phonological deficit, this implies that he/she has a language deficit; in other words, the child has not only dyslexia but, more fundamentally, a specific language impairment (SLI). Actually, dyslexic children <u>do</u> seem to have phonological and syntactic deficits (e.g., Godfrey et al. 1981; Shankweiler 1989; Crain 1989), although the relationship of SLI, phonological deficit, and dyslexia still remains unclear. This suggests that language potential for dyslexic children should be defined as the normal language ability

minus their linguistic ability. Such language potential, therefore, is difficult for dyslexic children to achieve. Given this regrettably complex and vague situation, where should the reading teacher begin? Certainly not with meaningless activities such as phonological segmenting exercises!

Surprisingly enough, many proponents of the phonological deficit hypothesis recommend such meaningless and often boring activities as the first step in reading instruction (e.g., Bradley and Bryant 1983; Lundberg, Frost, and Petersen 1988). Liberman and Liberman (1990) obviously disagree when they remark,

> Code Emphasis can be carried out in a pleasant, game-like atmosphere, with children participating happily, with rapidly growing understanding of the alphabetic principle (p. 71).

We would say rather, 'Children should enjoy exciting reading activities from the outset!'

The second definition of dyslexia which involves intelligence is a long-standing one. According to Stuart-Hamilton (1995), the definition of dyslexia is

> a profound reading difficulty (although note that there is evidence of some reading ability) which is not commensurate with the subject's intelligence, and which occurs in spite of adequate schooling (p. 35).

By this definition, reading potential would be viewed as intelligence minus reading comprehension. However, this definition does not seem to have pedagogical usefulness. First, how can we ascertain that the child's schooling is adequate? Second, intelligence can be viewed differently (e.g., Sternberg 1985). Finally and most importantly, the relationship between intelligence and language (and thus reading) is controversial (e.g., Chomsky 1967; Putnam 1967; see Steinberg et al. 2001, for a review). For example, if, as Chomsky claims, language is independent of intelligence, then reading should be independent of intelligence as well. If so, the issue and measures of intelligence are irrelevant to the issue of reading acquisition. On

the other hand, if following Putnam (1967), we claim that language is the product of 'general multi-purpose strategies', which is the basis of intelligence, then it would mean that reading is also the product of such strategies. However, no specifics have been available concerning how language is derived from such strategies. At any rate, unless these problems are resolved, it is vacuous to say that our goal is to close the gap between dyslexic children's reading ability and their intelligence.

A New View of Dyslexia

We hereby offer a more concrete and practical way of viewing dyslexia. Basically we use the following formula:

Formula 1.

Reading Potential = Listening Comprehension – Reading Comprehension.

In this formula, listening comprehension scores may be obtained on a standardized listening comprehension test, and similarly, reading comprehension scores, on a standardized reading comprehension test; the raw scores are transformed into scores which range from 0 to 1 (e.g., percentile/100). The Reading Comprehension score is sub-tracted from the Listening Comprehension score.

While the concept of reading potential is not new (cf. Smiley et al. 1977; Sticht and James 1984), what we propose is different in that for dyslexic children, (1) reading potential is related to the degree of dyslexia, and (2) similarly, reading potential is related to educational potential. According to the formula, the greater the difference score, the lower the reading achievement and the poorer the reader; con-sequently, the lower such reading achievement is, the greater the degree of dyslexia may be. (Note that this formula is not applicable to profoundly deaf people since in their case, listening compre-hension is necessarily zero. Note, too, that in some

cases, negative values may be obtained at some linguistic levels, cf. Healy et al. 1982.)

We propose the following simple principle of reading comprehension (e.g., Gough and Hillinger 1980):

Formula 2.

Reading Comprehension = Written Word Decoding x Listening Comprehension.

This formula states that children's ability to decode written words multiplied by their listening comprehension determines their reading comprehension ability. The basic idea is that if children can decode written words by uttering them out loud, then they will be able to comprehend the written words because, by utilizing their listening comprehension ability, they can 'listen' to the spoken words that they have just uttered. Thus, we may substitute Reading Comprehension in Formula 2 for that in Formula 1 to have a new working formula. However, before doing that, we must carefully examine certain aspects of Formula 2. For, while the formula obviously covers many common cases, it does not cover all. The following is one of the problems.

