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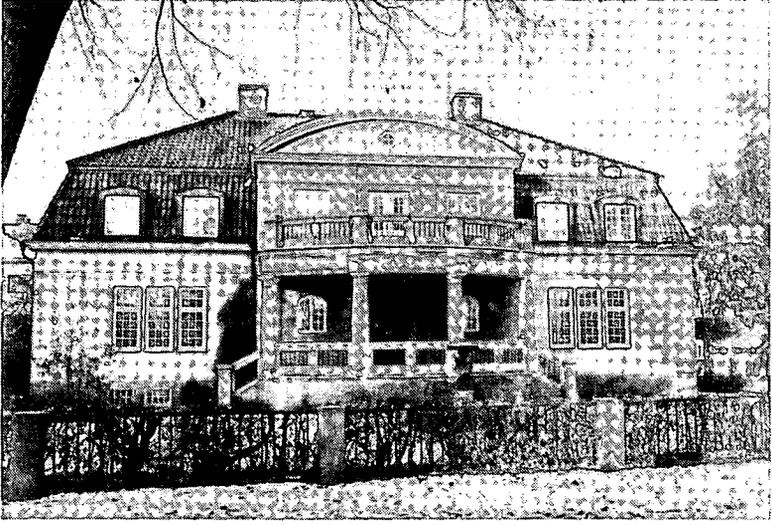
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ABSTRACT
            This book presents eight articles on reading disability and
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early prevention issues, and longitudinal data are dealt with in the book
from neurobiological as well as psychological and socio-educational
perspectives. Authors of articles in the book represent seven different
countries. Articles are (1) "Levels of Approaching Reading and Its
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Approach to the Diagnosis and Treatment of Reading" (PG Aaron); (3)
"Successful Remedial Teaching with Fewer Resources" (Pekka Niemi and Elisa
Poskiparta); (4) "Phonological Training and Reading Skill: Why Do Some
Resist?" (Stefan Gustafsson and others); (5) "Hemispheric Specific
Stimulation: Neuropsychological Treatment of Dyslexia" (Jan W van Strien);
(6) "Reading Difficulties and Special Instruction" (Aryan van der Leij); (7)
"Twenty-Five Years of Longitudinal Studies on Dyslexia" (Hanna Jaklewicz; and
(8) "Reading Disability and Its Treatment" (Mogens Jansen). (Author/RS)

Eve Malmquist Institute for Reading

READING DISABILITY
AND
ITS TREATMENT

Britta Ericson
Jerker Rönnberg (Eds.)

2

To Eve Malmquist

Reading disability and its treatment

Britta Ericson
Jerker Rönnberg (Eds.)

3

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Abstract

In this report eight articles on reading disability and its treatment are presented. The authors represent seven different countries and their articles deal with research in the field of dyslexia, reading and writing difficulties and their handicapping consequences. Phonological awareness intervention approaches, different kinds of dyslexia subtyping, early prevention issues, and longitudinal data are dealt with from neurobiological as well as psychological and socio-educational perspectives.

Keywords: dyslexia, reading disability, reading diagnosis, reading treatment, phonological awareness, othografic decoding, hemispheric specialisation, psycho-educational training.

Coverphoto: Britta Ericson

4

CONTENTS

Foreword

The quest for knowledge that can be of practical use for reading disabled children has been one of the more distinguishing features of the work of Dr Eve Malmquist, Professor Emeritus at Linköping University in Sweden. It is to him we dedicate this publication.

Some children and adults have difficulties to read. The reasons for their difficulties are still not fully known. How can they be helped to overcome their handicap, and how can full participation in society be accomplished? We thought that a description of some research results and the consequences in terms of treatment that these results may lead to, could improve our understanding of how to handle the educational and therapeutic processes in this area. We asked some internationally well known researchers to make their contributions to help, indirectly, the reading disabled. The results of our request are presented in this book. We thank you all for contributing to a better knowledge and understanding of reading disability and its treatment.

Sincere thanks also to Ingrid Holmberg for getting the manuscripts in order, to Ulla-Britt Persson for scrutinizing them, and to Inger Olofsson for the final layout.

Thank you all!

Norrköping in February, 1997

Britta Ericson   Jerker Rönnberg
Assistant Professor   Professor
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INTRODUCTION

This book is about reading disability and its treatment. The book represents a relatively uncommon, but sadly neglected standpoint in reading research. Research on dyslexia and reading disability is most often one-sided in the sense that neither diagnostic/descriptive nor remediation/intervention issues are addressed.

For example when the nature of decoding difficulties of a reading disabled child is analyzed, the consequences of the outcome of such research is rarely coupled to rehabilitative efforts.

This book aims at representing the state of the art in reading research - in the sense that it covers many of the relatively few efforts of international scientific standing that view diagnosis/description and remediation/intervention as mutually dependent activities that cannot, and should not, be separated. It is our intention that both researchers and practitioners should be able to benefit from the very eloquent chapters included in this volume.

In the first chapter, Lundberg and Høien focus on the developmental stages of word recognition in reading acquisition and address the causal role of phonemic awareness in learning to read. They demonstrate, by reviewing a large set of studies, that lack of proper phonological skills inevitably leads to poor and nonautomatized word recognition skills. Treatment programs therefore have to rely on or consider phonological awareness training procedures (cf. chapters 2, 3, and 4). Lundberg and Høien also paint the extremes of the reading disability area, going from studies on the neurobiological correlates of dyslexia to a sociocultural perspective on reading, including comparative international literacy studies, as well as historical studies of Swedish church records of reading ability.

In a second chapter, Aaron describes an approach in which reading disabilities best can be understood from the different components involved in the reading process, i.e., word decoding and comprehension. It is also the thrust of this comprehensive chapter that treatment procedures must be tailored to the particular weaknesses of a certain component, or to the interaction between the two. Accordingly, Aaron describes procedures that can identify

and treat three types of disability: (i) Specific Reading Disability, or Developmental Dyslexia, (ii) Nonspecific Reading Disability, and (iii) Generalized Reading Disability.

The following chapter by Niemi and Poskiparta is introduced by two cases, 7 and 11 years old, where the remediation procedures take into account, (i) scarce teaching resources, and, (ii) existing principles of linguistic awareness. The two cases are important lessons about the staggering improvements towards word recognition. A phonemic awareness approach to word decoding skills is especially appropriate in the Finnish language with its high sound to letter correspondence. This approach was also effective in a group intervention program in school, resulting in improved reading as well as listening skills.

Pertinent to the approach in chapter three, the fourth chapter by Gustavsson, Samuelsson, and Rönnberg report a study in which so called Improved and Resistant subgroups of 10-11 year-old readers were identified after a phonological intervention, modelled on the Lundberg, Frost, and Petersen (1988) study. Reading comprehension and word decoding skills were assessed, demonstrating that readers resistant to intervention generally possessed lower phonological awareness, and relied more on orthographic than phonological decoding skills when reading comprehension is accounted for. This result is important as it suggests that strictly phonological intervention exercises must be supported by other methods to overcome the difficulties that the resistant children face.

Chapter five, by van Strien, represents a neuropsychological approach to reading disability. The chapter is based on Bakker's hemispheric specialisation model of dyslexia, suggesting that about 65 per cent dyslexics can be classified (from reading errors) either as P-dyslexic or L-dyslexic. P-dyslexics are slow, but relatively accurate, readers, and are assumed to rely heavily on the right hemisphere for visuospatial processing, whereas L-type dyslexics typically are fast readers, making use of linguistic (guessing) strategies as revealed in their reading error patterns. Treatment procedures are targeted towards the less active hemisphere to achieve a more symmetric activation of the hemispheres during reading.

The sixth chapter by van der Leij is about reading disability and instructional methods. One of the main arguments of the chapter is that early prevention and intervention works well both for decoding (i.e., "bottom-up") and comprehension processes (i.e., "top-down"). Constraints exist; for example, longitudinal follow-ups and detailed analysis both of lower-level deficits and higher-level skills need to be addressed and subsequent intervention tailored to the particular problem level. Principles of instructional procedures are also discussed, including for example, that, (i) instruction should be focused on the deficient component, (ii) intense interaction between child and instructor should be stimulated, and, (iii) plenty of time should be given for practise, sometimes aided by efficient computer software.

In the seventh chapter, Jaklewicz reports on a 25-year longitudinal study (1969-1994) attempting to pinpoint factors that had determined the fate of dyslexic children. The existence of general learning disabilities, support from school, as well as the emotional disturbances associated with these learning disabilities are important determiners of future outcome in terms of education and work. Prevention programs are broad and include psycho-educational training for parents with dyslexic children, with psycho-therapeutic components, as well as special training methods for teachers.

In the final chapter, by Jansen, a relatively broad stance is taken where reading disability is couched in terms of the categories "word-blind"/dyslexics, reading retarded, weak readers, and functional illiterates. Educational consequences for remediation and intervention are briefly discussed in connection with the different groups. These terms are not only to be associated with schooling and reading. They point to other problems as well. One such example is functional illiteracy which is a core problem among both recent and second generation immigrants. Although normal in all other respects, cultural or other aspects can be obstacles for the acquisition of reading skill among these people. Jansen also launches a discussion of potential implications of reading and reading disability in the future, given technological advances and development of various kinds of text and reading opportunities.

As should be clear from the short descriptions of the contents of the chapters they all address diagnostic/descriptive issues in connection with remediation/intervention. These seem to be important conceptual cornerstones in grappling with the problem of reading disability. Effective treatment presupposes theoretically and empirically driven analyses of the relevant components of reading disability. This dual relationship can save us from having endless pedagogical debates without knowing what components or subsystems of the reading process that we are discussing. It also helps clean the air from proposals that only base their generalisations on descriptive reading research. Clinically oriented disability research needs the firm causal test that controlled intervention studies provide. Without such studies, we are at a loss.

Britta Ericson
Jerker Rönnberg

LEVELS OF APPROACHING READING AND ITS DIFFICULTIES

Ingvar Lundberg
Torleiv Høien

Introduction

Reading is a remarkable skill in its complexity and beauty. *"A wonderful process, by which our thoughts and thought-wanderings to the finest shades of detail, the play of our inmost feelings and desires and will, the subtle image of the very innermost that we are, are reflected from us to another soul who reads us through our book ....*

And so to completely analyze what we do when we read would almost be the acme of a psychologist's achievements, for it would be to describe very many of the most intricate workings of the human mind, as well as to unravel the tangled story of the most remarkable specific performance that civilization has learned in all history" (Huey, 1908/1968).

As a technology of mind written texts have had the most profound impact on society and mankind, changing the format of our thinking and externalizing our memory, thereby creating the basis for our civilization and empowering human cognition. A technology which allows the user to communicate with others from whom he/she is removed in space and time is certainly miraculous and has indeed had the most profound consequences for the living conditions of mankind. No wonder that mastery of such a remarkable system as written language has become a highly valued skill and prerequisite for success in our society.

Reading is certainly not a naturally evolved skill, but instead a skill which is a product of cultural evolution relying on cultural transmission for its continued existence. However, this does not mean that biological aspects of reading are irrelevant. After all, the

visual system as well as the central nervous system are deeply in-volved in the act of reading, and difficulties in acquiring skill in reading often involve biological system dysfunctions. On the other hand, a biological perspective implies a stereotype of an isolated individual reader thereby neglecting the fact that all reading is in a sense socially embedded, a cultural practice. Indeed, a great deal of reading is done in group settings, and the construction of meaning in a text is a matter of social negotiation.

If we want to capture the full complexity of reading and its diffi-culties we have to explore dimensions ranging from genes, neurons, sensory systems, cognition, linguistic functions, social relations, personality, self concept, cultural and historical contexts. The aim of this chapter is to outline with a very broad brush a framework of reading and reading disability which covers the various levels of analysis. A developmental perspective will also be included.

Reading is an unnatural act

The fact that reading is basically a cultural practice and not a naturally evolved ability like walking and talking makes its execu-tion seem strange and unnatural to an illiterate or preliterate child. For example, both authors of this chapter have independently experienced how our 2-year-old granddaughters not surprisingly sometimes complain when we are reading instead of playing with them. The complaints do not only express dissatisfaction with our neglect, they also reflect their perception of reading as a very un-natural act. It must indeed seem very strange to them when we are sitting in frozen immobility for hours looking at a flat surface from a distance of 30 cm. The white sheets of paper are covered with thousands of tiny figures, and the practitioners of the reading act waggle their eyes rapidly back and forth. The children cannot, of course, understand that the reader is carefully following the thoughts of another person laid out at another place, perhaps a long time ago. It is hard to see how this bizarre passivity could bring knowledge, knowledge originating from another mind which is partially controlling the reader's mind through the medium of print.

Biologically speaking, our eyes are probably not at all designed for long-term inspection of small marks at such close distance. Typically, the natural visual ecology of a moving organism provides the eye with a dynamic optical array specifying objects, surfaces and events in the environment (e.g. Johansson & Börjesson, 1989). The primary task for the visual system is then spatial orientation and identification and recognition of risks and affordances in the environment.

Visual functions and reading disability

It is not surprising that the unnatural, demanding eye behavior in-volved in reading has led people to assume an association between reading disability and abnormal eye functions (see for example Brod & Hamilton, 1973; Pavlidis, 1985; Rosner & Rosner, 1987). Popular remedial recommendations, especially among opticians, have been correction glasses or oculomotor training programs. However, most studies of eye problems as related to reading disability have suffered from several methodological weaknesses, such as lack of control group, poorly described details of the tests and procedures used, inadequate statistical evaluation, poorly defined phenotype of reading disability, etc. Recent and better con-trolled ophthalmological studies have not been able to show any significant relationships between peripheral eye disturbances and reading problems (e.g., Aasved, 1987, 1988). Within the so called Kronoberg project, a large-scale population study of reading dis-ability of all children in a Swedish county, Ygge et al (1993) reported that dyslexic students did not differ significantly from control children in terms of strabismus, accommodation, stereo acuity, vergence function or ocular dominance. Neither did eye movement recordings show any qualitative differences between the groups. Some evidence was found for a lower contrast sensitivity in dyslexic compared to normal readers in the lower and higher spatial frequency range. Earlier findings of a reduced spatial con-trast sensitivity in the low frequency range (e.g., Lovegrove et al., 1982, Breitmeyer, 1989) have been interpreted as a disturbance in the balance between the sustained and transient subsystems of vision (Lovegrove, 1989). However, the Kronoberg finding of a re-

duced sensitivity also in the high frequency range makes the sub-system interpretation more problematic.

In summary, we can conclude, on the basis of evidence accumulated over recent years, that poor reading is generally not caused by eye problems. A cultural artefact like script imposes new demands not only on the visual system but even more so on the cognitive system. Thus, the main locus of reading problems must be found at a different level. Before we approach the more critical levels, a few additional general comments on reading and its development are appropriate.

Literacy socialization

As we have emphasized, literacy skill is certainly not the result of a natural or universal developmental process like walking or talking. It is, rather, a cultural product or practice depending on cultural transmission. Thus, children should not be expected to automatically learn how to read as they grow to adulthood. Mere exposure to print in the environment is apparently not sufficient. Hundreds of millions of illiterate adults throughout the world reside in urban environments polluted with commercial print and road signs without spontaneously making progress in the acquisition of reading skill. *Explicit* instruction seems to be the necessary medium through which the organizational principles and rules of the alphabetic system are communicated. Simply looking at people who read, or being exposed to written material in the environment does not normally provide sufficient guidance for the acquisition of the skill.

Still, reading acquisition involves a great deal of informal literacy socialization before formal reading instruction is given in school. Many children have developed clear concepts of the nature and function of written language before they start school. Without yet being able to read they know some of the conventions of print, its directionality and lay-out principles. Many children seem to develop ideas and expectations about books and reading even before they begin to talk (Ninio & Bruner, 1978). Certain contracts of literacy are learned in picture-book reading episodes where decontextualized language is used. They learn that books concern fictio-

nal worlds of autonomous status. What is most important in listening to stories, however, is that through this experience, the child gradually begins to discover the symbolic potential of language, its power to create possible or imaginary worlds through words. Language then becomes the vehicle for transcending the immediate sensory world, and being released from the bonds of the present. The intricate dynamics of this symbolic development during the preschool years has most deeply been clarified by Piaget (1952).

By being exposed to written language through story reading, the child also gains familiarity with the particular syntactic organization and more explicit, elaborated and decontextualized character of written discourse which may be an important step in the acquisition of reading skill as well as involving a long-term impact on the cognitive system.

In homes where parents read extensively, children are provided with models or identification figures. When children meet reading adults whom they respect and love, they will take it for granted that reading is worthwhile. They are prepared and willing to embark on the difficult journey of acquiring skill in the highly valued activity. The process of identification is certainly a powerful force in the development or acquisition of values and skills in the life of a child. Basically, young people are deeply influenced by significant adults who appear to enjoy what they do, and who promise to make life more enjoyable.

A child who is exposed to half an hour storybook reading per day over the preschool years together with informal experience with toy letters, computer games, road signs, playful writing, postcards from grandmother, encouragement to learn the names of letters etc. will enter the first grade with thousands of hours of active involvement in text and print. This child has certainly also experienced and understood the joy of reading and its potential value in life.

Other children may have a very limited amount of exposure to print and very few opportunities to interact with text under the supervision of encouraging and interested adults. In fact, such initial differences between children even tend to increase over the years in a snowballing process known as the Matthew effect in educational development (Stanovich, 1986).

Before these reflections on informal literacy socialization bring us to the conclusion that early stimulating environments are crucial

for and causally related to successful reading acquisition in school, one should, for a moment, consider an alternative explanation of the positive relationship between early stimulation and later achievement. Such an explanation is based on an epigenetic view.

Genes and environment

In modern western societies a vast majority of people grow up in environments where there is at least a potential of rich literacy stimulation (environmental print, preschool settings, literate adults, newspapers, books, libraries, literate cultural values etc.). Children, almost regardless of social background, have thus a rich potential, an abundant source for "niche picking", i.e., provided they have a favourable genetic disposition they can construct their realities and select stimulation and experiences that optimally fit their talents. In a sense, one could say that genes drive experience (Hayes, 1960). Children with a natural facility with language may encourage adults to read more for them, take them to libraries and bookstores, provide them with writing tools, send them postcards etc. Thus, the primary source of early literacy socialization is not only the benevolent adult; the child herself plays an active and crucial role.

On the other hand, children with a less favourable genetic dis-position, maybe with genes implying high risk for developmental dyslexia, even in a potentially rich environment tends to carefully avoid situations involving the cognitive and linguistic demands typical of written language. Even ambitious parents will soon give up their efforts to stimulate their child, to read aloud, to go to the library etc. Thus, we ascribe to the children an active and construc-tive role in selecting and shaping their course of mental develop-ment. The dynamic interaction between genetic constitution and environment is a continuous process which should not be neglected when the socialization process is interpreted.

The genetic background of reading disability is by now well established. Already in 1950, Hallgren demonstrated the strong heritability of dyslexia in a well controlled family study (Hallgren, 1950). In the long-range Colorado Reading Project (DeFries, Olson, Pennington, & Smith, 1991) including a large number of

monozygotic and heterozygotic twins the inheritance of dyslexia was also quite clearly established. Lundberg and Nilsson (1986) used the unique Swedish Church Examination records and could follow families with reading difficulties across many generations. Family trees of well diagnosed dyslexic individuals living today could also be studied back to 1750 and clear evidence of reading disability as a family trait was given.

The exact genetic mechanism, however, is less clear, although modern linkage studies might give an answer soon (one such study is running now in the county of Kronoberg in southern Sweden). There is reason to believe that dyslexia is determined by a large number of genes, each contributing a small amount to the trait. The expression and severity, then, would be a function of the interaction between this multifactorial genetic predisposition and environmental experiences. Even though the field of molecular genetics is making remarkable progress, the issue of the genetic mechanisms involved in dyslexia cannot be solved until an acceptable phenotypic definition of the disturbance has been achieved. Current controversies on subtypes, on the role of visual functions, on the issue of a discrepancy between reading level and intelligence, all reflect that the phenotype of dyslexia is in need of much more clarification.

The development of visual word recognition

Although it has the quality of a mental revolution, reading acquisition is normally not a rapid transition from a non-literate to a literate state. As we saw in the section on informal literacy socialization, all revolutions have a prehistory; the child has taken important steps towards literacy long before he/she meets the formal teaching in school.

Høien and Lundberg (1988) followed the development of word recognition over several years in case studies of children in the Nordic countries. A good description and a reasonable explanation of the course of development from the age of about 5 years to about 8 years was provided by our stage model (a similar model was also proposed by Frith (1985). Four consecutive stages were assumed: pseudo-reading, visual logographic reading, phonemic alphabetic

reading and morphemic orthographic reading (see Fig. 1;1). Although some of the earlier stages might be passed through rather quickly for some children, the sequence of stages was assumed to be valid for all children.
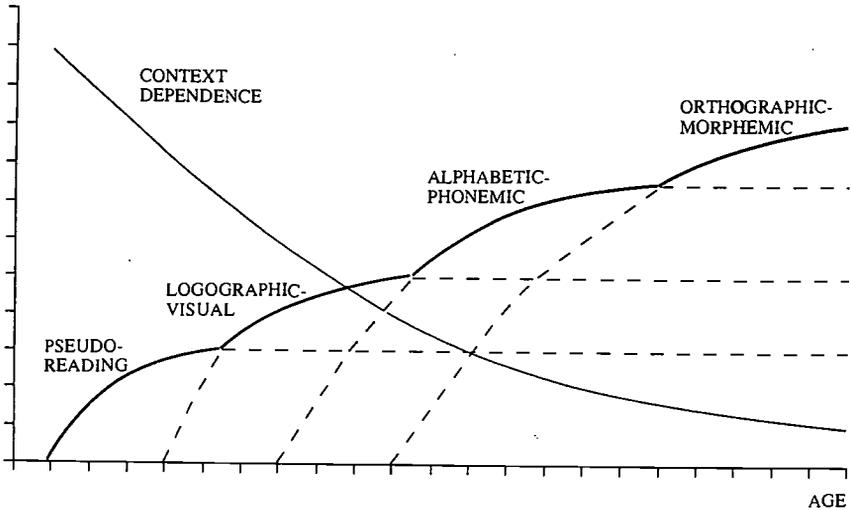
Fig 1;1   *A stage model for the development of word recognition*

An important feature of the model was the assumption of a gradual decrease in *context-dependence* as the development proceeds. That is, the more proficient the child becomes, the less need there is for compensatory reliance on external cues for word recognition (see also Stanovich, 1980).

In the *pseudo-reading stage* observed among the youngest children the printed words themselves were not particularly attended to; the child rather read the environment and "recognized" words only embedded in very specific contexts like a candy store, a gas station, or a milk box. Radical changes of the word spellings did not seem to make a difference. The critical mechanism for this kind of "reading" is attention to any cue that can guide the search for need satisfaction (hamburgers, ice-cream) or where meaning labels

could be attached to the environment. The child is basically a meaning seeking being.

In the *visual logographic stage*, the child starts to attend to the word itself, but not as a string of symbols requiring a decoding step but rather as a global visual configuration, where holistic as well as partial or idiosynchratic cues can be extracted and utilized (for example, X in the middle of the word TAXI). By systematically changing the word, it is possible to find out which cues are utilized by the child. Some children acquire an impressively large visual-logographic vocabulary before they enter the next stage. However, the increasing memory load together with the demands of more subtle discriminations are severely limiting factors, so a new and more efficient strategy is called for which utilizes the beautiful in-formation economy of the alphabetic system. Typical words in the visual-logographic vocabulary are the child's name, the names of parents, siblings, close relatives and pets, environmental print of high interest value like labels of edible and tasty products. The attention to words also triggers curiosity about letters and letter names. Eventually the letter names are used as rather effective partial cues indicating initial sounds of words (Ehri, 1991). Contextual support is also highly utilized during this transitional period of development. Playful writing attempts help the child to focus the attention on the sound structure of words. Thus, the step into the next stage might be rather small.

In the *phonemic-alphabetic stage*, the child comes to break the alphabetic code (or rather cipher), most often by being explicitly taught; an adult explains the system and directs the child's atten-tion to the phonemic structure of spoken words. As will be argued in more detail in the next section, this stage is the most critical stage on the child's road into literacy. It involves demands on linguistic awareness which for some children may be too high when they are subjected to formal reading instruction in school. Early failures at this stage is then the entrance to a viscous circle of con-tinuous failures in the future school career.

For those children who successfully break the code, a hectic period of practising the new skill starts. The careful attention to the segments of words makes the child discover the structures of higher order, recurring spelling patterns, position dependencies, prefixes, verb endings and other suffixes, word stems etc. The child is

entering the *morphemic-orthographic stage.* Extensive practice with many successful meetings with a word, eventually leads to an immediate recognition where the orthographic pattern triggers a direct access to the mental lexicon. Now, word recognition is becoming more and more automatized. When a word is exposed the reader cannot resist reading it. He/she automatically recognizes it without voluntary control and with no requirement of contextual support. An automatic, encapsulated and resource cheap processing module (Fodor, 1983) for visual word recognition is developed by extensive practice. The main and remaining requirement in reading is now related to comprehension and deeper interpretation of text.

The developmental model outlined in this section captures only one of the two major aspects of reading, i.e., word recognition. The development of the other aspect, comprehension, is far more complex and unknown, since it entails the full array of higher cognitive processes where the reader's prior knowledge, cultural competence and domain-specific proficiency have to be analyzed.

The stage model can also help to clarify the background and manifestations of reading disability or dyslexia. We can think of various phenotypes of dyslexia as arrests at various stages of development. If the main difficulty is to deal with the phonemic segments of words, one can predict that some reading takes place at the visual-logographic level, at least when highly frequent but phonemically complex words are processed. If the main difficulty is to deal with higher-order structures and use a direct and automatic route to the mental lexicon, one can expect a dysfluent, effortful, and errorprone word processing where each single segment is treated separately. Regardless of where in the developmental course the dyslexic reader has to make a halt, it seems quite clear that a main cause of the difficulties has to do with the specific linguistic requirements involved in the alphabetic system. In the next section we will further discuss these requirements.

Phonological awareness

Normally, children use language with the main purpose of communicating with other people. Their focus of attention is on

meaning, and the language forms themselves are transparent. Paying attention to the formal segments that build up an utterance would normally not be functional in the child's transactions with the environment. Or as the duchess in Alice in Wonderland said: "Take care of the sense, and the sounds will take care of themselves". In playful activities, however, the child may shift attention from meaning or content to linguistic forms and treat language as opaque objects, as in nursery rhymes and language games. But this kind of rather spontaneous metalinguistic activity may essentially differ from those cognitively demanding phonological skills that are required in the process of reading acquisition.

The phonological segments of speech, the phonemes, on which the alphabetic system is built, are not immediately accessible for conscious reflection. Without explicit guidance, they are not spontaneously extracted and attended to in the everyday life of a preschool child. Although young children talk in words, syllables and phonemes, they do not seem to have much conscious control over these units of language.

A word has a phonological structure. When a word is produced by a speaker, however, he/she needs only to think of the word. A biological, distinct module handles the phonological segmentation. Similarly, listeners need not figure out the phonological structure that has been co-articulated in a complex pattern of parallel movements of the speech apparatus into a global package of sound. The phonological module takes us beneath the surface of the words to the abstract level where words are stored in our mental lexicon. According to Lindblom (1989) phonemes can be regarded as emergent consequences of vocabulary growth in all languages, and not just units constructed by linguists to fit an alphabetic script. They are real linguistic units but only implicitly present in the lexicon of a language user. The productive use of an alphabetic script in reading new words and in spelling, however, requires an *explicit* awareness of phonemic segments. The crucial transition from a preliterate to a literate state, then, involves a step from implicit to explicit control of the phonemic units of language.

The causal role of phonemic awareness in learning to read

The strong relationship between phonological awareness and success in reading acquisition has been replicated over and over again, across languages, ages, and tasks used to measure phonological awareness (for reviews, see, for example Adams, 1990; Goswami & Bryant, 1990; Brady & Shankweiler, 1991; Leong, 1991; Lundberg & Høien, 1991; Bentin, 1992; Wagner et al., 1993). Less successful, perhaps, have been the attempts to understand and interpret the relationship.

One popular interpretation of the relationship is that the emergence of phonological awareness is simply a rather trivial by-product of learning to read in an alphabetic script, an almost inevitable consequence of becoming literate.

Our theoretical analysis of the phoneme concept, however, suggests that the other causal direction is more plausible. In order to learn how to read and spell one must discover that units of print (letters or letter groups) map on to units of speech sounds. Thus, the understanding of the alphabetic principle requires the ability to segment the speech stream into units of phoneme size. In this sense, phoneme segmentation is located at the very heart of reading and spelling development. The establishment of functional orthographic representations for rapid, automatic word recognition is then assumed to depend on explicit segmental phonology where the full and detailed anatomy of words are attended to. In this sense, phonological awareness might be regarded as a prerequisite for the acquisition of literacy.

Empirical arguments for this causal direction have been presented by Lundberg, Olofsson and Wall (1980), Lundberg, Frost and Petersen (1988), and Lundberg (1994). By studying the development of phonological awareness among nonreading preschool children and follow their progress in learning to read later in school, data were obtained indicating the causal direction. The causal interpretation was further strengthened by an experimental training study demonstrating that preschool children who enjoyed the benefit of daily games and excercises designed to promote phonological awareness outperformed control children without such

training. Thus, the trained children entered school and met the requirements of formal reading instruction better prepared than the non-trained children.

However, the relationship between phonological awareness and reading is not unidirectional; there are causal connections running in both directions: phonemic awareness facilitates the acquisition of reading and spelling and, at the same time, increasing literacy skills sharpen the phonological insight (Perfetti et al., 1987).

Phonological awareness and dyslexia

There is now a general consensus among researchers that non-automatic, slow, inaccurate, effortful and dysfluent word recognition is the core symptom of dyslexia. However, relatively little empirical evidence has been presented concerning the role of poorly developed phonological awareness as an underlying factor behind the word decoding problems.

Snowling (1981) and Snowling and Hulme (1989) presented convincing evidence on the role of phonological deficits in dyslexia. Manis, Custodio and Szeszulski (1993) showed in a developmental study, that dyslexic individuals failed to catch up with normal readers in phonological skills. The critical role of phonological awareness in reading disability or dyslexia has also been demonstrated by Lundberg and Høien (1989). A large number of reading and reading related tasks were examined in a study by Lundberg and Høien (1990). Dyslexic 15-year-old students were compared with an age-matched group of normal readers and a reading-level matched group of young, normal readers (about 9 years old). Most dyslexic students showed marked difficulty in reading nonwords which is an indication of their poor phonological skill. They read these words much slower and with far more errors than did the reading level-matched young students (see also Rack, Snowling & Olson, 1992). The fact that the two groups read real words equally well indicates that dyslexic children may use an alternative strategy for identifying words, perhaps relying more on orthographic patterns in a compensatory way.

The results were similar on the more direct phonological aware-ness tasks, phonological synthesis and syllable reversal, where the dyslexic children scored far below the comparison students. In fact, the overlap between the dyslexic group and the other two groups was almost non-existent. In a number of other tasks which were not related to reading the difference between the dyslexic and the comparison groups was small and insignificant. Thus, it seems that the problem for the dyslexic children is specific to the phonological system.

The primary difficulties with words arising from poorly deve-loped phonological skills may lead to secondary consequences, such as poor reading comprehension (too much effort has to be allocated to word identification), slow vocabulary development (the amount of print exposure is minimal), slow general learning in school (knowledge in content areas is most often text bound), low motiva-tion for reading (word reading is too slow, erroneous and effortful) - in short, the student is trapped in a viscous circle.

Fluency and accuracy in word reading require extensive practice and repeated meetings with written words. One can only learn to read by reading, and the poorer genetic disposition one has for this task, the more one needs to practice. However, the dyslexic student tends to avoid reading, thereby minimizing the chances of over-coming the genetic disadvantage.

The early failure on a socially highly valued domain also implies that the viscous circle involves socio-emotional problems and lower self esteem (Taube, 1988), which further contribute to the growing learning obstacles, make the student passive and prevent the development of metacognitive strategies (see Wong, Wong, & Blenkinsop, 1989). As the societal pressure on literacy skills in-creases, one can clearly see the disastrous long-term effects of early failures.

Neurological correlates of poor phonological awareness

Why then have some children such great difficulties in discovering the phonological structure of words? Is there an identifiable biolo-gical basis for the core symptom of dyslexia? We made a step in the direction of finding a neurological correlate of dyslexia (Larsen,

Høien, Lundberg & Ødegaard, 1990). Our 19 dyslexic students and their age-matched controls referred to above were examined using MRI (Magnetic Resonance Imaging). Brain scans showed that the planum temporale, an area involved in language processing, tended to be of equal size in the two hemispheres among the dyslexic subjects, whereas an asymmetrical pattern was more common among the normal readers. Seven of our dyslexic subjects showed extreme phonological problems. All of them had symmetry of the planum temporale. This is an unusually clear identification of a brain anatomical substrate of a psychologically defined symptom, which certainly needs to be replicated on other groups and with other techniques.

There is no reason to believe that the deviant brain morphology is the result of limited reading experience or failure in learning to read. It is rather something which has already developed in fetal life (Geschwind & Galaburda, 1987). The ultimate cause of this early deviation in brain structure is not known. Recent advances in developmental neurobiology, in molecular genetics and in methods for recording brain processes with high spatio-temporal resolution will certainly open up new ways for understanding the biological bases of dyslexia.

Recently, animal models have been used to study the biological basis of reading disability (Sherman, Rosen & Galaburda, 1988; Schrott, 1992). That may seem strange, since, so far, no animal is known for being literate. However, the operations of neurones are remarkably similar across species including man. In a strain of mice (the New Zealand mouse) with autoimmune disturbances some 40 per cent of the animals have a large number of ectopias in the architecture of the brain cells, i.e., small, irregular clusters of neurones in white matter where they should normally not occur. Such outbursts of cells have also been found among dyslexic individuals in post mortem examination of their brains (Galaburda, 1988). All nine human cases examined so far had numerous ectopias whereas normal brains only occasionally display a few anomalous microstructures of that kind.

The New Zealand-mice with ectopias turned out to have serious problems in learning tasks that normal mice learn quite easily, like maze-running or avoidance responses. One could then suspect that the presence of ectopias was a proximal biological cause of the

learning difficulty. Schrott (1992) could demonstrate that the animals could overcome their problems if their early environment was enriched by enlarging the cages, by providing the mice with toys and possibilities to explore. Thus, the biologically based obstacles for learning could be reduced or even compensated for by a rich and stimulating environment. Certainly, this finding should be encouraging and give way for rather optimistic educational conclusions. Biological constraints are not absolute. With a baseline of poor environmental conditions, enormous progress can be made by educational intervention.

We have now come to a point where most aspects related to reading difficulties can be summarized in the simplified framework outlined in Fig. 1;2. The causal chain goes from genes and neurones to phonological problems which in turn are assumed to be an important causal factor in dyslexia, where the primary symptom is difficulties with words (recognition and spelling). The secondary problems are part of a severe viscous circle which is most often hard to break. The social and emotional complications, however, are far from sufficiently explored.

26

Genes

CNS-deviations

(misplaced or malformed neurons in cerebral cortex or thalamus and/or symmetry of planum temporale)

Environment

Intrauterine

environment

Instructional

environment

(literacy expe-rience at home and school)

PHONOLOGICAL DEVELOPMENT

phonemic awarness

phoneme segmentation

LITERACY ACQUISITION

PRIMARY SYMPTOMS

word recognition spelling

SECONDARY SYMPTOMS (which may or may not co-occur)

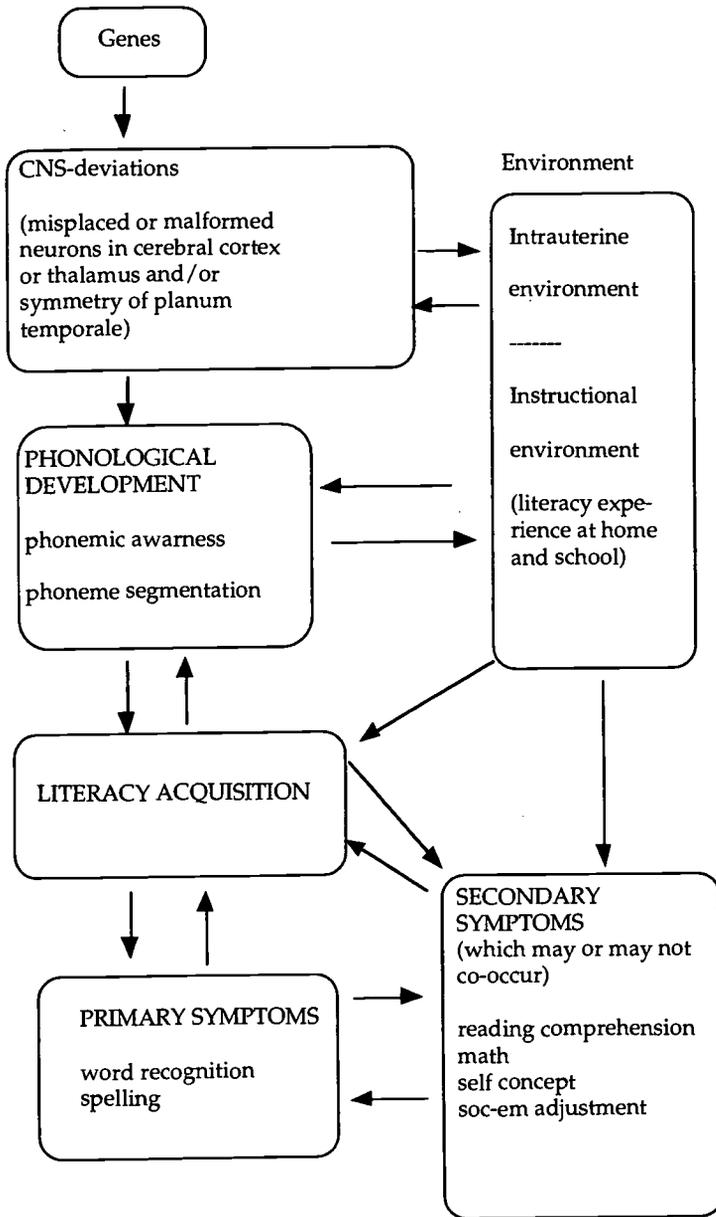reading comprehension math self concept soc-em adjustment

Fig 1;2. A multilevel framework for understanding dyslexia

27

A socio-cultural perspective on reading achievement

We have repeatedly emphasized that reading is primarily a cultural practice. This perspective implies the challenge to compare reading and reading instruction in different countries. Although reading and the teaching of reading are necessarily bound to unique configurations of cultural and historical conditions, there is probably also a lot of unity in the culture of reading and reading instruction around the world. The texts have many universal features in their functions, contents, structures and textual characteristics. The unity among various texts makes them possible to translate, and the cognitive demands, processes of comprehension and individual strategies in approaching reading tasks may reflect unity as well as diversity in reading and the teaching of reading.

The reading achievement of 9-year-olds and 14-year-olds in some 30 different countries has been compared in the large IEA study on Reading Literacy (Elley, 1994; Lundberg & Linnakylä, 1992). After years of careful planning and pilot studies to ensure comparability of achievement measures and other indicators, the main data collection took place in 1990/91 and included 210 000 students and 10 800 teachers. A main objective of the study was to examine the various background factors in home, school and society which could explain variations in reading achievement. But the "horse race" dimension also attracted a lot of attention, especially from media. It turned out that the Finnish students had the highest average achievement at both age levels. Swedish students also had high scores and ranked third in both age groups. The top scores of Finland and Sweden are remarkable, especially among the 9-year-olds, since the children in these countries had attended school for a much shorter period of time compared to children in most other countries.

When the differences in achievement between countries are interpreted, it is tempting to seek explanations in teaching strategies, teacher competence, school resources etc. Multivariate analyses of data show, however, that factors related to teaching and school conditions can only explain a minor part of the variation. Nothing indicates, for example, that Finnish teachers deliver better instruction than teachers in other comparable countries. Instead, it

is more likely that the explanations are related to conditions out-side school. Perhaps, the socio-cultural contexts in the Finnish and Swedish societies in a very special way enhance reading and reading interests.

A historical perspective might here be clarifying. Long before the industrial revolution and before the establishment of a compulsory school system, the literacy rate was almost 100 per cent in Sweden and Finland (which was a part of Sweden until 1809). Already by the end of the 17th century in the context of the Counter Reformation, a Royal decree was made public in which it was stated that all Swedish citizens had to be able to read and by them-selves see what the Holy Scripture said (Johansson, 1987). It was the responsibility of the head of the household to guarantee that all members of the household, including servants, were taught how to read. Manuals for efficient home teaching were soon circulated. The priest of each parish was assigned the task of controlling the level of reading achievement by annual church examinations. These were carefully recorded and often involved an elaborated grading system. Those who failed in the examinations had a hard time. Except for the disgrace of poor performance in the public event, they were not allowed to marry or to witness in court. In short, they were not qualified for full civil rights. Thus, the societal pressure was high and obviously also very efficient.

In the midst of the 18th century the records tell us that almost all adults in Sweden and Finland were able to read. One sometimes hears the opinion that the level of reading proficiency, in fact, was very modest and specific to certain religious texts. However, the leading historical researcher on literacy in Sweden in historical times, Egil Johansson, argues strongly that the reading skill was in-deed functional and was used also outside the religious contexts (Johansson, personal communication). The limitation of literacy had rather to do with the fact that writing ability was a rare skill among ordinary people.

The general reading ability in Sweden and Finland during pre-industrial time, when the country was a typical poor agrarian society, shows that there is no simple and necessary relationship between literacy and economic development. In the industrially much more developed country of England during the same period

the level of literacy was much lower. A look at the world today would reveal a rather high correlation between literacy and economic development. But still, the relationship might be complex and not necessarily causal in a simple sense.

The example Sweden-Finland also shows that a special value system might be developed in a society, with deep historical and cultural roots. Of course, nature, climate, and demographic conditions also play a significant role. As a contrast, we can take Mediterranean or many African societies where cultures are more oral, where people come together for discussions and oral tellings in streets, in cafés, at market places, at public wells, etc., in densely populated areas with a mild climate. In the scarcely populated Finland and Sweden, with more electric light than sun, the distance between people outside the circles of close relatives is long, written texts have been a highly valued form of human communication.

In this context, we can observe that no invention, no reform is done without a loss of value. On the loss account of script we can put a loss of personal intimacy, personal relationship to a master is substituted for by textbooks or manuals. We can also see how the art of mnemonics degenerates. The fear of forgetting could in a predominantly oral culture be equivalent to the fear of a burglary in a library. Remarkable memory achievements were not uncommon. For example, the Swedish scientist Celcius knew by heart the full authorship of Tacitus. The 16 000 lines of the Iliad as well as the gigantic Finnish epos Kalevala were primarily oral works.