Word Decoding, by definition, involves the transforming of orthographic codes into phonological codes. This fits in with the prevailing view of reading acquisition. Snowling (2001:38), for example, assumes that at a fundamental level, learning to read, first and foremost, requires the child to set up a system of mappings between orthography and phonology. However, this may not be necessary because, as stated above, the essence of reading is basically to extract meaning from orthography. Then, too, in some cases, word decoding can be performed without eliciting the meaning of the word that was decoded. For example, in reading aloud, a novice reader is often 'too busy reading [aloud]' to understand what he has just seen and uttered (e.g., Rozin and Gleitman 1977). This pheno-menon is quite understandable because one cannot handle two items of information (phonological information and semantic informa-tion) simultaneously unless one

can process at least one of them almost automatically. Supposing that the phonological output is an important outcome of reading activity, the question raised here is which information flow is more natural and easier, Orthography ∅ Phonology (∅ Meaning), or Orthography ∅ Meaning (∅ Phono-logy). Assuming the latter being the case, the goal of Word Decoding in Formula 2 is inadequate unless meaning is accessed. We should thus have Word Understanding replacing Word Decoding.

Then, too, Formula 2 may not account for the baffling finding of Fleisher, Jenkins, and Pany (1979), who successfully trained poor readers (fourth and fifth graders) to read a list of words as rapidly as good readers and then had them read a passage comprised of the practiced words. They found that the successful training did not improve the poor readers' comprehension performances. How can Formula 2 account for this surprising result, which would imply that the poor readers were poor listening comprehenders? (Note that the listening comprehension ability of subjects was not reported in the Fleisher et al. study.) However, this is not the only interpretation. The poor readers might have failed to access meaning despite their newly acquired decoding skills, probably because they were too busy decoding. They were focusing on form and not on meaning. (Cf. Tan and Nicholson 1997, for a successful case of teaching of words in isolation, where speeded word recognition training was combined with the whole word language emphasis on reading for meaning.) Furthermore, even if the poor readers had been average listeners and had become average word comprehenders, they might still have failed to integrate meanings extracted from individual written words.

This last interpretation (but not the others) seems to explain the following case of a Japanese boy. Yamada (in press) reports that a Japanese boy was a poor reader for many years despite the fact that his Verbal IQs (WISC-R, Japanese version) were consistently higher than 112 (full IQs ranging from 114 to 122), and he was able to read many more individual kanji words than his peers. In his sixth grade, the boy displayed a great dissociation between isolated written word under-standing (1 year ahead of his grade) and reading sentence/text comprehension (2.5 years behind his grade) in the face of his normal

listening comprehension. (Note that in the case of Japanese kanji words, meaning is usually accessed faster than phonology, e.g., Yamada 1998). It is suggested that this surprising dissociation emerged because the boy had little sentence/text-reading experience, even though he incidentally learned very many individual words in his everyday life (but see Masonheimer, Drum, and Ehri 1984). We interpret this as suggesting that the understanding of written words in isolation does not necessarily guarantee understanding the same words connected at the sentence/text level (e.g., Yamada 2002). In sum, we emphasize the following non-trivial truism: To understand written words at the sentence/text level, the learner needs to practice the meaning integration of written words at the sentence /text level.

Given this line of discussion, we arrive at the following formula:

Formula 3.

Reading Comprehension = Written Word Understanding x Written Language Integration x Listening Comprehension.

(Note that Formula 2 assumed that the value of Written Language Integration is 1, whereas later discussion has suggested that the value can be smaller than 1).

We now combine Formulas 1 and 3 to provide a resulting new formula:

Formula 4.

Reading Potential = Listening Comprehension x (1 – Written Word Understanding x Written Word Integration),

where the Listening Comprehension, Written Word Understand-ing, and Written Word Integration scores range from 0 to 1.

Interestingly, in diagnosing dyslexic children, no previous study has taken all of the variables in Formula 4 into consideration. Table 1 shows characteristics of some previous studies.

Table 1.

Some Characteristics of Dyslexic or Reading Disabled Children

Case	PA	SWU	WWU	LC	RC	
Cain et al. (2000)		Pos	Pos	-	-	Neg
Cain et al. (2000)		Neg	Pos	-	-	Neg
Yamada (in press)		-	Pos	Pos	Pos[a]	Neg
Smiley et al. (1977)		-	-	-	Neg[a]	Neg
Metsala (1997)		Neg	Neg	-	Neg[b]	Neg
Stothart & Hulme (1995)		Pos	Pos	-	-	Neg
Stothart & Hulme (1995)	Neg	Neg	-	-	Neg	

N.B. PA = Phonological Awareness, SWU = Spoken Word Understanding, WWU = Written Word Understanding, LC = Listening Comprehension, RC = Reading Comprehension.
Pos = Positive, Neg = Negative, - = Not available, a = Discourse level, and b = word level.