We have earlier emphasized the social dimension of reading. Even such every-day activity as newspaper reading clearly involves a social dimension. Although the very act of reading might seem very private, newspaper reading becomes in an important sense socially defined. Newspaper reading is often followed by discussions with other people, at the work place or in the family. The drastic selection made from the enormous material in a newspaper is to a large extent determined by the kind of conversations you anticipate and the kind of people you expect to meet. We have another example when the family is gathered around a manual or booklet with instructions for how to assemble a piece of new equipment or furniture. When workers are standing in front of the message board to read information from the manager of the company, there is also a typical situation where

text meanings are negotiated. It is not necessarily the most skilled reader in a technical sense (i.e., high scores on reading tests) who is the best reader in the social sense. Even individuals with low reading ability can reach a functional level by social compensation, where they find literacy helpers willing to give technical support.

The literate outcome of a group's transactions with print can thus be greater than any single individual's. For example, a group can be composed such that one individual has the technical skill, another a functional skill about how and when a certain document should be treated or composed, and a third person has relevant background knowledge about the social significance of a message.

Concluding comments

We have discussed reading and reading disability in a very broad perspective, from neuronal architecture and genes to socio-cultural contexts and historical conditions.

Reading has become a "hot" field in the current educational debate. The two major opposing camps in reading education are those advocating a code-oriented approach (phonics) and those advocating a meaning-oriented approach (whole language). The tension between these views is so strong that some outside observers would even seem to find themselves in the midst of a full-scale reading "war". However, neither side can claim any strong support from empirical research. Some of the controversy probably originates from the two sides emphasizing different levels of analysis. It seems to us that a broader view of reading where different levels are analyzed simultaneously and where a developmental perspective is included would calm down the debate.

Another common controversy concerns the concept of dyslexia. Some people tend to hold the view that this label is misleading and unnecessary. According to them, the biological explanation is completely wrong, a medicalization of a problem which is basically social in nature. Reading problems can thus only be understood in a socio-cultural and educational perspective. Other people tend to believe that only by clarifying the underlying biological mechanism will we have a chance to successfully deal with the problem.

Our view, which we have tried to spell out in this chapter, is that reading is a multidimensional concept which has to be analyzed on several levels at the same time. A developmental perspective is also necessary. No one can deny that the brain and the perceptual apparatus is active when we read. Neither can anyone deny that people differ a lot in terms of how easily they learn a task, even when social and educational opportunities are excellent. Under such circumstances, it seems highly probable that reading difficulties are individually and biologically determined. However, the long-term consequences for the individual and for society of early failure in learning to read must be understood in psychological, social and cultural terms. After all, a functional shortcoming is only developed into a handicap by circumstances in the social environment. A challenging task, then, is to deepen our understanding of the social forces behind the development of the most common handicap in modern society, i.e., reading disability.

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36

A COMPONENT-BASED APPROACH TO THE DIAGNOSIS AND TREATMENT OF READING DISABILITIES

P G Aaron

INTRODUCTION

This chapter describes a differential diagnostic procedure which is based on the assumption that there are different kinds of reading disabilities, and for optimal results, remedial instruction should be tailored to match the type of reading disability. The belief that there are different forms of reading disabilities arises from the premise that reading skill is made of several components and that weakness in each one of these would result in a different form of reading disability.

PART 1. THEORETICAL AND EMPIRICAL BASES OF THE DIFFERENTIAL DIAGNOSIS AND TREATMENT PROCEDURE

A component can be defined as an elementary information processing system that operates upon internal representations of objects and symbols (Sternberg, 1985). To be considered a component, the process should be demonstrably independent of other processes. An additional constraint placed on this definition is the level of theorizing chosen by researchers, often dictated by practical considerations. Because of this subjectivity, some researchers have identified the component of reading at a comparatively general level (e. g., Leong, 1987) whereas others have preferred a fine-grained analysis (e. g., Fredriksen, 1982) of reading. The diagnostic procedure described in this chapter defines components at a general level and considers reading to be made up of two components, *word recognition* and *comprehension*. The first component, word recognition,

(also referred to as *decoding* in this chapter), is the ability to pronounce the written word either overtly or covertly and is largely determined by the phonological skills of the reader. In the present context, word recognition, therefore, is used to refer to an ability to transform graphemes into phonemes; it is *not* used to refer to an ability to process words as gestalt units. Comprehension, the second component, is a higher level information processing ability and is used here as a generic term to include both reading and listening comprehension. The proposition that comprehension is a generic process which includes both listening and reading comprehension is supported by the findings of numerous studies which report high correlation coefficients between the two forms of comprehension. A typical finding is that of a study by Palmer, McCleod, Hunt, and Davidson (1985) in which a coefficient of .82 was obtained between reading comprehension and listening comprehension which led the investigators to conclude that reading comprehension can be predicted almost perfectly by a listening measure (see Aaron & Joshi, 1992 for a review).

Evidence for the componential nature of reading comes from four sources: developmental psychology, experimental psychology, neuropsychology, and genetic studies of dyslexia.

Developmental psychology

The existence of children who have average or above-average IQ but have difficulty in recognizing written words has been reported since the end of the last century (cf., Morgan 1896). These children have been traditionally described as developmental dyslexics. However, the possibility that there are children who can decode the written language quite well but have difficulty in comprehending it has been slow in coming. Carr, Brown, Vavrus, and Evans (1990) report that nearly 25% of poor readers can decode written passages well but cannot comprehend them nearly as well. In a British study, Oakhill and Garnham (1988) found that nearly 10% of the children in early primary grades have this form of problem. Stothard and Hulme (1994) studied 147 children and identified 14 children as having difficulty in comprehension but not decoding. This figure matches the one reported by Oakhill and Garnham.

In one study, Frith and Snowling (1983) found that children with dyslexia comprehend much better than they can read aloud, and some autistic children with hyperlexic symptoms decode print with considerable facility but do not comprehend well what they read. Indeed, studies of hyperlexic children show that they can recognize words and read aloud passages fluently without understanding them (e. g., Aaron, Franz & Manges, 1990, Healy, 1982). These studies indicate that decoding and comprehension are separable processes, a finding that is in agreement with the two-component view of the reading process.

1. Experimental psychology

In an experimental investigation, Jackson and McCelland (1979) studied undergraduate students and found that comprehension ability and reaction time in a letter-matching task accounted for nearly all of the variance seen in reading achievement. Investigations by Hunt, Lunneborg, and Lewis (1975) and by Palmer, McCleod, Hunt and Davidson (1985) also found that comprehension and speed of decoding the printed word are the two most important components of reading. More recently, Levy and Carr (1990), after discussing the nature of the reading process, concluded that comprehension and word recognition are dissociable processes and, therefore, could be considered to be components of reading.

2. Neuropsychology

Neuropsychological studies of "deep dyslexia" and "surface dyslexia" also indicate that comprehension and word recognition can be independently affected (e. g., Marshall & Newcombe, 1973). The reading deficits seen in cases of "deep dyslexia" indicate that word decoding skills can be impaired leaving comprehension relatively intact, whereas cases of "surface dyslexia" indicate that words could be recognized without being correctly comprehended.

3.   Genetic studies

Genetic studies of developmental dyslexia also support the view that word pronunciation skill is independent of comprehension skill. In a study of twins with reading disabilities, DeFries, Fulker, and LaBuda (1987) found significant heritability for word recognition, spelling, and WISC-R Digit-span but not for reading comprehension. After investigating MZ and DZ twins with reading disabilities, Olson and his associates (cited in Pennington & Smith 1988) found that nonword reading skill is highly heritable whereas comprehension is not. Commenting on these studies, Pennington and Smith (1988) conclude that in dyslexia, single-word reading, spelling, and digit span are genetically influenced but not comprehension.

The choice of the two component model is influenced by these empirical evidences as well as by practical considerations. The pragmatic considerations include the fact that the two-component model of reading requires relatively simple diagnostic procedures that can be carried out quickly and easily by the classroom teacher. More importantly, the diagnostic procedure leads directly to remedial instructional strategies. In other words, the diagnostic procedure is "outcome based", a phrase that has gained much popularity recently in the United States. It follows then that poor readers with a weakness in word recognition but adequate comprehension skills can be expected to do best when they receive remedial instruction that focuses on improving phonological skills; conversely, children with weak comprehension but adequate decoding ability are likely to become better readers when remediation is focused on comprehension skills; children who are weak in both these areas can be expected to improve when they receive a comprehensive remedial instruction. There is empirical evidence to justify these expectations. For instance, Oakhill and Garnham (1988) report that, in their studies, they found that poor comprehenders who improved their decoding skills after training, did not show a corresponding improvement in comprehension. According to Palincsar (1986), children who had comprehension deficiencies but good decoding skills, improved their comprehension skills after receiving metacognitive training that was designed to improve comprehension.

PART II. DIFFERENTIAL DIAGNOSTIC PROCEDURE

The conventional diagnostic procedure that is used in the U. S., for identifying reading disability is based on the extent of the discrepancy found between a child's potential for reading and his/her actual reading achievement. This diagnostic procedure runs into two problems: one is the determination of the extent of discrepancy that marks reading disability and the other is the method adopted for estimating the child's reading potential.

Determination of the extent of the discrepancy that serves as a marker for reading disability is not a psychological decision but a fiscal one, based on the amount of monies allocated to a school district in any given year. Because of this, the number of children identified as having reading disability can vary from year to year.

The method used for estimating the reading potential is to administer an intelligence test to the child and then projecting his/her reading potential from the IQ obtained from the test. This practice is based on two assumptions: (i) the relationship between IQ and reading achievement is unidirectional (i. e., IQ determines reading ability and not *vice versa*) (ii) the correlation between IQ and reading achievement is sufficiently high to predict the latter from the former. Both these assumptions are, however, unwarranted. For example, it is well known that poor readers spend less time in reading than good readers do and, as a result, fail to develop sufficient language and vocabulary skills. It is also well documented that these stunted language skills can, in turn, lower the verbal IQ of poor readers (Stanovich, 1986; van den Bos, 1989). This phenomenon labelled as the *Matthew Effect* (Gospel according to St Matthew, 25:29) indicates that reading skill can affect verbal IQ and, therefore, the IQ-reading relationship is not unidirectional but is reciprocal. As for the second assumption, the correlation coefficients obtained between IQ and reading achievement scores generally fall in the vicinity of 0.4 or 0.5. Interpreted statistically, this means that IQ can account for only about 16% to 25% of the variance seen in reading achievement scores.

Perhaps the most serious drawback in using IQ tests for identifying reading disability is that such a procedure is not outcome-based. In other words, the IQ-reading achievement discrepancy may be able to detect a reading disability but gives us no hint regarding the cause of the reading problem, nor does it lead to decisions regarding remedial instructions. The procedure described in the following pages is expected to minimize some of these problems.

The diagnostic procedure described in this chapter is based on the following propositions:

(1) reading ability is, ultimately, the ability to comprehend written language;

(2) reading ability is composed of two major components - decoding and language comprehension;

(3) apart from decoding and the differences attributable to modalities effects, reading comprehension and listening comprehension are mediated by the same cognitive mechanisms and, therefore, are highly correlated;

(4) the best available predictor of reading comprehension is, therefore, listening comprehension; and

(5) development of decoding and comprehension skills can be arrested independent of each other resulting in three kinds of reading disabilities:

(i) Specific Reading Disability or Developmental Dyslexia, associated with deficient decoding but adequate comprehension skills,

(ii) Nonspecific Reading Disability, associated with poor comprehension but adequate decoding skills

(iii) Generalized Reading Disability, associated with deficiencies in both decoding and comprehension.

There is empirical evidence to support the proposition that poor readers can be classified into three categories. The first group of individuals marked by adequate listening comprehension skills but poor decoding skills is referred to by labels such as dyslexics, and children with specific reading disability. Poor reading comprehension in these individuals is not a primary problem but is secondary to weak word recognition skill. The sporadic reports of weak liste-

ning comprehension skills of individuals with dyslexia appear to be due to weaknesses in short-term phonological memory of these individuals and not due to comprehension deficit *per se*. For example, Shankweiler, Crain, Brady and Macaruso (1992) cite a number of studies which show that when materials are presented in ways that lessen memory load, children with reading disability perform as well as good readers on tasks of spoken language comprehension. Neuropsychological studies also indicate that patients with limited phonological memory who have difficulty retaining and repeating sentences verbatim can, nevertheless, comprehend the meaning of sentences and make judgements about their semantic and syntactic correctness (Martin, 1993). In the present context, developmental dyslexia is defined as deficient reading comprehension in the presence of adequate listening comprehension. Defining dyslexia in these operational terms also mitigates the fact that a satisfactory definition of dyslexia has always eluded experts in the field of reading disability.

The evidence for the existence of the second group - those with adequate word recognition skills but poor comprehension - was presented earlier in the chapter (Carr et al., 1990, Oakhill & Garnham, 1988, Stothard & Hulme, 1994). In this chapter, these children are described as having Nonspecific Reading Disability. Traditionally, educators refer to this type of children as "word callers". Children with hyperlexia represent an extreme condition of this form of reading disability.

The third form of reading disability which arises out of deficits in both word recognition and comprehension skills is, perhaps, the most prevalent category of reading problem. Individuals who can be placed in this category invariably have IQs in the low-average or borderline range. For this reason, individuals with decoding and comprehension deficits are described as having Generalized Reading Disability. A good deal of confusion exists in the dyslexia research literature because of failing to identify children belonging to this group and separating them from children with dyslexia.

Evidence was provided earlier in the chapter to show that different remedial approaches may be necessary for the different types of reading disabilities. For this reason, differential diagnosis of reading disabilities becomes a necessity. Such a differential diagnosis is based on the symptomatic differences among the three

forms of reading disabilities, a topic which we will now turn our attention to.

Symptoms that Constitute the Syndrome of Developmental Dyslexia or Specific Reading Disability

The phonological weakness seen in individuals with dyslexia manifests itself in several symptoms; hence it is best to consider dyslexia as a syndrome. The following description of the dyslexia syndrome is based on the proposition that the difficulty experienced by individuals with dyslexia in recognizing words can be traced to phonological weaknesses. Some researchers have, however, proposed that more than one type of developmental dyslexia exists. If, indeed, there are different kinds of dyslexic subjects, they will require different forms of remedial instruction. For this reason, the issue of subtypes is not a trivial one. One such subtype, arising from weaknesses associated with visual processing has been proposed by Stein and Fowler (1980). Evidence that support the existence of this subtype, however, is scanty (e. g., Aaron, 1993; for a dispassionate discussion of this issue, see Miles & Miles, 1990). Still others have noted that there might be dyslexic children whose difficulty arises not because of their inability to transform graphemes into phonemes (i. e., decoding), but because of their inability to process words as whole units (e. g., Castles & Coltheart, 1993). This proposition is based on the hypothetical dual-route model of reading. According to this model, one route is used for word recognition by transforming graphemes into phonemes with the aid of grapheme-phoneme conversion rules. Word pronunciation, when this strategy is utilized, is said to be "assembled" and the process is described "sublexical". The second route recognizes words by processing them as gestalts, without analyzing them into constituent graphemes. Under these circumstances, the word is said to be "addressed" and the process is described "lexical". The dual- route model further assumes that readers rely on the sublexical route for reading aloud unfamiliar words and pronounceable non-words and the lexical route for reading aloud "irregular" words (also referred to as exception words) that do not conform to modal rules of pronunciation. For instance, the pronunciation of the non-word

"habe" can be achieved only by assembling the phonemes that correspond to the graphemes through sublexical processes. On the other hand, pronunciation of the word "have" (which is pronounced differently from cave, nave, pave, etc.,) is retrieved as a single unit by accessing the lexicon. Consequently, there can be two types of poor readers, one who cannot read correctly aloud pronounceable non-words because they cannot use grapheme-phoneme conversion processes effectively, and the other who cannot pronounce correctly "irregular" words because of an impoverished lexicon.

An overwhelming body of research indicates that dyslexic children are very poor in reading non-words because their grapheme-phoneme conversion skills are weak. The evidence for the existence of a putative second type of dyslexics who can read non-words well, but cannot read aloud "irregular" words is almost non-existent (but see Castles & Coltheart, 1993). For example, based on their research, Gough and Walsh (1991) note that they have not seen children who perform poorly on non-word reading tasks but well on tasks that require the reading of irregular words. Furthermore, the notion that reading aloud of "regular" words and irregular words is accomplished by two different mechanisms may not be a valid one; certainly, the human information processing system can handle more than one rule (as in the pronunciation of "cat" and "city"). Barron (1986) has presented other evidence to show why the dual route model fails to provide a satisfactory account of the acquisition of word recognition skills. The postulated two subtypes of developmental dyslexia may, in fact, represent two substages in reading acquisition rather than two subtypes.

The symptoms that constitute the syndrome of developmental dyslexia or specific reading disability are described in the following section.

1. Poor grapheme-phoneme transformational skill

The most obvious deficit seen in dyslexics is poor word-recognition skills. Even though the written word could be recognized by extracting its meaning and without resorting to phonological transformation, such a strategy appears to develop as a result of exten-

sive reading. It can, therefore, be assumed that, not having a size-able vocabulary, beginning readers tend to rely on the decoding strategy for recognizing printed words. Furthermore, in order to extract the meaning of long sentences, the string of words in the sentence has to be kept in a temporary memory store. Phonological memory appears to be well suited for this purpose. The phonological memory of individuals with developmental dyslexia, as indicated by digit-span, is almost always poor, a condition that can impede reading comprehension.

2. Slow reading speed

A number of studies show that the speed with which words are recognized is a major variable that contributes to individual differences in reading skills. Even though some poor readers may be able to recognize some written words without resorting to phonological recoding, these children are held back when they encounter unfamiliar words and words that lack meaning. Slow reading is not limited to children; college students with dyslexia also are slow (Aaron & Phillips, 1986).

3. Errors in oral reading

Oral reading is routinely employed by teachers as a means of assessing the reading skills of children as well as for improving the reading skills of young children. While poor readers tend to make more errors than skilled readers, it is the type of oral reading errors that distinguishes dyslexic readers from the other types of poor readers. Substitution errors committed by dyslexic readers indicate that they depend on context for recognizing words which often does not radically alter the meaning of the sentence. Thus, a dyslexic child may read the sentence "This is the house that Jack built" as "This is the home that Jack bought". In contrast, poor readers with comprehension deficit (Nonspecific and Generalized Reading Disabilities) often produce words that alter the meaning of the sentence; occasionally, they also produce neologisms. Sometimes, dyslexic readers utilize minimal cues involving the first two

letters of a word and guess the word. They, however, seldom gene-
rate neologisms.

Individuals with dyslexia also tend to omit many function words
and word suffixes; they also frequently substitute one function
word for another. For instance, the article "a" may be substituted
for "the" and the preposition "on" for "above". While evaluating
these errors, the most important criterion to be kept in mind is
whether the gross meaning of the sentence or phrase is preserved
or not.

4. Poor spelling

Many studies of developmental dyslexia suggest that poor spelling
is a concomitant of reading disability. This should come as no sur-
prise because spelling-to-sound relational rules are used both in
reading and spelling. Being weak in phonological skills, dyslexic
readers commit an unusually large number of spelling errors.

Traditionally, the ability to spell was thought to be primarily a
visual process involving memorization of the sequence of letters in
words. Drawing from developmental studies of others as well as
her own research of children's acquisition of spelling skills,
Treiman (1993), however, has argued that spelling is an attempt to
represent a word's sound rather than it is an attempt to recall the
string of letters in a word. The high degree of correlation seen
between spelling and decoding skill supports this view (Ehri, 1983;
Bruck & Waters, 1988; Rohl & Tunmer, 1988). Sometimes it is
claimed that there are adults who are poor spellers but good
readers. A study by Joshi and Aaron (1991), however, shows that
these so called "poor spellers but good readers" might be able to
read words as sight words, but still have subtle phonological
deficits. It should be noted, however, that there are many words in
the English language which cannot be spelled correctly by using
rules of pronunciation alone. Under these circumstances, some kind
of non-phonological memory for orthographic units should play a
role. Kreiner and Gough (1990) call this "word-specific memory"
and have provided evidence which suggests that such a memory
does play a role in spelling words.

Children's mastery of spelling skills appears to proceed in stages that correspond to the development of grapheme-phoneme relational skills. Treiman (1993) has identified four stages of spelling development: (1) the precommunicative stage in which there is little evidence of correspondence between phonemes and graphemes, (2) the semiphonetic stage (e. g., mail -"ml"; carpet-"crpt"), (3) the phonetic stage (e.g., city-"sity"; blue-"bloo"), and finally (4) the morphophonemic stage in which phonemic, semantic, and syntactic information is used to achieve correct spelling. I have gone into some detail about the acquisition of spelling skills because there have been attempts to classify dyslexia into subtypes also on the basis of spelling errors. Perhaps the best known work in this regard is the one by Boder (1973) who classified spelling errors into three categories: *dyseidetic* (e.g., girl-"gal"; blue-"bloo"), *dysphonetic*, (e.g., girl-"gril"; stop-"spot"), and *mixed*. Sometimes, *dyseidetic* and *dysphonetic* subtypes are considered equivalent to "visual dyslexia" and "auditory dyslexia," respectively. However, the developmental trends seen in the acquisition of spelling skills discussed above provides an alternative explanation. It appears that the different kinds of spelling errors, instead of representing different subtypes of dyslexia, represent two substages of spelling development. Evidence for this interpretation of spelling errors was obtained by Phillips, Taylor, and Aaron (1985). Indeed, dysphonetic spelling errors are seldom seen in the writings of college students with dyslexia. Phonologically acceptable spelling errors indicate that the subject has reached stage 3 of spelling acquisition but not the more linguistically complex stage 4.

5. Errors of syntax in written language

Errors of function word usage and word suffixes are often seen in the writings of dyslexic subjects. Even though there may be a considerable amount of intersubject variation in this regard, errors of written syntax mirror those seen in oral reading of these individuals. Some of these errors are due to confusion between homophones ("were" for where; "one" for won) and thus reflect a subtle phonological weakness. Experimental studies also show that when a printed word is read, the root morpheme is stripped off its suffix

and is processed as a separate unit (Gibson & Guinet, 1971). It would be reasonable to expect that lacking semantic content, suffixes are handled by the phonological mechanisms. This would explain the large number of suffix omissions and substitutions seen in the oral reading and writing of dyslexic subjects.

6. Excessive reliance on context for word recognition

A distinction should be maintained between utilizing context for comprehension of sentences and depending on context for word re-cognition. It is in the latter sense "context dependency" is used here. A substantial number of studies show that subjects with weak word recognition skills depend more on context for recognizing written words than good readers do (e. g., Allington & Fleming, 1987; Mitchell, 1982). The word substitutions made when reading aloud is an indication of context dependency. Oral reading errors made by dyslexic subjects often are context appropriate and do not drastically disrupt the meaning of the sentence.

7. Adequate listening comprehension

Even though an ability to listen and comprehend spoken language well can not be considered a symptom of a problem, it is very useful for differentiating developmental dyslexia from the other two types of reading disabilities. As noted earlier in this chapter, reading comprehension and listening comprehension are highly correlated and developmental dyslexia is indicated by poor reading comprehension in the presence of adequate listening comprehen-sion. It should, however, be noted that poor reading comprehen-sion of dyslexic subjects is not a primary deficit but is secondary to word-recognition problems.

Symptoms Associated with Nonspecific Reading Disability

1. Adequate grapheme-phoneme transformational skills

Individuals who can be considered as having Nonspecific Reading Disability have adequate or even superior word recognition skills. This is particularly true for common words and high frequency grammar words. Unlike individuals who show symptoms of dyslexia, these subjects very seldom misread grammar words.

2. Adequate reading speed

The speed with which individuals read lists of words or familiar passages is within normal limits.

3. Errors in oral reading

The number of oral reading errors committed by individuals with Nonspecific Reading Disability is strikingly smaller than that of individuals with specific reading disability. However, errors that are committed during oral reading are likely to be context inappropriate; occasionally this can also be seen in their reading. Weber (1970) notes that poor comprehenders not only produce inappropriate errors but are not likely to correct those errors.

4. Spelling errors

Reading involves the transformation of graphemes into phonemes and is a word recognition task; spelling involves the converse process but is a recall task. As a result, spelling is a more difficult skill to acquire than word reading.

Individuals with Nonspecific Reading Disability are reasonably good spellers. However, unlike individuals with dyslexia who mis-

spell even common grammar words, they tend to misspell only uncommon words. The misspellings also reflect a weakness in morphophonemic skills.

5. Errors of syntax in written language

Errors involving the use of simple syntax is not frequently seen in the writings of these individuals. However, syntactically complex sentences (e.g., passive voice interrogative negative) and sentences with embedded clauses are not often seen in their writings; when they attempt to produce such sentences, errors can be seen. This frequently alters the meaning of sentences. The thematic quality of their writings is also poor.

6. Reliance on context for word recognition

Context is seldom used for word recognition by individuals with Nonspecific Reading Disability. When these individuals encounter difficulty in recognizing words, they often guess the word which results in inappropriate words which can disrupt the meaning of the sentence.

7. Poor listening comprehension

Unlike individuals with dyslexia, the listening comprehension of individuals with Nonspecific Reading Disability is almost always poor and matches the level of their reading comprehension.

Symptoms Associated with Generalized Reading Disability

Individuals with Generalized Reading Disability have a combination of all the weaknesses of the other two groups of poor readers. In general, the symptoms of individuals with Generalized Reading Disability reflect a combination of both poor decoding and compre-

hension skills. Their reading problem, in fact, is one of the several manifestations of their weak cognitive skills. Their IQs are also in the below-average or borderline range.

The Differential Diagnostic Procedure

The primary purpose of the diagnostic procedure is *not* to classify the poor reader into one of the three categories of reading disability but to identify the weak processes that contribute to his/her reading problems and to recommend appropriate remedial procedures.

Diagnosis involves two testing procedures, formal assessment and informal assessment. The formal procedure utilizes standardized tests and the informal procedure utilizes locally developed tests as well as clinical observations.

The formal diagnostic procedure is based on the expectation that because reading comprehension and listening comprehension are highly correlated and that reading is made up of two components, comprehension and decoding, once the contribution of listening comprehension to reading is factored out, the remaining deficit could be attributed to decoding. This view is advocated by investigators who subscribe to the componential view of reading. For instance, according to Gough and Tunmer (1986), reading (R) equals the product of decoding (D) and comprehension (C). That is, $R=D \times C$. It follows that if $D=0$, then $R=0$; and if $C=0$, then R is also 0. When this proposition is translated into pragmatic terms, it follows that the reading difficulty of a subject who has good listening comprehension but lower reading comprehension can be attributed to poor word recognition skill. Conversely, the reading problems of children who have poor listening comprehension skill originate from comprehension deficits or a combination of comprehension and decoding deficits.

Formal Assessment

Reading comprehension can be assessed with the aid of any well standardized diagnostic reading test. The use of two tests, an un-

timed test and a timed test is recommended. An untimed test suitable for individuals whose primary language is American English is Woodcock Language Proficiency Battery (WLPB), (Woodcock, 1991). A timed test that can be used is the Stanford Diagnostic Reading Test (SDRT), (Karlsen, Madden & Gardner, 1984). These two tests use different methods for assessing comprehension; the WLPB is in a close format whereas the SDRT requires the subject to read a passage and then answer a set of questions. As noted earlier, the difference in performance between a timed test and an untimed test could yield useful diagnostic information. In addition to the test of reading comprehension, the WLPB also has subtests to assess vocabulary and word-attack skill as well as listening comprehension. Listening comprehension can be assessed: (i) by administering the listening comprehension subtests of the WLPB and (ii) by reading to the subject the alternate form of the reading comprehension subtest of SDRT and then requiring the subject to answer questions. Even though assessing listening comprehension with the aid of a test intended for assessing reading comprehension is a departure from standard procedures, this form of assessment produces satisfactory results. The listening comprehension subtest from the Wechsler Individual Achievement Test (Wechsler, 1991) is yet another standardized test that can be used. Clinical observation, however, shows that it tends to yield somewhat inflated scores.

The next step in the diagnostic procedure is to compare the reading comprehension scores of the student with his listening comprehension scores. The raw scores obtained on these tests are converted into standard scores for the purpose of comparison. The logic involved in this comparison is that if the student has a listening comprehension score that is average or better and a reading comprehension score which is lower, his reading difficulty is due to poor decoding skill. In contrast, if he has below-average scores in both forms of comprehension, the deficit is not limited to the written language but includes spoken language as well.

How large must be the discrepancy between the two comprehension scores to be considered indicative of genuine difference? At a very basic level, if there is no overlap between the confidence limits set up by + 1.96 standard error of measurement, then it can be inferred that a difference between these two scores exists and that such a difference is not due to errors of measurement. For instance,

a college student obtains a standard score of 93 on reading compre-
hension and a score of 110 on listening comprehension on the
Woodcock Language Proficiency Battery. When the 95% confidence
range is computed by adding and subtracting 1.96 standard error of
measurement to each of these standard scores, we obtain a range
of 87-101 for reading comprehension and a range of 104-112 for
listening comprehension. Given there is no overlap between these
two estimates, we can conclude with 95% confidence that a true
difference exists between reading comprehension and listening
comprehension and that the source of this discrepancy is his poor
decoding skills. The student's performance on tests of word re-
cognition and other formal and informal tests can be checked to see
if this inference is correct.

The IQ test is often useful as a backup tool. The test that has
been most frequently used for assessment purposes is the WISC -R
(WISC III, now) or WAIS. One of the robust findings that has
emerged from our clinical studies is that the digit-span of dyslexic
individuals, regardless their age, is always well below average.
Individuals with other forms of reading disabilities may also per-
form poorly on the digit-span test; however, dyslexic individuals
get above-average scores on many of the subtests of the
Performance Scale.

Informal Assessment

Informal assessment provides supporting evidence for the initial
diagnosis made on the basis of the results of formal testing. This
form of assessment would include information obtained during
interview, observations made during testing session, clinical im-
pressions, as well as the results obtained by administering non-
standarized tests described in the following section. Teachers and
clinicians can develop their own local norms in order to correctly
interpret students' performance on these tests.

1. Decoding skills

The best way to assess decoding skill is to require the student to read a list of words with which he is unfamiliar. Familiar words would not serve the purpose because they could be read as sight words, without resorting to decoding. For this reason, decoding skill is almost always assessed by using a list of pronounceable non-words. The intent of using a list of nonwords is to assess the reader's ability to convert graphemes into phonemes. It has to be noted that even non-words could be read aloud without resorting to decoding but by using analogy (Treiman, Goswami, & Bruck, 1990). For example, a nonword such as "dake" can be read by ana-logy because it has many neighbors such as "cake", "bake", "make", and so on. For this reason, the list should contain many words without neighbors so that they cannot be read by analogy. An example is the non-word "daik" which does not have many similar looking words. In addition to this criterion, the nonwords should also be selected on the basis of developmental trends of grapheme-phoneme conversion skills and should, therefore, contain complex digraphs, blends, and onsets (e. g., th, gh, ough, etc.).

2. Reading speed

As noted earlier, dyslexic subjects are typically slow readers. Even though requiring subjects to read a passage and computing the time it takes to read would appear to be a straight-forward method for assessing reading speed, this procedure runs into a peculiar problem. That is, even young children who are proficient in reading, pause and ponder over words they have not encountered before. Consequently, two or three unfamiliar words in a passage can have a disproportionately large depressing effect on the reading speed and thus confound the results. For this reason, the use of a list of highly familiar function words and a list of matched content words is recommended. Children (and adults) with dyslexia, when compared to skilled readers, take longer time to read both lists. The difference between the time taken to read the two lists also has diagnostic value, with function words invariably

taking longer time to read. This time difference is much larger for individuals with dyslexia than it is for skilled readers.

Yet another way of evaluating the effect of reading speed on comprehension is to assess reading comprehension by administering two kinds of tests, one a timed test and the other, an untimed test and noting the difference in performance. Runyon (1991) found that college students identified as having reading disability performed much worse than students from a control group on the comprehension part of the timed Nelson-Denny reading test. When the test was administered without time restrictions, there was no significant difference between the two groups in reading comprehension. Contrary to these observations, poor readers belonging to the other two categories of reading disability do not show substantial improvement in comprehension when the time restrictions are removed.

3. Oral reading

Information about errors in oral reading can be obtained by selecting a passage from a textbook appropriate for the grade the child is in. It is preferable to select a passage which the child has not encountered before.

4. Spelling

Poor spelling is assessed by first requiring the child to read aloud a list of words and subsequently dictating only those words which the child had successfully read earlier. This is because unfamiliar words are spelt almost always phonetically; this can result in spelling "errors". It is a good practice for the examiner to read to the child the target word first, then read aloud a sentence in which the word is embedded, read the word aloud again, and then to require the child to write it down. The quality of the written spelling invariably provides hints about the level of the child's mastery of phoneme-grapheme skills whereas the percent of errors committed yields a quantitative measure.

As noted earlier, acquisition of spelling skills proceeds in stages. Consequently, the spelling test should contain words that can yield qualitative information as to which stage the subject has reached. Moats (1993) recommends the use of words representing three different orthographic patterns: (1) *transparent*-words such as "him", "wet", and, "cow" which have relatively simple phoneme-grapheme relationship; (2) *morphophonemic*-words such as "re-hearsal", "coming", "hopped", and "audition" whose spelling pattern is governed not only by phonology, but also by semantics, syntax, stress patterns, and etymology; (3) *opaque*-words such as "cough", "tongue", and "gnaw" whose spelling patterns are not governed by familiar linguistic factors and, therefore, have to be learned by rote. Spelling correctly words whose orthography is transparent reflects a mastery of phoneme-grapheme relational rules; spelling correctly words whose orthography is morpho-phonemic indicates the utilization of complex linguistic knowledge; spelling correctly words whose orthography is opaque indicates the successful utilization of word-specific memory.

5. Errors of syntax

Errors of syntax in written language are noted by asking the subject to write a paragraph or two on a topic specified by the examiner. The product is evaluated both for quality of writing as well as for errors of syntax and errors involving the use of grammar words.

6. Context-dependency

Context-dependency is assessed by asking the subject to read aloud a long list of words taken from the passage used for evaluating errors in oral reading (#3 above). The words on the list that are misread by the subject are noted and then his reading of the passage is examined to see how many of the words missed in the list had been read correctly in context. The percent of words read correctly in context but missed in the list provides a measure of context-dependency.

Diagnostic Procedures with Preschool Children

Many parents with children in late kindergarten or beginning first grade become aware, for the first time, that their child may have a reading problem. A diagnostic reading test is out of question because the child is just beginning to learn to read. In such cases, assessment must focus on skills that are prerequisites for learning to read. One such skill is phonological awareness and another is memory for phonemes. A combination of a test of phonological awareness and a test of phoneme repetition can be a reliable predictor of reading achievement. Tests of phoneme awareness assess the child's ability to identify and manipulate phonemes that are in words that are presented auditorily. A commercially available test of phoneme awareness is the Lindamood Auditory Conceptualization test (Lindamood & Lindamood, 1971). Items that can be used in developing a phonological awareness test also can be taken from an experimental list developed by Stanovich, Cunningham, and Cramer (1984). The phoneme repetition task, which assesses memory for phonemes, requires the child to repeat a string of phonemes that are presented orally. Gathercole, Willis, Baddeley, and Emslie (1994) have developed a standardized list of non-words that can be used for this purpose.

PART III.   TREATMENT PROCEDURES

Available treatment approaches can be classified into two broad categories: those which are designed to improve word-recognition skills, and those which are created to improve reading comprehension. The approach chosen for use as well as the specific method adopted will depend on the nature of the deficit seen in the students.

1.   Improving Word-recognition Skills

A number of studies show that poor decoding skills are associated with poor phonological skills and that training in phonological awareness and phonological analysis improves word recognition

skills (Bradley & Bryant, 1985; Hurford, 1990; Lundberg, Olofsson, & Wall, 1980). Children with Specific Reading Disability, eventually, improve in comprehension also. In a yet unpublished study, we taught word-recognition skills to a group of seven first-grade children through synthetic phonics and with the aid of an interactive writing computer program. These children had adequate listening comprehension but poor reading comprehension even though they were nearing the end of the first grade. The intervention program lasted for three months. Post-treatment evaluation showed that 5 out of the 7 children showed noticeable improvement in their decoding skills. Surprisingly, these 5 children also showed similar improvement in reading comprehension even though the intervention program did not focus on comprehension. Two children did not show improvement in decoding skills; these two children also did not show improvement in reading comprehension. We interpret this finding to indicate that, in these 5 children, weak decoding skill was acting as a limiting factor of reading comprehension.

During the initial stages, phonological awareness training is entirely oral-aural. After the child has demonstrated an awareness of phonemes, graphemes are gradually introduced and subsequently, the relationship between graphemes and phonemes is taught. During later stages, the connection between larger units of graphemes such as syllables and words and their pronunciation is taught. Detailed information about phonological awareness training and transferring such awareness to the reading task is presented in Aaron (1989) and in Aaron and Joshi (1992). *Auditory Discrimination in Depth* (Lindamood & Lindamood, 1993), a commercially available program, introduces consonant and vowel sounds through a multisensory experience of hearing, seeing, and feeling. Children hear these sounds, see the tongue and mouth movements as these sounds are produced, and feel the sounds by putting their hands against lips and vocal chords. Subsequently, children are taught to discriminate the different phonemes by associating them with wooden blocks of different colors. Finally, children are taught to associate various phonemes with the letters of the alphabet. At this point, phonics reading instruction could be introduced by switching over to the *Spalding's Writing Road to Reading Method* (Spalding & Spalding, 1986). The Spalding method has a good track record as indicated by research findings.

Furthermore, this method emphasized writing from the very beginning.

2. Improving comprehension skills

Comprehension failure could be for two reasons: (1) not having the required knowledge, and/or (2) not having or not being able to use the appropriate reading strategies.

Not having the required knowledge could, in turn, be due to two reasons: not having adequate vocabulary to comprehend the written passage or, not having the required background knowledge (schema) for comprehending the written passage.

3. Vocabulary instruction

Vocabulary is a very important correlate of reading ability. Studies which have examined the relationship between vocabulary size and reading comprehension report correlation coefficients that range from .66 to .75. Teaching vocabulary by presenting a list of words with their dictionary meaning in a paired-associate format is known to be an ineffective method of vocabulary instruction. This is not an unexpected finding because it is easier to remember and recall meaningful information than pairs of words memorized in a rote fashion. Vocabulary instruction can be indirect or direct. Indirect instruction depends on providing opportunities for the reader to encounter words in the context of sentences and passages by increasing the opportunities for reading. Many experts, however, believe that repeated encounters with novel words in text is fortuitous, and, therefore, cannot be relied upon as a dependable means of vocabulary acquisition. For this reason, many educators recommend direct instruction in the teaching of vocabulary. Direct teaching of vocabulary includes the following three techniques: semantic mapping, cluster analysis, and morphological analysis. Semantic mapping is a technique in which the relationship between a word and its semantic relatives such as antonyms and synonyms are portrayed in the form of a visual display. This can be carried out as a classroom project. Cluster analysis is very similar to

semantic mapping but is limited to the development of conceptually and thematically related words. Morphological analysis involves analyzing words into root morphemes and their affixes, and tracing the etymological origins of words.

4. Development of background knowledge and schemata

A practical approach to the development of the schema necessary for comprehending a written passage is the *Language Experience* approach. This approach is based on the belief that the language and experience of children can be a much better vehicle to impart reading skills than a set of preselected passages which may be remote from the reader's background. Typically, *Language Experience* instruction may follow these steps. An opportunity is created for children to experience an event, such as watching a movie or visiting a hospital. After this experience, children sit in small groups and narrate their experiences. The teacher writes these narratives on the chalkboard and children copy these on sheets of paper. Subsequently, the children are asked to read the sentences they have on their sheets to the class. These sheets of paper are eventually bound together to create the child's own book.

5. Strategy instruction

Many poor comprehenders either do not possess the strategies necessary for comprehending a passage or do not realize that they are not utilizing these strategies when they read. Thus, strategy instruction has two components:
(1) teaching the strategies that are essential for reading comprehension, and
(2) developing metacognitive skills so that the reader is able to monitor his/her use of (or failure to use) these strategies.

Strategies that are essential for reading include knowing the purpose of reading (for details, for appreciation, for global concepts, for purposes of critiquing, etc.), being able to identify the main idea, being able to identify supporting details, being able to

locate inconsistencies, being able to predict, and make inferences. Metacognitive training includes making the reader aware of his own abilities and limitations and adopting the needed compensatory actions. It also includes the development of an ongoing comprehension monitoring skill so that corrective actions can be undertaken when comprehension fails.

The *Reciprocal teaching* advocated by Palincsar (1986) combines training in the use of these strategies and the creation of metacognitive skills which enable the reader to monitor the extent to which he/she uses these strategies. In the case of a failure to use these strategies, the reader is sensitized to this failure and is taught to take corrective action. According to Reciprocal teaching, there are six comprehension strategies:

(1) understanding the purpose of reading

(2) activating relevant background knowledge

(3) allocating attention to main ideas

(4) critical evaluation of the passage

(5) using comprehension activities (such as summarizing questioning, clarifying, and predicting) and monitoring them

(6) making inferences including interpretations, predictions, and conclusions.

There are three major steps in Reciprocal teaching. First, these strategies are taught overtly and explicitly by the teacher. The teacher uses role playing and modelling techniques to accomplish this goal. Second, the students are coached to implement these strategies and activities as they read. This part of the instruction can be carried out in small groups with the teacher constantly monitoring the students' performance. One member of the group assumes the teaching role. This method of teaching is "reciprocal" because each student in the group gets an opportunity to play the role of the teacher. During the third and final stage, the teacher fades the support as the students learn to implement these strategies and activities spontaneously.

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Chapter III

SUCCESSFUL REMEDIAL TEACHING WITH FEWER RESOURCES

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Introduction

The purpose of the present paper is to suggest how current know-ledge about reading acquisition can be used in a manner that is both effective and economical. Trying to correct a severe reading failure after, say, five years of schooling is time-consuming and costly. The same is true of a larger group of students in first and second grade who lag behind the level of their classmates, while understanding less and less of the discourse in the classroom. The authors are in-volved in a large-scale project whose purpose is to develop a model of how to identify such beginning difficulties and to provide a re-medy immediately after the start of the school. We have also worked with students who have gone through all conventional attempts to help their reading problem but who, after several years, cannot read at all. Our basic tenet is that the knowledge we have at present is sufficient for useful teaching designs. What is needed is a proper organization of the work in order to prevent the all too common frictions between adults who are in one way or another involved with the learning problem.

A child's reading failure worries the parents and teachers. After a while even the child becomes aware that he or she is performing below the level expected by important adults. The scene is set for events that are not merely cognitive or pedagogical in nature. What can be done and how? A popular answer has been, throughout the 1900's, that the problem be dealt with by a direct attack. It is assumed that the weak spot should be strengthened by extensive practice. For this purpose, remedial and supportive teaching resources are needed. This field, in its turn, is impregnated by assumptions that a single cause or a combination of causes

underlies the problem. Great efforts may be spent, for example, on strengthening the problem reader's sensory and motor skills. While such alleged causes have much intellectual appeal, the allegations seldom bear fruit. In fact, there is little reason why they should, as such explanations have failed to solve problems of a simpler nature than a reading difficulty. Take juvenile diabetes as an example. It was once thought that regular injections of a sufficient amount of insulin would keep the illness under control. However, it soon became apparent that a good balance of glucose in blood serum results from a complex interaction involving insulin, diet, physical exercise and feelings. The most straightforward procedure with insulin and diet probably leads to bad feelings and an impoverished quality of life, paradoxically resulting in disturbed balance.