In the case of Cain et al. (2000), for example, the poor readers' Written Word Understanding scores would be closer to the normal readers' Spoken Word Understanding scores; however, they were probably poor readers because their Written Word Integration and/or Listening Comprehension scores were low. In the case of Yamada (in press), on the other hand, it is considered that both the Written Word Understanding and Listening Comprehension scores were sufficiently high, but the Written Word Integration score was low, resulting in poor reading comprehension and higher reading potential.

Finally, for the sake of completeness, we must modify Formula 4. One may note that listening comprehension is a global factor which can be decomposed into two main parts, Spoken Word Under-standing and Spoken Words Integration. The latter variable includes syntax, inferencing, and pragmatic knowledge. We thus have the following final formula:

Formula 5.

Reading Potential = (Spoken Word Understanding x Spoken Words Integration) x (1 - Written Word Understanding x Written Words Integration).

While Formula 4 is adequate for most practical purposes, Formula 5 accounts for the possible effects of phonological deficit on reading comprehension. We will return to this issue in the next section.

Diagnosis of Dyslexia in the New Formula

Formula 4 provides us with more concrete diagnostic and pedagogical measurements, although most of these remain to be shown empirically. We consider here how we can use the formula. Basically, we have two levels of measurements for each variable: within-subject values and between-subject values. For the former, we use the same linguistic stimuli for listening comprehension and reading com-prehension (e.g., Sticht and James 1984). If we find some difference here, that would constitute reading potential, thereby providing us with information on exactly what children fail to comprehend and what they can be taught. On the other hand, we can examine children's listening and reading comprehension against their peers' listening and reading comprehension. If their percentile score in listening comprehension is better than that in reading compre-hension, then the difference would be taken as their reading potential. This score would indicate the children's weaknesses, but would not identify specific areas for remedial work.

Let us now stipulate two components, Written Word Understanding and Written Words Integration. For Written Word Understanding, we need to measure the difference between the mapping between sound and meaning (the listening relationship), on the one hand, and the one between orthography and meaning (the reading

relationship), on the other, at the word level; in other words, the difference between listening vocabulary and reading vocabulary. The results of this measurement would indicate word reading potential (or word reading difficulty). This diagnostic method greatly differs from the limited methods used in previous studies. For example, Swan and Goswami (1997) use the traditional picture-naming/word-naming tasks, where the flow of information is Meaning ∅ Speech on the picture-naming task, and Orthography ∅ Speech (∅ Meaning) or Orthography ∅ Meaning ∅ Speech on the word-naming task. This method is inadequate. Our diagnostic tool uses speech forms and orthographic (written) forms as stimuli, with semantic processing (e.g., semantic categorization, synonym judgment, and picture matching) as responses (i.e., Speech/Orthography ∅ Meaning).

Now let us turn to two practical methods for measuring Written Word Understanding. First of all, we need to select words which the child comprehends by ear but not by eye. Such words would be appropriate targets for teaching. This is based on the assumption that what has been learned by ear can be learned by eye (cf. however, Hogben 1997; Slaghyus, Lovegrove, and Davidson 1993; Stein 2001). Although Gleitman and Rozin (1977) stated, 'The problem with reading is not a visual perception problem; the problem is rather that the eye is not biologically adapted to language' (p. 37), the statement is controversial. If such were the case, sign languages, for example, would not exist.

Secondly, we may need to select the most learnable words from among the appropriate words. It would be useful to have a hierarchical order among the appropriate words for teaching. Such hierarchy could be defined as spoken words which one can comprehend immediately, automatically, and holistically. We shall call these 'audiowords', in analogy to sight words.

One method for detecting audiowords is to employ a speech-gating technique, in which the child listens to increasingly longer segments of speech input from word onset over a series of trials, and is asked to identify the target word in each trial (e.g., Metsala 1997). Metsala (1997) demonstrated that poor readers needed more of the input to recognize spoken words than did normally achieving peers.