In our view, direct attacks on a reading problem suffer from three serious shortcomings. Firstly, reading failure represents a deficient cognitive skill, not an illness that can be cured. Secondly, the measures suggested by an "illness approach" are aimed at assumed yet unknown causes. Thirdly, a sizeable portion of a problem reader's resources are left dormant instead of being used as reading skill building blocks. The first two criticisms can be met by an adequate theory of reading acquisition. In fact, research on and practical applications of linguistic awareness satisfy this need (e.g., Bradley & Bryant, 1983; Juel, 1988; Lundberg, Frost, & Petersen, 1988). The question is, thus, how to organize the existing psychological and social resources in an optimal way to help the problem reader. Needless to say, the present economic hardships seem to underline the importance of the issue.

At our Center for Learning Research we have learned from bitter experience that linear thinking may lead to unpleasant surprises, particularly with persistent reading problems. Characteristic of such problems is the frustration felt by all parties. Feelings of guilt and mutual accusations tend to dominate the scene, often precluding constructive initiatives. A child's failure is very distressing to the teacher who may feel that his or her prestige is at stake. The parents are even worse off, particularly if there is a history of reading failure on either parent's side. With these considerations in mind, we have adopted a systemic approach (see, e.g., Plas, 1986) to persistent reading failures in an attempt to reduce the psychosocial distress around the problem. Our point of de-

parture has been to arrange a meeting among all parties: the child and parents, classroom teacher, special teacher, speech therapist and school psychologist. This simple count reveals that there are usually no fewer than six adults directly involved with the child's reading problem, the seventh being the worker from our Center. It may sound trivial to say that such an impressive congregation displays many conflicting motives and sentiments and is vulnerable to the extent that the child's reading problem soon may matter less than adult prestige. Our approach has, therefore, aimed at simplifying the social structure while guaranteeing that nobody will be left uninformed. The intervention has started with a promise that our Center from now on assumes full responsibility for a possible failure. However, the Center will provide effective supervision for one, but only one person who will be the primary resource for the child. All the others who are involved will form a support group that meets once per term if not otherwise stipulated. In practice, it has turned out that the person directly involved is almost always either the classroom or special teacher of the child.

Somewhat surprising has been the constant finding that the parents, particularly the mother, have done too much work with the child's reading problem. Therefore, our standard instruction to them has been to leave the teaching proper to the designated person. This need was dramatically underscored in the family of an 8-year-old boy who could not read a single word. The school psychologist interviewed the despairing mother who felt abandoned with the boy's difficulty while working with him 3 to 4 hours daily after school. Despite her efforts, the boy displayed no progress in his reading but instead tended to play with his toys during the sessions. The last straw for the mother had been when the father had lost his temper with the son, had taken the toys away and ordered him to start working. When asked about the consequences of this scene, the mother reported that the boy had started to do his homework ! Our psychologist had a background in family therapy, and she soon realized that the mother had needed her son's reading difficulty as a tool in her struggle with her husband. The recommendation was thus made that the family should cease to interfere with the son's schoolwork. No wonder that the boy learned to read within six weeks.

In the following, two case studies are reported on students who were predicted to remain non-readers for the rest of their lives. However, in both cases there was someone who firmly believed that there was some capacity in the child. This was the situation when our Center was contacted.

Case SK: Fluent speech, no reading

SK was 11 years old when his teacher contacted the Center for Learning Research. SK had gone to a special school because of general mental retardation (WISC-R score 55). His record revealed no neurological defects. During his five years in school SK had learned to say the alphabet and spell a few syllables. However, he could not combine syllables in a meaningful way and he showed no signs of linguistic awareness. He spoke fluently in a clear voice. The teacher felt that SK still had unused capacity and he was willing to try once more to teach him to read because he saw "sparks in the eyes" of the boy. SK's mother had recently been divorced from her husband. She welcomed the proposal. The school principal gave his support to the consultations and teacher colleagues expressed their interest in the project.

It was obvious that phonics based on phonemic awareness would be an appropriate teaching method. The almost complete grapheme-to-phoneme correspondence of the Finnish language favors this approach. Thus, the debates on teaching methods deal with the relation of phonics to the spoken language. The older variants of the method used in Finland resemble spelling with the names of the letters, not their phonetic forms. SK had primarily been taught with such an approach in the past. However, he was totally confused about reading. This was no surprise in view of his reduced working memory capacity which equalled three items. These facts suggested that SK would probably benefit from the teaching approach where the relationship between spoken and written words is made explicit (Cunningham, 1990).

The program was begun in August 1986 with a concentrated training in phonemic awareness. At baseline SK identified the first letter correctly in 7 and the last letter in 3 frequent four-letter words (maximum 18 + 18). After two months' training he scored 14

and 12, respectively. Subsequently, the teacher organized 2 to 3 individual sessions per week with SK, each lasting 20 min. This duration was the upper limit for SK's patience. In November, SK had a reading vocabulary of about ten two-syllable, four-letter words. He tried out consonants in his mouth before joining them with a vowel. By February 1987, his reading vocabulary had increased to 25 words. SK now displayed alphabetic-phonemic reading which is the third lowest stage in Høien and Lundberg's (1988) model consisting of 10 stages of reading development. The breakthrough happened at this point. In April, SK easily read words of five letters. He also started to guess on the basis of context and tried to get the teacher to verify the guesses. The value of consultations was apparent because the teacher felt frustrated by these tendencies. His motivation was boosted when it was pointed out that SK's behavior was in line with predictable reading progress. At the end of the term, SK started to borrow books from the school library which he took much pride in. In November 1987, he recognized even long words and his general reading speed was 15 words per minute. He was markedly less dependent on the teacher, with good reason: he had started to praise himself for a successful performance. The latter was interpreted as an indicator of awakening metacognition.

A typical learning plateau followed the above progress. In March 1988, SK read at a speed of 17 wpm, gradually becoming confident in his word recognition. The following August, two years after the start of the program, SK was judged eligible for an integrated school. In this school form, special classes use the same facilities as the regular ones and the idea is to bring about a constructive mix of "normal" and "special" students. Although considered a promotion by all of us, this decision turned out disastrous for SK. During the two and a half months in the integrated class he displayed absenteeism and was strongly under the influence of others. He soon developed an impressive record of violations against rules, thereby expressing his anger and frustration. On his own initiative, he was then transferred back to his old school where he immediately became a well-behaving student. As a healthy reminder to us well-meaning but ego-centred adults he extracted a promise that he would never again be sent away from his "own"

school. In spring 1989, three years after the program was started, SK was reading fluently with somewhat monotonous prosody. Only infrequent long words caused a slight hesitation.

Case MS: Deteriorated speech and extensive brain damage

MS was seriously injured in a traffic accident at two years of age. He recovered after having been unconscious for three weeks. MS was very slow in everything and his motor functions remained severely deteriorated after the accident, including clearly impaired speech. The parents of MS wanted to provide him with every opportunity they could. Therefore, they contacted the Center for Learning Research in 1987 when MS was seven years old. The question was whether MS would be able to start school at the usual age.

The active vocabulary of MS was 1.5 year behind his age level. However, his passive vocabulary, although also less than average, was clearly larger. This finding was considered encouraging. Because MS was very motivated to begin school, a decision was made to place him in an integrated special school. The intervention started in spring 1987, five months before MS was to enter the school. The principal person to work with MS was his speech therapist who began with exercises in linguistic awareness. It turned out that MS was well able to master rhyming tasks and he was also good at rhythmic production of syllables and comparison between different word lengths. However, phoneme synthesis and subtraction succeeded only partly.

School started in August 1987 and MS proved a motivated stu-dent. The teacher adopted a phonics method in accordance with the program introduced by the speech therapist. The latter worked continuously with MS and in harmony with the efforts of the school. The slowness of MS was compensated for by his persistence which began to bear fruit. In January 1988, he could decode simple two to three letter syllables. In September 1988, after one year's hard work, MS displayed alphabetic-phonemic reading at level 3 according to Høien and Lundberg (1988). He could struggle his way through the text in the primer but his reading was slow to the ex-

tent that measurement of speed made no sense. The breakthrough happened after this point. In December 1988, MS could recognize a word by using a syllable-by-syllable strategy. What was characteristic of his decoding was that he tasted the first phoneme in his mouth before entering the syllable. He started to correct his own mistakes and liked to read his own books. Given his extremely slow reading speed, 5 wpm, this was proof of his enduring motivation. Along with improved school performance, he also took social steps, becoming happier, choosing his own TV programs, establishing social contacts and showing more initiative in his physical environment.

The subsequent development of MS's reading was undramatic. His strong motivation helped him to overcome the obstacles. In March 1989, he showed accurate phoneme discrimination resulting in fewer and fewer decoding errors. He needed less assistance with homework and had established further social contacts. Two years after the program had begun his reading was still alphabetic-phonemic, level 6 according to Høien and Lundberg (1988). He read independently albeit slowly, at about 15 wpm.

Discussion of cases

The above feats of SK, MS and their mentors probably do not strike anyone as novel. In special education more unconventional approaches are usually applauded. These may include the use of mega-vitamins, selected sounds, motion sickness pills, colored lenses etc. In contrast, in the cases of SK and MS, we used so many commonly known working methods that the cases might appear rather dull. Yet, our two students learned to read in spite of massive obstacles, after failed attempts by many qualified workers. Is there anything particular about our interventions that might suggest cautious generalizations?

The question posed is not new. Our literature search revealed that many authors have set out to find common determinants for successful interventions. It is trivial to state that an intervention is meant to bring about a change in a situation. However, a prospective change is usually accompanied by resistance on the part of those directly involved or, as often happens, by their fellow

workers. The purpose of the resistance is of course to secure the survival of old methods which are felt to be safe. In an article bearing on this point, Guskey (1986) has argued that two factors are regularly ignored when reforms are introduced. These are the teacher motivation and the concrete conditions for using the working method at the practical level. With regard to motivation, the number one characteristic is the credibility of the proposed intervention. The other factor, concrete conditions, is intimately connected with motivation. Guskey (1986) argues that, first of all, there must be reasonable guarantees that the intervention will achieve its objective. This is diametrically opposed to the usual approach where the teacher is persuaded to make one more heroic attempt which can fail. The temptation to succeed is by far a stronger motivational factor than any attitude change based on persuasion. From this point of view, the content of the intervention should be rather similar to the practice followed by the personnel. This feature contradicts, in an interesting way, the pseudoscientific procedures which usually wear an overcoat borrowed from the natural sciences. In fact, we feel that the issue is the teacher's integrity and risk-taking capacity. The wildly "creative" methods allow for failure because the blame can always be put on the daring procedure. On the other hand, the teacher's narcissism is satisfied by virtue of the courageous and revolutionary nature of his or her endeavor, irrespective of how unreflected the latter may be. The closer to daily reality the teachers work, the more exposed they are in terms of their competence as perceived by others. The reward is obvious, however. Interventions based on the day-to-day work of the school can be introduced in concrete terms without a need for general reflexions on less substantial visions (Mazzarella, 1980). Crandall (1983) goes a step further, suggesting that the responsible consultant be a charismatic person able to speak from a practical angle. Such a qualification is, of course, intimidating for any prospective school consultant or teacher trainer. It probably does not violate too much Crandall's intentions, if charisma is interpreted as credibility, that is, as faith in one's own work that shows in practice. Finally, irrespective of the form of the intervention, regular and accurate feedback must be given to the teacher (Shulman, 1986).

What do our two cases look like from the perspective of the principles described above ? We feel that the question can be answered.

We were not confronted by problems of teacher attitude because the initial contact was made by them. The program proposed by us was close to the practice familiar to the special teachers and speech therapists. Exercises in linguistic awareness, particularly phonemic awareness, make much sense in the Finnish language. We also gave detailed descriptions of and timing recommendations for the successive steps. The feedback proved to be important in many ways but particularly in one somewhat unexpected sense. During the consultations and many times afterwards it became obvious that teachers have considerable difficulty in recognizing the small steps of progress the student is taking, an observation repeatedly made by us even afterwards. For example, when we pointed out that self-praise indicates metacognition, in spite of the fact that reading speed was not improved, the teachers expressed their surprise. Speed appeared, on the whole, to be their primary concern. Steps like awakening guessing, decreasing guessing and self-correction were hidden by the daily practice mill. Lastly, while it is perhaps difficult to speak about our own charisma or lack of it, we did one thing that greatly added to our credibility as consultants. This act was our promise to assume full responsibility for any failure, coupled with a statement that credit for any success would go to the school workers.

In the following, we describe how the logic of our case studies was extended to cover an entire school.

School intervention: same resources, better results

In ambitious school systems one goal is always to diagnose, prevent or at least correct learning difficulties at an early stage. Finland, for example, has an extensive network of municipal Family Counselling Centers and Health Centers. In each of them school psychological services are available. The problem is not one of resources but rather a lack of diagnostic and pedagogical software. The need for this software is widely recognized in Finland today. When our Center approached the Academy of

Finland in 1991 with a proposal to develop a school-specific working model for the early detection and correction of learning problems, a generous grant was awarded.

Our experience with difficult cases suggested that interventions based on linguistic awareness are effective and easily adopted by teachers and speech therapists. Consequently, we set out to investigate whether it is possible to diagnose children at risk before they start school, and whether appropriate and immediate training in linguistic awareness would bring them up to the reading level of their classmates. In Finland, this means accurate word recognition and spelling by the end of the first school year, in other words, at the age of eight years. Thus, our intervention study differed from that of Lundberg, Frost, and Petersen (1988) who trained all their children already in preschool. Our aim was to show that the same objective can be achieved during the first school year with resources already existing in schools.

Not surprisingly, the key variable in the diagnosis was the level of linguistic awareness in the spring about four months prior to the start of school. In two schools, 119 children were to start as first-graders in August 1992. Two comparable schools with 121 first-graders served as controls. The children were diagnosed using an extensive cognitive-emotive test battery. The results showed that, apart from 18 per cent who could already read, there were 26 pupils, 12 boys and 14 girls, in the intervention schools, who did not show any signs of linguistic awareness. They were to comprise the intervention group. The control group consisted of pupils in two other schools. Matching was performed individually in terms of phonemic awareness, the WISC-R full scale and verbal scale, listening comprehension, working memory capacity, and mathematical-logical skills. Matching was successful to the extent that there were no differences between the groups except for verbal IQ where the control group scored significantly higher ($t=2.88$, $df=25$, $p<.01$).

Our aim was to establish a linguistic awareness training program that can be run during regular school hours in the school clinic. Two constraints were important. Firstly, the effort experienced by the child must not exceed that of ordinary lessons, neither timewise nor subjectively. Secondly, our worker (the second author) teamed up with the special teacher in a way that was well

within the limits of her duties. In practice, the special teacher was observing the events in order to learn the features of the program.

Our 26 children at risk worked in groups of 3 to 6. The group members were always from the same class. Each group met three to four times a week and a session lasted 20 minutes. The classroom teachers were informed in detail about the aims and content of the intervention which extended from September to December 1992 covering 13 weeks. The program advanced gradually towards different subskills of linguistic awareness of increasing complexity. Special emphasis was put on the connection between sound and print (see e.g., Ball & Blachman, 1991; Bradley & Bryant, 1983; Fox & Routh, 1984; Williams, 1980). The program consisted of the following four areas which were introduced in succession;

(1) Clarifying the child's self image and providing him or her with a feeling of ability to work as a member of a group (sessions 1 through 4). Tasks were deliberately made so easy that every participant mastered them (for example, "tell me the color of your socks"). Materials were chosen with an emphasis on the personal relevance to the child.
(2) Rhymes and nursery rhymes (sessions 5 through 16) were included in order to teach the children how to listen to the structure of the words. They were not yet asked to manipulate phonemes at this stage.
(3) Word and syllable awareness (sessions 17 through 26) were trained in order to make the children understand how spoken and written language both consist of words. According to Adams (1990), this insight is a necessary prerequisite before any training in phoneme manipulation can be introduced.
(4) Training in phonemic awareness (sessions 27 through 47) aimed . at helping the children to perceive single phonemes in the beginning, middle and end of words, and to combine different phonemes into meaningful words. Segmenting ability is needed in spelling and blending ability in word recognition.

Students in the control group followed their normal school routines. Eleven of them were diagnosed as needing remedial teaching in reading and spelling. This diagnosis was made by the classroom teacher and/or the special teacher. These 11 pupils re-

ceived traditional remedial teaching during the same time as the intervention group participated in linguistic awareness training.

The effects of the intervention were investigated by means of four tests. Of these, the test of phonemic awareness was based on four subscales which were

(a) deleting a syllable from a word,
(b) sound blending,
(c) naming the initial phoneme of a word, and
(d) deleting the initial phoneme from a word.

The maximum score was 40, i.e., 10 for each subscale. The other tests measured word recognition as well as spelling and listening comprehension.

Results

Figure 3;1 shows that, in the beginning of the intervention, both groups scored in linguistic awareness clearly below their school-mates who could not read or write before they started school. However, the intervention group outperformed the controls already on an intermediate test ($F(1, 50)=3.91$, $p<.05$). This difference still prevailed in January 1993, as can be seen in Figure 3;2. Even the control group had improved its performance. This fact reflects the efficiency of the regular school curriculum.

78
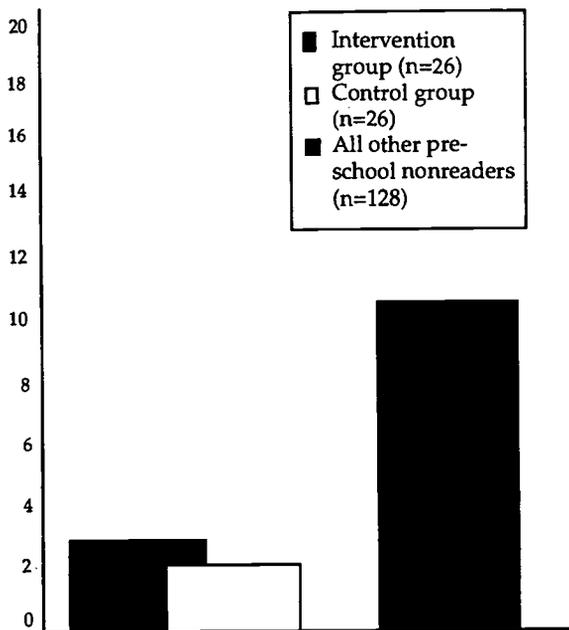
Fig 3;1.   *Phonological awareness in preschool age children (6-years-olds) before school start*
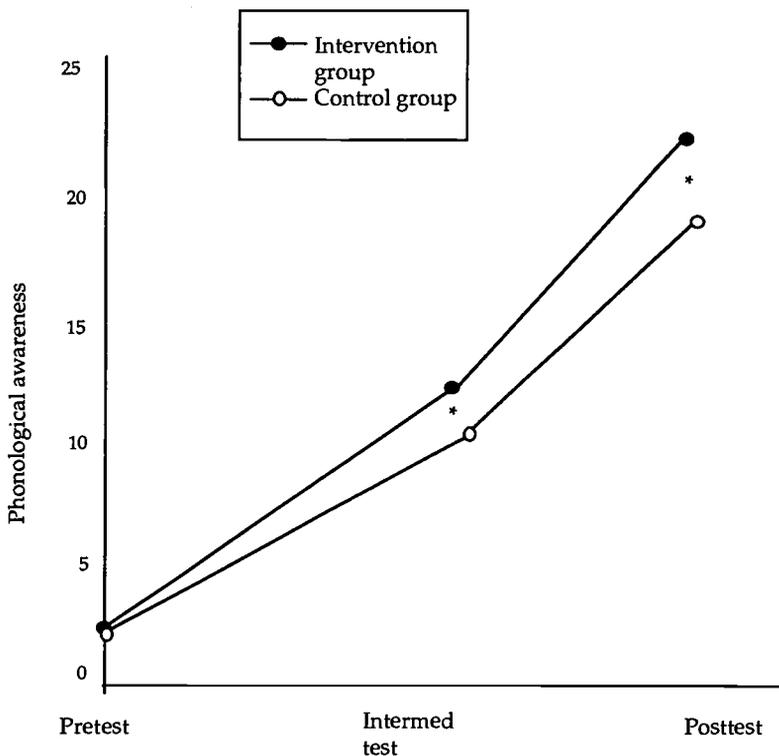
Fig 3;2.   *The effects of intervention on phonological awareness (n=26)*
*Note. * 0 p < .05 in t-test comparison between the groups.*

Immediately after the termination of the program, the intervention group showed superior performance in a word reading task, $F(1, 50)=5.74$, $p<.02$. More interestingly, transfer of training was observable five months later both in spelling and word recognition. The intervention group outperformed the controls in a spelling (sentence writing) task, $F(1, 50)=4.42$, $p<.05$. Figure 3;3 reveals an even more striking finding, namely that the intervention group had reached the spelling level of other preschool non-readers who had not been diagnosed as needing remedial teaching.
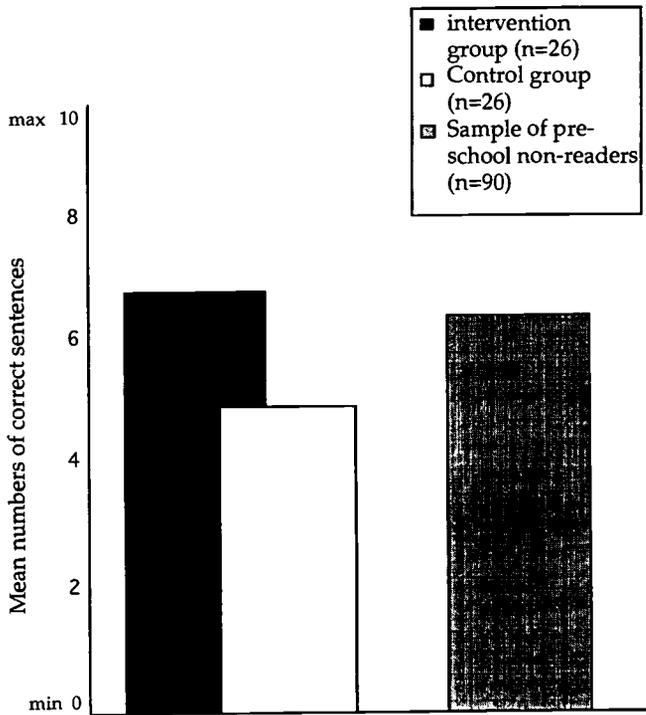
Fig 3;3. Delayed effects of intervention on spelling
(Sentence writing-task) (4 months after training)

The final reading test measured word recognition. The test used was the Danish OS-400 (max=400, time 15 min) where a written word is matched against four pictorial alternatives. Both the intervention and control group had made progress. Means were 133 and 109 correct, respectively. Again, the intervention group performed at the level of other preschool non-readers. The statistical significance between the intervention and control groups was, however, only marginal, $F(1, 50)=2.99$, $p<.09$. The explanation was interesting. It turned out that all intervention pupils and controls not receiving remedial teaching performed similarly. The exception consisted of those in the control group (n=11) who had received

traditional remedial teaching. Their mean of 80 was clearly below that of all the others.

This result is provocative in two respects. Firstly, it serves as a control against the notorious Hawthorne effect because the students receiving traditional remedial teaching were given as much additional attention as the intervention group. Secondly, it appears that the diagnosis carried out in the school is accurate, whereas the traditional remedial teaching is not effective.

Finally, an additional transfer effect emerged in that the intervention group improved its listening comprehension by the end of the first school year, whereas the control group did not show progress, F (1, 48)=48.96, p<.001, by analysis of covariance. The fact that 11 control pupils had received traditional remedial teaching played no role in this result. The effect on listening comprehension is dramatic in view of the fact that the groups had started at the same level one year earlier.

General discussion

What lesson can we learn from these studies? Certainly not one of new dramatic path-breaking methods which give the practitioner an aura of competence based on knowledge not easily available to others. We think that the real gain lies elsewhere. The significance of linguistic awareness to reading acquisition has been established during the 1980's. The theory gives words to something that teachers have long known in an unsystematic fashion. Now they have a theory available which organizes the practical work along the lines already familiar to them. Therefore, it is easy for them to accept and adopt the suggested working methods. Our results suggest that developing linguistic awareness not only speeds up reading acquisition but also leads to transfer effects. The well-known result that word recognition and spelling benefit from training in phonemic awareness is not surprising in view of the fact that this training is primarily aimed at improving the student's decoding. However, it is less obvious why there should be a dramatic improvement in listening comprehension due to the same training. This result is in line with the finding reported by Juel (1988). In her

82

follow-up study, the students entering school with little or no phonemic awareness became poor decoders. An even more unfortunate development was that, although the prospective good and poor readers started school at the same level of listening comprehension, they displayed a significant difference in this skill at the end of the fourth grade. One can only imagine the devastating effects this must have on reading comprehension. Juel's (1988) result can be understood in terms of a good decoding ability leading to a willingness to read and thus to improved reading comprehension (see, e.g., Stanovich, 1986). This, in turn, boosts listening comprehension by increasing the student's vocabulary. The finding that training in phonemic awareness has immediate effects on listening comprehension can probably be understood in terms of a similar positive Matthew effect. Training makes the classroom discourse more understandable to the student who then benefits more from teaching. Our program also emphasized the social discipline in the small groups. For example, it was not accepted if a student took someone else's turn. Listening comprehension might prove an important tool in fighting more generalized learning difficulties. As a determinant of reading comprehension it becomes more important with increasing age (Curtis, 1980). Its relationship with reading comprehension is particularly strong among adult readers (Carpenter, 1980). If such a positive development can be brought about by a fairly simple training in linguistic awareness, the gain is enormous.

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84

Chapter IV

PHONOLOGICAL TRAINING AND REA-
DING SKILL: WHY DO SOME RESIST?

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Stefan Samuelsson
Jerker Rönnberg

INTRODUCTION

Several studies have provided evidence for the importance of phonological skills in learning to read (see Share & Stanovich, 1995 for a review). One source of evidence is studies of dyslexic children, linking their reading difficulties to an impairment in the phonological system (Lundberg & Høien, 1989; Snowling, 1981; Snowling & Hulme, 1989; Stanovich, 1988). Another source of evidence is longitudinal studies which have shown that phonological skills, such as phonological awareness, measured before any formal reading instruction has been given, are good predictors of early reading acquisition (see Goswami & Bryant, 1990; Wagner & Torgesen, 1987, for reviews).

To provide evidence for the causal effect of phonological skills on the development of reading skill, a number of phonological intervention studies have been conducted, five of which will be described here briefly. In a study by Bradley and Bryant (1983), 65 children, 6 years of age, were divided into four groups. One group was taught about rhyme and alliteration and trained in sound categorisation. Another group received the same phonological training together with explicit instructions about letter-sound correspondences. A third group, serving as a control, received training not directly related to phonology or reading (e.g., putting pictures into categories). Finally, there was another control group, which received no training at all. The results showed that after two years, the group that received training in both sound categorisation and letter-sound correspondences were significantly better at reading than the controls. The group that had only been taught sound cate-

gorisation also seemed to improve their reading skill more than the controls, but the difference was not significant. The improvement was specific to reading and spelling, and not generalizable to, e.g., mathematics.

In another intervention study by Lundberg, Frost, and Petersen (1988), a large group of Danish kindergarten children were given phonological awareness training before they had received any formal reading instruction. The results showed that in grade 2 these children were significantly better at reading than a control group, but the size of the training effect on reading skill was modest.

A third training study (Cunningham, 1990), included two different types of phonemic awareness training. Kindergarten and first-grade children were given either "skill and drill" training focusing on phoneme segmentation and blending, or "metalevel" training in which the same phonemic awareness training was given together with explicit links to reading. A control group listened to and discussed stories. The results showed that reading skill improved more in the two groups which had received phonemic awareness training. Also, the "metalevel" group made more progress in reading than the "skill and drill" group.

In another training study by Ball and Blachman (1988; 1991) the effects of "phoneme awareness" training and "language activities" training in kindergarten children were studied. Phoneme awareness training included word segmentation, letter names and sounds, sound categorisation and spell-by-sounds training. Language activities training consisted of training in letter names and sounds and general language activities. The results showed that the "phoneme awareness" group made most progress in reading and spelling.

Finally, in an intervention study Hatcher, Hulme, and Ellis (1994) investigated 7-year-old poor readers who were divided into four groups; Reading with Phonology, Reading Alone, Phonology Alone and a Control. Thus, the children were given training in reading, phonological training or a combination of both. The Reading with Phonology training also included activities explicitly linking reading and phonology. In their study, the results showed that the Phonology Alone group made most progress on phonologi-

cal tasks, but the Reading with Phonology group made most progress in reading.

Judging from these intervention studies, phonological training seems to stimulate the development of reading skills in young children. The results also suggest that there is a causal relation between phonological skill and reading acquisition, and that poor readers mainly should be characterized by phonological deficits. By now, knowledge of the effectiveness of phonological training as a tool for teaching reading skills in the poor reader has also spread to remedial teachers.

However, two critical issues remain: First, the reported effects on reading skill were rather modest in size. Second, the critical results of these studies are represented by the mean performances of groups of individuals. It is important to notice that reading is a complex activity. A multitude of different cognitive (and other) factors are involved in the process of reading. Children representing dissimilar cognitive skills could very well react differently to training. Also, young children of the same age might represent quite different maturity levels. Thus, a group of young children of the same age is far from homogeneous. Numerous attempts have been made to categorise poor readers in general, and dyslexic readers in particular, into separate subtypes. Because there is still no general agreement on any categorisation of this kind, these attempts have not been successful. At any rate, it is quite clear that in a group of poor readers there exist substantial developmental and cognitive individual differences.

These constraints must have implications for the effectiveness of a training program, and even if poor readers in general benefit from phonological training, one would expect to find marked individual differences. In the present study, therefore, we will examine differences in word decoding skills and phonological awareness between a group of poor readers resistant to phonological training and a second group that improved their reading skills substantially with identical training.

In the present study, we will also specifically examine the ability to use the two main decoding strategies; orthographic and phonological word decoding. Most models of the acquisition of word identification skills suggest that both phonological and ortho-

graphic information are involved in identifying words in printed form (Ehri, 1987, Ehri & Wilce, 1987; Frith, 1985). Phonological word decoding skill refers to an identification of words based on phonological information, whereas orthographic word decoding skill refers to the ability to recognise words directly on a visual basis. The relative influence of each decoding skill in reading, however, is assumed to change with age in normal readers from a phonological to a more orthographic reliance in word identification (Ehri, 1987; Ehri & Wilce, 1987; Frith, 1985; Juel, Griffith, & Gough, 1986). Empirical support for these stage models comes from several studies suggesting that the contribution of phonological skills is gradually decreasing with an increase in reading skill, and that phonological skills in non-readers serve as a strong predictor of later reading achievement (Goswami & Bryant, 1990; Lundberg, Olofsson, & Wall, 1980). Thus, it is suggested that poor readers rely on phonological information for word identification to a greater extent than do age-matched normal readers who primarily use more direct orthographic information. Although a strong orthographic reliance is found in skilled young readers, their phonological skills continue to develop throughout childhood (Backman, Bruck, Herbert, & Seidenberg, 1984), suggesting that there is a relation between phonological and orthographic decoding strategies, and thus, no clear dissociation between different word decoding skills (Aaron, Wleklinski, & Wills, 1993; Gough & Walsh, 1991; Juel, Griffith, & Gough, 1986). On the basis of these proposed stages, as well as the relation between word decoding skills, it could be assumed that poor phonological word decoding most of the time *excludes* skill in orthographic word decoding, whereas skilled orthographic word decoding frequently should *include* skill in phonological decoding.

Thus, one general conclusion from these studies is that both phonological and orthographic routes to lexical entries are normally either intact or poorly developed in children with some years of reading experience. A poor reader, suffering from phonological deficits, would not be able to reach normal phonological or orthographic reading ability. Considerable progress in reading ability can be made by relying on visual strategies and other intact mechanisms. Some poor readers may learn to read by gradually increasing their "sight vocabulary" of printed words, without using

88

the phonological reading strategy (Snowling & Hulme, 1989). However, by learning to read in this way, the lexical system of the child lacks the complex set of connections between letters and sounds, which characterizes the lexicon of the reader in the ortho-graphic stage of reading development (Seymour, 1986). The second purpose in this chapter was to follow the development of phono-logical and orthographic word decoding skills during one year of phonological intervention and to study the relation between these two word decoding skills and text reading skill.

METHOD

Participants

Thirty-three poor readers were selected from nine different schools in Norrköping, Sweden. They were all children in grade 4, which means that they were 10-11 years old. The criterion for being a poor reader in this study was that the child needed and was getting special instruction in school because of reading difficulties (immigrants who might have difficulties with the Swedish language were excluded from the study). Sixteen children in grade 2, thus being two years younger than the poor readers, were randomly selected as controls. The two groups were matched according to initial skill in text reading. After the period of intervention, the 33 children who received phonological training were divided into two new groups. One group, named Improved readers, consisted of the 17 children who showed the most improvement in text reading skill after the intervention and the other group, named Resistant readers, consisted of the 16 children who showed the least improvement. Thus, three groups were included in the study: Improved readers, Resistant readers and Controls.

The children receiving phonological training were a little older (10-11 years old) than in the intervention studies referred to earlier. By that age these children have been given formal training in rea-ding for more than three years and still they have not reached a satisfactory level of reading skill. During their years in school they

have continuously received training concerning the letters of the alphabet and their corresponding sounds. They have also received training in spelling and in text reading on numerous occasions. On the other hand, the amount of strictly phonological training, focusing directly on the sound structure of the language, has been very limited.

MATERIALS AND PROCEDURE

The phonological training program

The intervention of the present study consisted of a phonological training program which was focused on phonological awareness, that is, awareness of the sound structure of language. It was inspired by another Swedish phonological training program, "Språklekar efter Bornholmsmodellen" (Häggström & Lundberg, 1994), but the exercises were adapted for children in grade 4. Several other sources were also used and some new phonological exercises were developed. The exercises were compiled in a booklet. Explicit instructions were written before each exercise in the booklet and after each exercise there was a comprehensive training material consisting of words or sentences. The training program consisted of 7 different types of phonological exercises: rhymes, position analysis, subtraction and addition of sounds, segmentation, synthesis and accentuation.

The phonological training program was compiled and constructed by the authors with considerable help from 10 remedial teachers who had experience from teaching children with reading difficulties. The same teachers later used this training program and taught the 33 children in the training group. The teachers were instructed to use the training program systematically. All seven parts of the booklet were used when teaching the children. The teachers were told not to include letters in connection with the phonological training in order to keep the intervention strictly phonological. Thus, no "metalevel" or "linkage" activities were included in the present study.

With a few exceptions, the reading teachers met the children in the training group two times a week, in their ordinary schools, and each session lasted 20 minutes. The teachers were instructed to note the time spent on each type of phonological exercise, for every particular child, in every training session. The first period of the intervention lasted from February -95 to May -95 and the second period lasted from September -95 to December -95. The Improved and the Resistant readers received an equal amount of phonological training (a total of approximately 800 minutes).

The test-battery

Two separate tests, both simultaneously measuring text reading performance and reading comprehension, were included in the test-battery (Malmquist, 1977). In the first reading test, the children were instructed to read a short story (600 words in length) as accurately and quickly as they could. In the text, there were 20 sentences which were incomplete, such that one word was missing and replaced by a parenthesis with three single words. The children were instructed to select one out of the three alternatives that would complete the sentence in an appropriate way, every time they reached a parenthesis in the text. The children were allowed to work with the text for 6 minutes.

In the second reading test, the children were asked to read twelve short stories (20-150 words in length) as fast and accurately as possible and to answer multiple-choice questions related to each story. The total number of multiple-choice questions was 33 and the children were allowed to use 8 minutes to complete the test. The total number of correct responses from both reading tests (i.e., a maximum of 53=20+33 correct responses) was then used as an index of text reading performance.

Also, two tests measuring orthographic and phonological reading skill, respectively, were used in order to gain more specific knowledge concerning the word decoding skills of the children, before, during, and after the period of intervention. In the test measuring the ability to use the orthographic strategy, the subjects were presented with columns consisting of two Swedish words which had visual similarities and identical pronunciation (i.e.,

"hej"-"häj" ("hello" in English)) on a piece of paper, one of the words being a real word ("hej") and the other one being a nonword. The subjects should identify which word was a real word, that is, which one had the correct spelling, as quickly as possible. The number of correct words being chosen during two minutes was taken as a measure of the subjects' orthographic reading ability.

In the phonological word decoding test, a list of word-pairs was again presented to the subjects. This time neither of the words were real words (nor were they spelled correctly), but one of the words sounded like a real Swedish word if it was spoken aloud (i.e., "kjur"-"sorf", where "kjur" sounds like the Swedish word "tjur" (bull in English)). The subjects were requested to identify, as quickly as possible, which word sounded like a real word, and the number of correct words being chosen during two minutes was taken as a measure of their phonological reading ability.

Yet another test (UMESOL: Segment subtraction) was used to assess the phonological awareness of the children. The task here was to listen to which segment of a word had been removed from an original Swedish word (i.e., "What has been removed from the word "krokodil" if only "kroko" remains?").

The four different tests measuring reading skill and word decoding skills were administered in groups consisting of approximately six children, whereas the test measuring phonological awareness was performed individually. The total time needed to complete the test-battery was approximately 50 minutes.

The 49 children were given these tests on three different occasions. The first test session took place in December - 94, the second in May -95 and the third in December -95. The same experimenter (Stefan Gustafson) administered all the tests of the present study.

RESULTS AND DISCUSSION

After the third and final test session, all children who had received phonological training were divided into two new groups. The 17 children who showed the most improvement in reading skill after the intervention, were put into the group named Improved readers. The 16 children who showed the least improvement in reading skill were put into the group named Resistant readers. In Table 4;1 the

results on the tests measuring text reading skill (the results on two separate tests formed a Reading index), orthographic and phonological decoding skills, and phonological awareness, at test-sessions 1, 2 and 3 are presented for each group.

As can be seen in Table 4;1, there were no differences between the three groups in reading skill, and orthographic or phonological decoding skills at test session 1 (all p's >.50). On the other hand, the results on the phonological awareness test showed that the Resistant group performed below both the Improved group and the Controls (both p's <.05). Thus, the results suggest that the main difference between Improved and Resistant readers before the intervention, was a difference in phonological awareness. At test session 2, no differences between the three groups were found, on either of the tests (all p's >.40).

After the intervention, at the third test session, no difference were found between the Improved and the Controls on the tests measuring reading skill (p>.50), whereas the Resistant group per-formed below these two groups (both p's <.05). Thus, the Improved group enhanced their reading skill just as much as the Controls between the first and third test session, whereas the Resistant group showed very little improvement. At test session 3, no diffe-rences between the three groups were found on the orthographic word decoding test or the phonological awareness test (all p's >.30). On the test measuring phonological decoding skill, the Controls outperformed the other two groups (both p's <.05).

Table 4;1. *Reading skill, orthographic and phonological decoding skills, and phonological awareness, before, during and after the intervention, for Improved readers (N=17), Resistant readers (N=16) and Controls (N=16)*

	Improved	Resistant	Controls
Test session 1, Dec. -94			
Reading index	20.8	20.5	21.4
Orthographic decoding	10.4	7.8	8.0
Phonological decoding	10.9	11.5	12.6
Phonological awareness	7.6	5.7	7.9
Test session 2, May -95			
Reading index	28.7	25.2	28.8
Orthographic decoding	16.8	15.2	14.1
Phonological decoding	14.8	12.8	16.1
Phonological awareness	9.2	8.1	8.6
Test session 3, Dec. -95			
Reading index	36.8	26.3	37.3
Orthographic decoding	22.1	17.2	23.4
Phonological decoding	15.2	14.5	23.4
Phonological awareness	10.1	9.8	8.7

To examine the relative contribution of phonological and ortho-graphic word decoding skills to reading skill, before, during and after the intervention, nine separate multiple regression analyses were performed, one for each group of children (see Table 4;2).

These results are quite clear-cut. Both orthographic and phono-logical word decoding skills contributed to reading skill in the group of children that benefited the most from the phonological training. On the other hand, only orthographic word decoding skill contributed to reading skill in the Resistant group. For the controls both reading strategies contributed to reading skill, at least at test sessions 2 and 3.

Table 2. Relative contribution (ß) of orthographic and phono-
logical decoding skills on reading skill at test sessions 1-
3 for Improved readers (N=17), Resistant readers
(N=16) and Controls (N=16)

	Improved	Resistant	Controls
Test session 1, Dec. -94			
Orthographic	.57*	.85*	.21
Phonological	.43*	-.04	.68*
Test session 2, May - 95			
Orthographic	.66*	.60*	.46*
Phonological	.37*	-.10	.55*
Test session 3, Dec. -95			
Orthographic	.44*	.87*	.46*
Phonological	.66*	-.02	.55*

* denotes a significant contribution to text reading skill (p<.05)

First, it is important to note that the results replicate the previous
findings that phonological training enhances the phonological
awareness of young children (Lundberg, Frost, & Petersen, 1988;
Hatcher, Hulme, & Ellis, 1994). This holds true both for the
Improved and the Resistant readers (see Table 4;1). However, the
present study clearly demonstrates that it is by no means certain
that an improvement in phonological awareness is followed by an
improved reading skill. Despite the fact that the Resistant readers
steadily increased their phonological awareness during the inter-
vention, this only had a very limited effect on their reading
achievement. Now, let us turn to the key question of the present
study: why do some resist?

The results presented in Table 4;1 and Table 4;2 suggest that the
Improved and the Resistant readers differ in at least two ways.
First, the Resistant group entered the intervention with less phono-
logical awareness than the Improved group. Second, phonological
word decoding skill did not contribute to text reading performance
for the children in the Resistant group. The Resistant readers thus
seem to rely almost exclusively on orthographic word decoding.

These differences seem to suggest that strictly phonological interventions have very limited effects on children who suffer from poor phonological awareness and rely on orthographic word decoding. One implication of these results concerns the relative effectiveness of intervention studies emphasising strictly phonological training and studies which also include explicit linkages between phonology and letters (Bradley & Bryant, 1983; Cunningham, 1990; Hatcher, Hulme & Ellis, 1994; Lundberg, Frost & Petersen, 1988). It is quite possible that the Resistant children particularly need explicit instructions concerning the links between phonemes and graphemes. One can assume that these children, suffering from phonological deficits, relied on orthographic word decoding when they began to learn how to read. The results of the present study show that the Resistant children continue to rely on orthographic word decoding during and after they receive phonological training. Thus, phonological training alone might be a necessary but not sufficient intervention for Resistant children. In addition to phonological training, more explicit instructions concerning letter-sound correspondences might be required to help them make use of the phonological word decoding strategy.