For our purposes, we want to know what spoken words the poor readers and their peers recognized on earlier trials. At present, no research seems to have been conducted from this perspective. In passing, Metsala suggested that

> spoken word recognition may be developmentally delayed in those with reading disabilities and may play a causal role in these children's failure to acquire adequate alphabetic knowledge (p. 159).

This suggestion is consistent with the implications of Formula 5.

Let us now turn to Written Words Integration of Formula 4. Written Words Integration, as does Spoken Words Integration, embraces many sublinguistic skills, including syntactic processing, and inferencing. (As stated above, Written Words Integration is not necessarily the same as Spoken Words Integration, although there would be a close relationship between the two.) To obtain Written Words Integration scores, we would have to compare children's ability to understand the meaning of individual written words in isolation and their ability to understand the meaning of sentences comprised of those words. In some cases (e.g., the case of the Japanese boy above), understanding individual written words in isolation may far outrun the understanding of written sentences, thereby reducing the Integration score and magnifying reading difficulty in a larger linguistic context. In other cases, children may better understand written sentences by means of integration and inferencing, even though they do not know all of the constituent words. In such cases, the degree of reading difficulty would be reduced.

Finally, we consider the phonological deficit hypothesis from the standpoint of Formula 5. The literature shows the existence of a strong correlation between measures of children's phonological awareness and their progress in reading several years later (e.g., Bryant and Bradley 1983). Given Formula 5, we can interpret such a correlation in the following way: Children with high phonological awareness would have better Spoken Word Understanding skills, whereas those with low phonological awareness would have poor Spoken Word Understanding skills. This implies that <u>at the outset</u> of

reading acquisition, the reading potential (i.e., listening comprehension minus zero) of the former children is greater than that of the latter children (cf. Formulas 1 and 5). (This does not mean, however, that phonological awareness is necessarily the main determinant of reading acquisition.)

To make clear the nature of the relationship between phonological awareness and reading comprehension, let us take Bradley and Bryant (1991) as an example. Bradley and Bryant state, 'When rhyme scores have been obtained in preschool children, they prove to be reliable predictors of later reading ability' (p. 40). In terms of Formula 5, we can recast this statement by replacing rhyme scores with Spoken Word Understanding scores. In a similar vein, when Bradley and Bryant (1991) assert that training in rhyme helps reading, we can properly reinterpret it as follows: Training in rhyme, which highlights some salient features of the words, helps enhance Spoken Word Understanding (Formula 5), which in turn helps reading. This is exactly the process that describes the long way from awareness of phonemes (i.e., the meaningless, abstract, minimum linguistic units) to comprehension of a written text (i.e., the meaningful, maximum linguistic unit). While Spoken Word Understanding (which can comprise phoneme awareness) constitutes only one part in the formula, phoneme awareness could be a good predictor, depending upon the strengths of the correlations among Spoken Word Understanding, Spoken Words Integration, Written Word Understanding, and Written Words Integration.

Conclusion

The two competing reading methods, i.e., phonics and whole-language methods, by and large, run parallel with the two tracks of dual-route processing theory, i.e., the sound/phonological route and the meaning/lexical route (e.g., Coltheart, Patterson, and Marshall 1980). In a good reader, the two routes may compete or function complementarily for better reading. Either way, in learning to read, the child has to aim at mastery of both routes. In fact, no researcher

would say that one is enough. Snowling (2000), for example, says that 'it is important to reiterate that there is nothing incompatible about combining phonological and "whole-language" approaches to reading' (pp. 196-197). However, since Snowling (and other scholars like him) regard phonological deficits as the main determinant of reading failure, they give priority to the meaningless phonological processing route over the meaningful lexical route.

In considering dyslexic children, we have given more weight to meaning-oriented reading. Dyslexic children can learn to directly associate print and meaning in learning the written language, because they have learned to directly associate speech and meaning in acquiring the spoken language. To the extent that they learn and use language by ear, they can learn and use the same language by eye if they are exposed to written words in meaningful contexts. Our goal is thus to close the gap between their listening comprehension and reading comprehension. The ideal reading programs in this view include Doman (1965) and Steinberg (1982), where from the outset children begin to learn meaningful written words in a communicative environment. In conclusion, the incidence of dyslexia depends both on the theory of dyslexia applied, and on the way children are taught to read. By modifying the traditional view of dyslexia and the traditional way of teaching, we can minimize the incidence of 'dyslexic' children.

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