Here, one should also note that Swedish has a phonologically shallow orthography, as compared with English (i.e., a more consistent spelling-to-sound relationship). Thus, Swedish children would be expected to benefit more from phonological training than English children. In spite of this, strictly phonological training was not sufficient for the resistant children.

Interestingly, the Improved group enhanced their text reading skill just as much as did the Controls. This is a positive result when the very different initial status of the children in these two groups is considered. The Improved group consisted of children who were 10-11 years old and still needed special teaching because of severe reading difficulties. The Controls, on the other hand, were normal readers but two years younger. At test session 1, they had received formal reading instruction in school for only about 1.5 year and substantial improvements in their reading skills would be expected during the following year. This suggests that strictly phonological training might be effective for children who already possess a basic level of phonological awareness and who rely on phonological word decoding to some extent.

The present study calls attention to the need to apply an individual difference perspective when planning and implementing a phonological training program for poor readers. The results specifically suggest that in order to detect children who might resist to improve their reading skill by means of phonological training, one ought to assess their level of phonological awareness and their reliance on orthographic or phonological word decoding, respectively. Failure in doing so may unnecessarily jeopardise their reading development.

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Chapter V

HEMISPHERE SPECIFIC STIMULATION: NEUROPSYCHOLOGICAL TREATMENT OF DYSLEXIA

Jan W. Van Strien

Introduction

The left and right parts (hemispheres) of the brain differ in both anatomy and function. Anatomical asymmetries are subtle but can be demonstrated unequivocally (Geschwind & Levitsky, 1968). The most notable asymmetry is found for the brain area of the temporal plane. This region forms the upper surface of the temporal lobe. In 70% of people the temporal plane is larger on the left side. Interestingly, the left temporal plane is highly involved in language. Regarding functional asymmetries in the brain, it is well known that, in the vast majority of people, the left hemisphere is specialized in language, while the right hemisphere is specialized in visual and spatial perception (Springer & Deutsch, 1994). In addition, about 90% of people are right-handed, indicating left hemisphere control for fine motor movements. The term 'cerebral dominance' has been used to describe the left hemisphere superiority for language and handedness.

Neuropsychological models of dyslexia have proposed a link between brain asymmetries and disability. Concerning anatomical asymmetries, there is ample evidence that the incidence of temporal plane asymmetry is substantially reduced among dyslexics (Galaburda, 1989; Larsen, Høien, Lundberg, & Odegaard, 1990). These results support the idea that dyslexia is of neuro-developmental origin.

Reading disabilities have been related in various ways to functional brain asymmetry. A common view, dating back to Orton (1928), holds that reading disability is linked to reduced cerebral dominance. Although several studies employing behavioral brain asymmetry tests found evidence of a lesser degree of hemispheric

asymmetry in dyslexics, other studies found no asymmetry differences between dyslexics and normals (e.g., Hoppes Aylward, 1984). An alternative view is that reading disabilities are related to the functional asymmetries themselves, rather than a consequence of a reduction of these asymmetries. Such a view allows for subtyping dyslexia in a right-hemisphere dyslexia and a left-hemisphere dyslexia, each having quite different features. In the present chapter, I will evaluate the hemisphere specific dyslexia model of Bakker (1979, 1990), which represents the latter view. Bakker's model covers both the normal and the disturbed process of learning to read. It offers a variety of treatment possibilities, which can be applied depending on the type of dyslexia. The classification of dyslexia subtypes, the various treatments, and the outcome of validation and treatment research will be discussed in this chapter.

P-type and L-type dyslexia

According to Bakker's (1979, 1990), neuropsychological model for the normal and the deviant learning-to-read process, the relative participation of left-and right-hemisphere functions in the process of reading changes with development. In the initial stage of the learning-to-read process, there is a predominance of right-hemis-pheric involvement: the novice reader will use visuo-perceptual analysis to discriminate and identify the perceptually complex graphemic information. In the course of normal development, the grapheme identification becomes an automatism. The child will then switch to semantic and syntactic strategies, predominantly generated by the left hemisphere. This shift in hemispheric in-volvement has been demonstrated in electro-physiological studies (Bakker & Licht, 1986; Licht, 1988; Licht, Bakker, Kok, & Bouma, 1988). Reading disabilities develop when these respective hemis-pheric balances are disturbed.

Children with P-type dyslexia are slow but relatively accurate readers, with a fragmented style of reading. Children with L-type dyslexia are relatively fast but inaccurate readers. Children with P-dyslexia rely primarily on right-hemispheric visuo-perceptual pro-cessing, and are relatively unable to switch to left-hemispheric, se-

mantic strategies in the later stages of the learning-to-read process. Children with L-dyslexia employ left-hemispheric, linguistic strategies prematurely or even from the very beginning of the learning-to-read process. The characteristics of the P/L typology are summarized in Table 5;1.

Table 5;1. Bakker's P and L typology

Subtype	P-type dyslexia (perceptual reading type)	L-type dyslexia (linguistic reading type)
Prevailing reading strategy	Visuoperceptual	Linguistic
Hemisphere primarily involved	Right hemisphere	Left hemisphere
Reading style	Accurate but slow and fragmented reading	Inaccurate and hurried reading
Treatment	Stimulation of the left hemisphere by means of HSS and HAS	Stimulation if the right hemisphere by means of HSS and HAS

Note. HAS: hemisphere-alluding stimulation; HSS: hemisphere-specific stimulation

Classification of P-and L-type dyslexics

Discussing the P- and L-type classification, I assume that prior to their subtyping, children have been identified correctly as dyslexic, for instance, in accordance with the definition of the World Federation of Neurology (Waites, 1968). To classify children as P- or L-dyslexics, a standardized text-reading test with levels of difficulty of 5 to 7 months above a child's present level is administered. This procedure results in a sufficient number of reading errors made by the dyslexic child to allow such a classification. Reading errors are scored as substantive errors (real errors, such as

omissions, and additions), or as time-consuming errors (such as fragmented reading, hesitations, corrections, and repetitions). Time-consuming errors are no real misreadings, since the end result is correct. Further, the time needed to complete the text-reading test is registered. Because texts for different levels of difficulty have different time norms, the reading time is expressed as 100 x the ratio of the total time needed and the time norm. So if the norm for a given piece of text is 60 seconds and a child needs 90 seconds to read this text, the time score is 150.

For research purposes, we usually collect data form a large screening group. We then classify dyslexics as P-subjects (accurate but slow readers) if they score below the median on substantive errors and either score above the median on time-consuming errors or score above the median on the time measure. We classify dyslexics as L-subjects (inaccurate but fast readers) if they score above the median on substantive errors and either score below the median on time-consuming errors or below the median on the time measure. In this manner, about 65% of dyslexics can be classified as either P- or L-dyslexics. With this system of classification, it is inevitable to find unclassified mixed-type dyslexics (35% of dyslexics). Within the restraints of our research efforts, we commonly examine the most manifest P- and L-children. For research, this may be an obvious choice, but in clinical practice, of course, the type of dyslexia is not always clear-cut. Currently, we are working on standardization of the classification instrument. Normative data for the Dutch language have been collected for 153 unclassified dyslexic children at the two lowest reading levels (Bos & Van Vliet, 1990). The number of substantive errors, the number of time-consuming errors and the time measures have been converted to normalized standard scores for each of the two levels. This way of scoring allows for within-subject comparisons, very much like the verbal IQ and the performance IQ can be compared within a person. The direction and the magnitude of the difference between a child's speed and accuracy score indicates whether it is a P-type, L-type or mixed-type dyslexic. In the latter case, a skilled remedial teacher can adapt treatment procedures (e.g., alternate or combine P- and L- treatment strategies).

The normative study with 153 unclassified dyslexic children shows that the number of substantive errors is hardly related to the

number of time-consuming errors ($\underline{r}$= -.16) or to the time measure ($\underline{r}$ = -.10). This indicates that speed and accuracy are independent dimensions. As can be expected, the number of time-consuming errors and the time measure are substantially correlated ($\underline{r}$ = .60). It is yet not certain whether both speed measures would be incorporated in a final standardized clinical classification procedure.

Treatment

The basic idea for treatment is that psychological stimulation affects the physiology of the brain (Bakker, 1984). Treatment of P- and L-dyslexia is based on stimulation of the insufficiently active hemisphere, that is, the left hemisphere in children with P-dyslexia and the right hemisphere in children with L-dyslexia. The repeated stimulation of a specific hemisphere will result in cortical activation and perhaps in durable physiological changes. Ideally, treatment of P-dyslexics leads to faster reading and to relatively decreased reading accuracy. Treatment of L-dyslexics leads to an improvement in reading accuracy and a relatively slower reading speed. One could think that these outcomes merely signify that one type of dyslexia is substituted with another. This, however, is not the case. As a result of treatment, P-dyslexics start speeding up their reading pace, initially at the cost of some accuracy (which does not turn them into L-dyslexics). L-dyslexics start correcting themselves. They make less mistakes, but initially need more time to read a test (which does not turn them into P-dyslexics). Eventually, the switches by P-dyslexics will be advantageous.

There are two ways in which a hemisphere can be stimulated: hemisphere alluding stimulation (HAS) and hemisphere specific stimulation (HSS). HAS treatment aims at making a strong appeal to one side of the brain. With L-dyslexics, exercises are done that allude (alludere: Latin for "refer to") to the right hemisphere. To accomplish this, texts are made perceptually complex by using different type-faces and upper and lower case letters within words. With P-dyslexics, activities are done that refer to the left hemisphere. Exercises such as rhyming, filling in deleted words, and ordering words to make up sentences are used.

HSS treatment aims at direct stimulation of the left hemisphere in P-dyslexics and the right hemisphere in L-dyslexics. HSS usually takes place via the visual or tactile pathways to the brain.

Visual HSS is based on the neural visual pathways from the right half of the visual field to the left hemisphere and from the left half of the visual field to the right hemisphere. The principle is depicted in Figure 5;1. From this figure it can be seen that, if one is looking at point X, the region to the left of this point is projected to the right hemisphere, while the region to the right of point X is projected to the left hemisphere. The regions to the left or right of the point X are the visual half-fields. HSS is accomplished by presenting words in the left or right visual half-field.
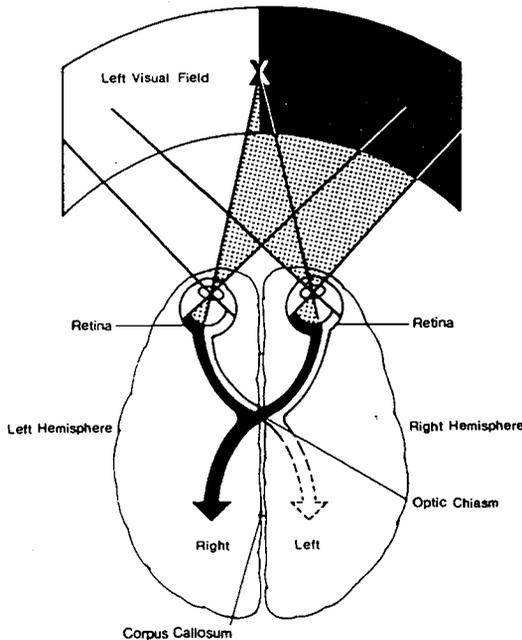
Fig 5;1.

Crossed relationship between left visual field and right hemisphere (the "white" tract), and right visual field and left hemisphere (the "black" tract), respectively. Retina: the light-sensitive surface at the back of the eye. Optic chiasm: a junction in the brain where visual information crosses over to the opposite sides of the brain. (After S.C. Levine, Hemispheric specialization and functional plasticity during development. In Frank , M. (Ed.), A Child's Brain. New York: Haworth Press, 1984.)

Bakker and Moerland (1991) developed a remedial computer program for visual HSS called HEMSTIM. By means of this program, letters or words (to be read by the child) are flashed on the computer screen to the left visual half-field if L-dyslexic children are treated and to the right visual half-field if P-dyslexic children are treated. To ensure proper fixation at point X in the middle of the screen, the child has to position the mouse cursor on the central fixation dot. The fusion of the cursor and the fixation dot trigger the presentation of a word. To prevent that a child moves its eyes away from point X to the left or to the right, the presentation times of the words are less than 0.3 seconds. The level of difficulty of the words can be adapted to the level of the child, and the presentation duration can be lowered when a child reaches 90% accuracy. HEMSTIM offers the capability to combine HSS treatment with HAS treatment. To achieve this, HEMSTIM has several different type-faces, which can be mixed for treatment of L-dyslexic children. In this way, perceptually complex words (instead of words in one familiar type-face) can be flashed to the left visual field. For treatment of P-dyslexics, abstract words (such as *cold, love*) can be used instead of words that are concrete in meaning (such as *house, bike*). Abstract words are thought to allude to the left hemisphere more than do concrete words.

Tactile HSS is also based on a crossed relationship between hemispheres and the opposite side of the body. Stimulation of the fingers of the left hand primarily activates the somato-sensory region of the right hemisphere, while stimulation of the right hand activates the left hemisphere. Tactile HSS treatment is accomplished by presenting the reading material by touch. The child palpates plastic letters that are affixed in the grooves of a planning board. The planning board is placed in a training box which prevents visual feedback. L-dyslexics use their left hand and receive concrete words. P-dyslexics use their right hand and receive abstract words. As will be discussed below, both laboratory and field experiments have demonstrated that HSS treatment, compared to control treatment, results in better reading accuracy in L-dyslexic children and larger improvement of reading fluency in P-dyslexic children (Bakker et al., 1990; Bakker & Vinke, 1985).

Validation research

A number of studies have been conducted on the validity of the P
and L subtyping. In the domain of brain electrical activity, Bakker
and Licht (1986) demonstrated significant differences during rea-
ding between P- and L-dyslexics. Words were flashed in the central
visual field. Each word evoked a brain electrical potential, the so-
called *word-elicited potential* (see Figure 5;2).
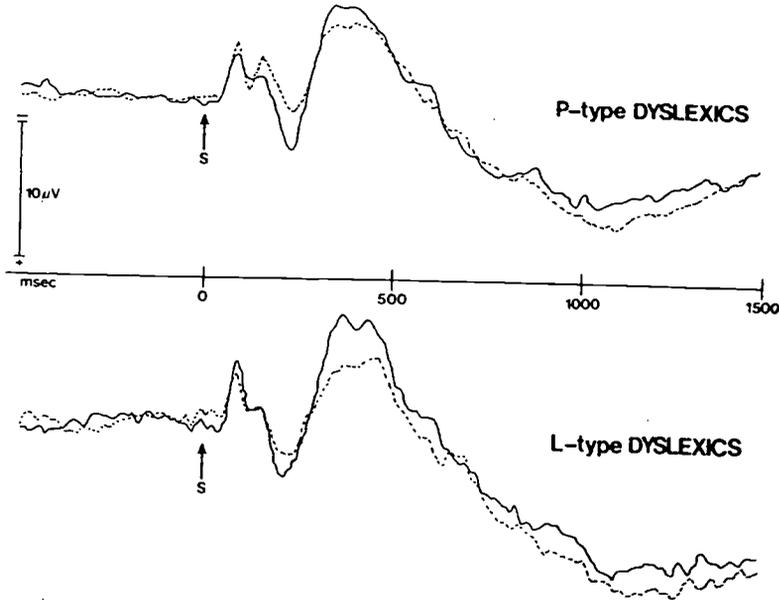
*Fig 5;2   Visual evoked responses elicited by words presented in the
central visual field of P- and L-type dyslexics. ———— T3;
-------- T4. From Bakker and Licht (1986). Copyright 1986
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The word-elicited potential is the electrical response of the brain to
the presentation of a word and consists of a series of positive and
negative electrical peaks. The amplitude of the peaks can be de-
tected by electrodes placed on different regions of the head of the
child. Bakker and Licht found, among other differences, that the

first negative peak (the so called N1 peak, occurring about 100-200 milliseconds after the word presentation started) was larger in the left temporal region in L-dyslexics, whereas this peak was larger in the right temporal region in P-dyslexics. This is an interesting outcome because, as mentioned above, parts of the temporal region are highly involved in language.

In another brain potential study (see Bakker, Licht, & Van Strien, 1991), a selective attention task was administered to 16 L-dyslexics, 20 P-dyslexics, and 20 normal readers. The children had to respond to target letter stimuli (presented for 0.1 second) and to neglect all other (non-target) letters. In one half of the experiment they had to attend the left visual half-field, in the other half they had to attend the right visual half-field. They were instructed to fixate on a central cross. Target and non-target letters resulted in brain potentials with different amplitudes, and these differences were the object of study. Contrary to P-dyslexics and normal readers, L-dyslexics showed almost no amplitude differences over the visual region of the brain in the 100-200 milliseconds period after onset of the letter presentation. This may indicate that in L-dyslexics the visual regions in the brain are less involved in the detection of target letters than in P-dyslexics and normal readers. For the amplitude differences of the so-called P500 peak (a positive peak 0.4-0.6 second after onset of letter presentation), group-specific hemispheric asymmetry patterns were found. In normal readers, P500 amplitude differences were larger over the left hemisphere, whereas in L-dyslexics these differences tended to be larger over the right hemisphere. P-dyslexics showed larger differences over the left hemisphere when target letters were presented in the right visual half-field, and larger differences over the right hemisphere when the target letters were presented in the left visual half-field. Although the functional significance of these patterns remains to be investigated, the brain potential studies, so far, have demonstrated that P- and L-dyslexics differ with regard to the lateral distribution of electrical brain responses to various verbal tasks.

Differences between P- and L-dyslexics in cognitive functioning have also been examined. Van Strien, Bakker, Bouma, and Koops (1990) tested 25 P-dyslexic boys, 22 L-dyslexic boys, and 28 normal reading boys with a number of cognitive tests that assessed either

verbal or visuo-spatial functions. Not surprisingly, P- and L-dyslexic boys exhibited impaired performances on the verbal tasks. However, P-dyslexics, who supposedly refrain from linguistic reading strategies, did not show a larger verbal deficit than L-dyslexics. Compared to P-dyslexics, L-dyslexics performed worse on a figure-rotation task. In this task the child has to decide whether rotated figures are identical to given target figures or mirror images of them. The figure-rotation task closely resembles the discrimination that is required, for instance, to distinguish the letters "b" and "d". The impaired performance of L-dyslexics on this test is in agreement with Bakker's hypothesis that these dyslexics have difficulties with the processing of visuo-spatial features of written language.

In another study (Van Strien, Bouma, & Bakker, 1993), 23 P-dyslexics, 22 L-dyslexics, and 28 normal reading boys were administered a *lexical-decision* task with three-and four-letter words and nonwords. The child's task was to decide whether strings of letters (presented on a computer monitor) were existing words (e.g., *mast*) or nonwords (e.g., *nart*). Responses were made by pressing response keys, and the response times were measured. Laterality studies with normal readers have demonstrated that, with familiar words, the left hemisphere is capable of parallel processing of letter information, whereas the right hemisphere operates by a sequential processing of letter information. Processing time in the left hemisphere is not affected by word length, while processing time in the right hemisphere is dependent on word length (Young & Ellis, 1985; Ellis, Young & Anderson, 1988). Van Strien et al. expected that P-dyslexics, who supposedly rely on right-hemispheric word-reading strategies, would show longer latencies for four-than for three-letter words, due to sequential processing of letter information. On the other hand, L-dyslexics rely primarily on left-hemisphere strategies and hence will employ parallel processing of letter information. Therefore, L-type dyslexics, like normal readers, were expected to show no word-length effect for words. Indeed, P-dyslexics showed a statistically significant word-length effect, with the mean response time for four-letter words being 115 milliseconds longer than for three-letter words. L-dyslexics and normal readers displayed absolutely no response time differences between three- and four-letter words.

Further evidence for different word-reading strategies of P- and L-dyslexics has been reported by Licht (1989).

Genetic components in the origin of dyslexia have been demonstrated by twin studies, which resulted in concordances for dyslexia (that is, both children showing dyslexia) of 84-90% for monozygotic (identical) twins (who share completely identical genetic dispositions) as contrasted with concordances of about 30% for dizygotic (fraternal) twins (Lewitter, DeFries, & Elston, 1980). Also, influences of the family environment can play a role (Childs & Finucci, 1983). As the influence of family antecedents on dyslexia has been established, the question arises whether P- and L-dyslexics display differential familial influences. Van Strien et al. (1990) invited the biological parents of P- and L-dyslexics and the biological parents of normal reading children to participate in a study concerning cognitive performance. All children and their parents completed a series of verbal and visuo-spatial tests. Statistical analysis by means of a so-called *principal component analysis* revealed that the performances on the various tasks could be expressed in two factors: a Verbal/Memory factor and a Visuo-spatial factor.

For all subjects, composite scores for these two factors were calculated. In addition, midparental values were calculated. The midparental value is the average of the composite scores of both parents on a factor. Table 5;2 shows the familial resemblances expressed (a) as midparent-child indices and (b) as single-parent-child effects for the Verbal/Memory factor and the Visuo-spatial factor. It should be noted that these indices are measures of familial resemblance rather than measures of heritability (see Van Strien et al., 1990, for details).

Table 5;2. Midparent-child values and direct parent-child effects for the verbal/memory factor and the visuospatial factor.

	Families of P-dyslexics	Families of L-dyslexics	Families of Controls
Verbal/memory factor			
Midparent-child	.18	.61	.22
Father-son	.07	.37	.04
Mother-son	.13	.27	.16
Visuospatial factor			
Midparent-child	.69	.66	.24
Father-son	.56	.28	.21
Mother-son	.04	.26	.05

From Table 5;2 it can be seen that, for both the Verbal/Memory factor and the Visuo-spatial factor, the midparent-child indices are low in families of normal reading boys and high in families of L-dyslexics. In families of P-dyslexics a high midparent-child index was found for the Visuo-spatial factor only. Concerning the direct parent-child effects, it should be noted that, if the direct father-son and mother-son effect are added, the result should approach the midparent-child index. The direct single-parent-child effects indicate that in families of L-dyslexics, the familial resemblance for both factors can be attributed to both the father-son effect and the mother-son effect. In families of P-dyslexics, the familial resemblance for the Visuo-spatial factor can be attributed principally to the father-son effect. In families of normal readers, the familial resemblance for the Verbal/Memory factor is mainly caused by the mother-son effect, whereas the familial resemblance for the Visuo-spatial factor is mainly caused by the father-son effect. In sum, this study demonstrated differential familial resemblances among families of P-dyslexics, and normal reading children.

Finally, treatment research, besides investigating the efficacy of HSS and HAS, also sheds light on the validity of the P-and L-classification. This research will now be discussed.

Treatment research

In a laboratory experiment, Bakker and Vinke (1985) contrasted HAS and visual HSS with hemisphere *nonspecific* stimulation. Each treatment group contained seven children. Except for two no-training groups. all children received 22 treatment sessions, with one session (of approximately 45 minutes) a week. It was found that visual HSS was most profitable for L-dyslexics. On word reading and sentence reading, HSS treated L-dyslexics exhibited a statistically significant decrease in the number of substantive errors, a significant increase in time-consuming errors, and a sig-nificant decrease in reading speed (as indicated by the total number of words attempted). For P-dyslexics, HAS appeared to be a better treatment strategy than HSS.

In a field experiment, Bakker, Bouma, and Gardien (1990) in-vestigated the efficacy of tactile HSS treatment of P- and L-dyslexics in comparison to regular remedial treatment. Twenty-eight L-dyslexics were treated with left/hand/concrete word HSS and 26 P-dyslexics were treated with right-hand/ abstract word HSS. In the control groups, there were 21 L-dyslexics and 23 P-dyslexics, receiving regular remedial treatment. All children were treated by remedial teachers during 20 sessions, with two sessions a week. HSS treated L-dyslexics tended to show more improvement in accuracy (fewer substantive errors) on text reading than control L-dyslexics. After treatment, HSS-treated P-dyslexics made significantly fewer time-consuming errors on word reading (that is, they read more fluently) than did control P-dyslexics. It was concluded that, which tactile HSS, the improve-ments seen in P-dyslexics were more robust than those in L-dyslexics. The authors suggest that tactile HSS is the most appropriate treatment for P-dyslexics, because tactile exploration is a relatively slow process that fits the slow reading style of P-

dyslexics. Visual HSS (with the rapid presentation of words) best fits the hurried reading style of L-dyslexics.

Spyer (1994) has investigated this hypothesis. She contrasted visual and tactile HSS in both dyslexia subgroups. Nine P-dyslexics were treated with tactile HSS and 8 P-dyslexics with visual HSS. Abstract words were presented to all P-dyslexics. Seven L-dyslexics were treated with tactile HSS and 7 L-dyslexics with visual HSS. Concrete words were presented to all L-dyslexics. All children received 14 treatment sessions over a seven-week period. Given previous results, Spyer predicted that in P-dyslexics tactile HSS, as compared to visual HSS, would lead to faster and less accurate reading, whereas in L-dyslexics visual HSS, as compared to tactile HSS, would lead to slower but more accurate reading. Contrary to expectations she found that visual rather than tactile HSS resulted in less accurate word reading in P-dyslexics. In general, her findings did not support the hypothesis about the differential effects of tactile and visual HSS in P-and L-dyslexics. Besides methodological and treatment differences between studies, another reason for this seemingly inconsistent outcome may be that the hypothesis was too much based on the empirical evidence of the two previous studies (Bakker & Vinke, 1985; Bakker et al., 1990) rather than on theoretical considerations. In Bakker's model, the basic idea is to stimulate the less developed ability. For L-dyslexics, this implies that their reading needs to be slowed down and they need to be stimulated to pay more attention to the physical properties of the written text (this alludes to the right hemisphere). This is exactly what can be accomplished by tactile HSS. With this in mind, it should have been predicted that tactile HSS is more appropriate for L-than for P-dyslexics. In P-dyslexics, treatment should be aimed at boosting the reading speed. This can be achieved by flashing words for a short moment. Because the presentation times are short, the slow reading P-dyslexic will be forced to guess more often (guessing alludes to the left hemisphere). Therefore visual HSS, as compared to tactile HSS, would result in less accurate word reading in P-dyslexics. This is what Spyer found in her study. The alternative hypothesis does not explain the differential outcomes of visual and tactile HSS in the previous studies. It may be that in visual HSS there is an optimum duration of word presentation for the treatment of P-dyslexics. If

112

presentations are too short, the words do not make sense to P-dyslexics; if the word presentations are too long, the reading process is not speeded up. In both cases, visual HSS treatment of P-dyslexics will not lead to the best possible results. This, of course, awaits further investigation. For the moment, it cannot be concluded whether tactile or visual HSS is better for either P- or L-dyslexia. In clinical practice, however, both methods can easily be combined.

Van Strien, Stolk, and Zuiker (1995) investigated the efficacy of a modified visual HSS procedure as compared to standard visual HSS. Several laterality studies have demonstrated that threatening stimuli allude to the right hemisphere (see Van Strien & Morpurgo, 1992). Van Strien et al. hypothesized that threatening words (such as *dead, shark, hate,* or *pain*) will stimulate the right hemisphere. In L-dyslexics, the stimulation of the right hemisphere due to the threatening content of the words would add to the stimulation due to HSS. It was predicted that the reading improvement would be greater in L-dyslexics who were treated with threatening words than in L-dyslexics who were treated with neutral words (such as *wheel, start, lane,* or *foot*). In P-dyslexics, no beneficial effect was expected from the use of threatening words. Ten P-dyslexics were treated with threatening words in the right right visual field and 10 L-dyslexics were treated with the same threatening words in the left visual field. In the control groups, there were 10 P-dyslexics and 10 L-dyslexics, who received the same neutral words in the respective visual half-fields. Threatening and neutral words were matched for difficulty level, length, and frequency. All children were treated during 12 HEMSTIM sessions, with three sessions per week. The results supported the predictions made. After treatment, L-dyslexics in the experimental group made fewer substantive errors and more time-consuming errors, and exhibited slower reading on a sentence reading task than did L-dyslexics in the control group. P-dyslexics in the experimental group were slower than P-dyslexics in the control group. For P-dyslexics, this is an adverse treatment effect, which is possibly also due to the right hemisphere stimulation by threatening words. It was concluded that L-dyslexics (but not P-dyslexics) can benefit from the use of the threatening words in visual HSS.

Conclusions

The basic assumption of Bakker's dyslexia model is that dyslexia is associated with disturbances of the relative participation of each cerebral hemisphere in the process of learning to read. When a child relies primarily on right-hemispheric visuo-perceptual processing, and is unable to switch to left-hemispheric, semantic strategies in the later stages of this process, P-dyslexia arises. If a child employs left-hemispheric, linguistic strategies prematurely from the very beginning of the learning-to-read process, L-dyslexia arises. P-and L-dyslexics can be classified according to reading accuracy. Children with P-type dyslexia are slow but relatively accurate readers, with a fragmented style of reading. Children with L-type dyslexia are relatively fast but inaccurate readers. The validation studies indicate that when dyslexics are classified this way, differences in electrical brain activity, cognitive functioning and familial resemblances can be demonstrated. The results of these studies confirm the notion of differential hemisphere-specific involvement in P-and L-dyslexics during reading and other cognitive activities. In addition treatment research has shown that HSS and HAS are effective treatments for P-and L-dyslexia.

Of course, more research efforts are required to take the P/L typology further. An important theoretical question is whether the P/L model can be integrated with other dyslexia models such as cognitive neuropsychological models of word-reading modes (e.g. Ellis et al., 1988) and *dual-route* models of reading disturbances (e.g., Coltheart, Curtis, Atkins, & Haller, 1993). An important clinical topic is whether HSS is appropriate for dyslexics who cannot be classified as either P-or L-dyslexic. In addition, various parameters of the HSS and HAS treatment of P-and L-dyslexics remain to be investigated. The development of P- and L-dyslexia in time also needs examination. To address this question, a longitudinal prospective study of children at risk for dyslexia is currently underway.

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Chapter VI

READING DIFFICULTIES AND SPECIAL INSTRUCTION

Aryan van der Leij

Introduction

A large number of students are faced with reading difficulties when they attend school. Quite often, they are still unable to read and write properly in their adult life. Especially in societies with high demands on literacy skills their career at school and employment is hindered by the fact that they do not master the basic literacy skills. Therefore, it is important to recognise their difficulties and give these students kinds of instruction that fulfil their special educational needs, preferably at a young age to prevent the accumulation of their backwardness and frustration.

The development of literacy skills is determined by a complex of inter-acting exogenous and endogenous factors. Attempts have been made to relate reading difficulties at the achievement level to different underlying causes, and to define categories and subcategories (or subtypes) of reading difficulties. However, the differentiation of reading difficulties is complicated by three confusing facts. First, reading development and the development of literacy skills are processes which involve the interaction between student aptitude and environmental variables. At any time, it is hard to determine which of the two sets of variables is more decisive in the development of reading difficulties (the nature/nurture discussion). Second, within the aptitude of students, some processes may or may not compensate for impairments of other processes ('internal compensation'). As a result, the outcome in terms of general reading achievement may obscure underlying difficulties which may become manifest at a later stage of development. For example, 'dyslexia' in gifted students may only be detected at a relatively late age. Third, a lack of environmental stimulation at an early age may mask the reading difficulties because lack of experience and demo-

tivation negatively affect the aptitude in a general way. In contrast, adequate early instruction may be relatively successful in controlling risk factors and may serve as a protective factor ('external compensation'). To cope with these issues, research on reading difficulties should cover the variance in aptitude (including endogenous factors), in environmental stimulation and in the interaction between them. Moreover, data-collection should be carried out in a longitudinal design to be able to detect developmental changes. Furthermore, intervention studies should validate the differences in origins in aptitude-treatment designs. Although these ideas are theoretically well established (e.g., by Stanovich, 1986), for practical reasons most researchers have dedicated their efforts to reduced research questions.

Fragmented as it may be, reading research has recently produced some very interesting insights about the cognitive characteristics of the students with reading difficulties and the various ways to treat their problems. This chapter tries to describe some of the more recent developments in both topics. Because of chapter limitations, students who have only comprehension and no word decoding difficulties will be left out (see for a more detailed description Van der Leij, 1994a).

The difference between bottom-up and top-down processing

To indicate the cognitive characteristics of reading difficulties, it is relevant to differentiate between lower and higher order processing. Lower order or bottom-up processing is data-driven as is the case in decoding information to store in working memory. Higher order or top-down processing is conceptually driven as is the case in language activities (Spear & Sternberg, 1987). Analogically, reading can be subdivided into word decoding skills and reading comprehension. Although mastery of the reading skills involves the interaction between a variety of cognitive processes, it is clear that the acquisition of word decoding skills relies heavily on lower level automatization processes ('bottom-up'). After the first stage of reading acquisition, the development of reading comprehension is

decreasingly explained by competency in decoding skills and increasingly by the influence of higher level language competence (Perfetti, 1985). Indeed, the growing involvement of 'top-down' processes is evident (e.g., Aaron, 1991).

The point to be stressed in this chapter is that although all students with reading difficulties to a certain degree suffer from lower level deficits which explain their word decoding difficulties, they may vary considerably in availability of higher level abilities (Stanovich & Siegel, 1994). As a consequence, it is important to analyse their cognitive profile in diagnosis to select the right treatment.

The definition of lower level deficits

The existence of lower level deficits is well documented (e. g., by Rutter, 1978; Spear & Sternberg, 1987). Traditionally, this phenomenon is called 'developmental dyslexia' or 'specific reading disability'. An endogenous factor of genetic origin is indicated as the main cause (e. g. Olson, Wise & Rack, 1989). According to the current definition of developmental dyslexia, students who have a lower-than-normal IQ are excluded from the dyslexic category. In their case, the deficit may be complicated (and masked) by other factors like impairments of higher level processes and/or poor motivation, sometimes correlated with low SES (socio-economic status) and ethnic background. Obviously, it is easier to diagnose lower level deficits in its relatively 'pure' form in students who are not affected by other factors: students within the middle and upper parts of the intelligence distribution, stemming from environments which stimulate language, metacognition and motivation for learning at school. Traditionally, the diagnosis 'developmental dyslexia' or 'specific reading disability' has been restricted to this kind of students.

However, if the cause is hereditary, the question may be raised why nature would be so selective as to protect children with lower IQ's and lower SES backgrounds from suffering from lower level deficits. Because it is hard - if not impossible - to find a reason other than an arbitrary decision, the traditional concept and definition of

developmental dyslexia has met serious criticism (see for recent reviews: Stanovich & Siegel, 1994; Stanovich, 1994; Toth & Siegel, 1994; Fletcher, Stuebing, Shaywitz & Shaywitz, Rourke & Francis, 1994). For instance, Rutter (1978) notes that there is no reason to assume that "... social disadvantage protects children from dyslexia". Instead, there is empirical evidence to show that a lower level deficit is not correlated to SES or ethnic background or IQ level. Therefore, the restriction of lower level deficits to relatively intelligent higher SES students and, more importantly, the suggestion that they suffer from exclusive deficits, is not a valid one. Students who show reading backwardness and are in the lower regions of the IQ-distribution, may suffer from the same kind of lower level deficits as the dyslexic students do. Consequently, in this chapter it will be assumed that students may combine lower level deficits with varying degrees of higher level abilities (see also Van den Bos, 1990).

The cognitive nature of lower level deficits

In their review, Spear and Sternberg (1987) conclude that poor execution of lower level processes which determines the awareness of the sound structure of speech (phonological deficits) and poor automatization of decoding skills are two strong indicators of a lower level deficit. The hypothesis of a phonological deficit as the core of 'developmental dyslexia' is well documented (e.g., by Snowling, 1987). The phonological module is very important in learning and applying the analphabetic writing system, because essentially the alphabetic system is based on grapheme-phoneme correspondence. A deficit of the phonological module will result in poor word decoding processes in reading. This is most obviously indicated by poor non- (or pseudo-) word reading which demands decoding at the single grapheme-phoneme translation level. As is reviewed by Rack, Snowling and Olson (1992), poor word decoding is strongly correlated to poor execution of nonword reading.

Although the phonological deficit hypothesis has received strong empirical support, the picture may not be complete. Recently, the idea that the cause should be extended to the broader area of an

automatization deficit - see Spear and Sternberg (1987) who refer to the work of LaBerge and Samuels, (1974) - has been investigated. An automatization deficit in the speed of processing incoming information does not only affect phonological processing and decoding skills (Yap & Van der Leij, 1993, 1994b) but also other information processes like the accurate and fast execution of visual skills, motor skills and articulation. For example, Nicolson and Fawcett (1990) were able to prove that 12 year old developmental dyslexics find it hard to combine a motor balance task (which should be highly automatized at their age) with an attention consuming decision task, in contrast to chronological age controls. A replication of their study shows that the development of the automatization of basic skills of developmental dyclexics is at the level of much younger reading age controls (Yap & Van der Leij, 1994a). In comparison to the phonological deficit hypothesis, a much broader domain of information processing is covered by the automatization deficit hypothesis. Phonological processing is strongly correlated to the characteristics of the alphabetic system, but the automatization of basic skills like keeping your balance while processing other information is not. Consequently, the predictive power of the automatization deficit hypothesis involves more domains of information processing than the phonological deficit hypothesis (note 1). Clinical workers in the field seem to be in favour of the broader automatization deficit hypothesis because 'developmental dyslexics' may also show poor execution of other basic skills than reading when time pressure or interfering secondary tasks put a high demand on accurate and fast (automatic) processing.

It is important to note that Nicolson and his colleague (for a review, see Fawcett & Nicolson, 1994) added the hypothesis of conscious compensation to the idea of an automatization deficit. By use of higher level processes, the automatization deficit may be (partly) compensated ('internal compensation'). This means that control processes like monitoring and strategies of working memory need to be more involved in tasks which normally rely on automatic processing. In addition, to comprehend what is read, heavy demands are made on the retrieval of prior knowledge and text-reading strategies. As a consequence, to achieve at the same level, students with lower level deficits have to use more of their attentional

122

resources by conscious effort than normal readers of comparable age (or, to put it simply, they have to work harder). Evidently, the task demands have to be in favour of using top-down skills and permit avoidance of automatic word decoding skills as for example is the case in a reading comprehension task without speed pressure or reading aloud. Moreover, the result will be dependent on the availability of 'top-down' compensatory resources in the cognitive profile of the student.

Developmental changes and influences of the environment

Because of the endogenous origin of lower level deficits, one could argue that the development of reading difficulties is basically dictated by maturation and that influence of the environment is small. However, while nature defines the boundaries of development, nurture affects the pathways that are taken and influences the relative strengths of risk and protective factors. For example, Stanovich (1986) hypothesizes that children who show lower level deficits and have only mediocre internal compensation (average IQ's) may undergo developmental changes in their aptitude as a consequence of the negative interaction between their deficits and the environment. When the environment is not stimulating enough (i.e., does not treat the reading difficulty properly), deficits which are quite specific early on, may spread to other areas of the aptitude, including (higher level) cognitive skills and motivation. He calls this phenomenon the Matthew effect ('the poor get poorer' by environmental deprivation).

When this theory is translated into processes, negative experiences with reading, starting as a low level deficit, may generalize to higher level processes like the acquisition of knowledge, control processes, and, most importantly, to motivation. As a consequence of less and negative experiences with written material, the development of vocabulary and general knowledge will increasingly lag behind expectation. Control processes like monitoring and execution of memory strategies are less practised, and, in interaction with cognitive deterioration, a process of demotivation occurs.

Stanovich (1986) notes that it is doubtful that instruction at a relatively late stage (i.e., after some years of failure in regular schools), may disentangle the Gordian knot of deficits and lags in aptitude. Indeed, the prognosis for these students to become proficient readers, if they are not detected early, does not seem to be very positive. For example, the results of a study suggest that students who suffer from lower level deficits and have average (verbal) IQ's, increasingly lag behind reading age controls in automatization of the reading process. While comparable at an earlier stage, these students had only mastered the fast and accurate processing of simple words at the age of 12, whereas normal 8 year-old-students already performed well at the level of more complex words (Van der Leij, 1993). Furthermore, the results of well-controlled experiments on intensive computer-assisted instruction show only minor effects on the word decoding skill of 10 year old students who already have been suffering from lower level deficits for about four years (Van der Leij, 1994b, see also later section).

The development is not only dependent of the availability of external compensation but also of internal. Gifted students from stimulating backgrounds may escape from the spreading effects. In Stanovich's view, these students"... have remained immune to the negative cascade of interacting skills deficits and Matthew effects surrounding reading" (ibid., p. 384). He suggests that the group of students who do not (or to a lesser degree) profit from internal compensation and environmental stimulation, is much larger. Students with average or below average IQ's, are apt to become victims of the Matthew effect. To decrease the effect, they need substantial external compensation to make up for the relative lack of internal compensation. Unfortunately, quite a few of them stem from inattentive families and have non-tutoring teachers within a poorly adaptive school system. In their case, educational deprivation at home and at school may be considered as a secondary (exogenous) negative influence in addition to the original endogenous cause. The same can be about students in still lower IQ areas, who are often called the 'Garden Variety', essentially characterised by the combination of reading backwardness and low IQ in contrast to 'developmental dyslexics' who combine reading backwardness with average IQ (Stanovich, 1988). As is hypothesized by Stanovich and Siegel (1994), it seems unlikely that students

124

with average IQ's differ from students with lower IQ's in the deve-
lopment of word decoding skills because they share the same defi-
cit. Indeed, the results of a longitudinal study indicate that dyslexic
and Garden Variety poor readers with comparable reading back-
wardness and chronological age both suffer from an increasing lag
in word decoding processes in comparison to reading age controls.
However, the possibility to use 'top-down' strategies, as is the case
in text reading, gives the students with higher verbal IQ's some
opportunity to compensate for their decoding difficulties (Van der
Leij, Hoeksma & Smeets, 1994).

Assuming that the former description of the characteristics of
reading difficulties is adequate, it seems clear that diagnosis and
intervention in the case of lower level deficits should be based on
three main principles;

(1) Interventions should preferably be based on early detection and
prevention of cumulative negative effects.
(2) Diagnosis should include analysis of the severity and nature of
lower level deficit-phonological processing and
automatization of basic skills - and of the availability of higher
level skills.
(3) Interventions should aim at 'bottom-up' remediation of word
decoding problems and at the use of 'top-down' skills for rea-
ding comprehension, adapted to the individual aptitudes and
needs of the students.

In the next sections, examples of promising intervention program-
mes are described, divided in 'bottom-up' and 'top-down' inter-
ventions.

'Bottom-up' interventions

From the mass of possible 'bottom-up' interventions, four seem to
be promising: instruction of decoding prerequisites before formal
reading instruction starts, extra instruction as a supplement of
formal instruction, direct instruction in the classroom, and com-
puter-assisted instruction.

Instruction of decoding prerequisites before formal reading instruction starts

Early instruction of decoding prequisities of students who are at risk of developing a decoding difficulty has received attention by several researchers from different countries (e.g., Bradley & Bryant, 1985; Lundberg, Frost & Petersen, 1988; Cunningham, 1990; Ball & Blachman, 1988, 1991). The main idea in all the studies was that children who are weak in phonological skills, need extra instruction before the start of formal reading to prevent a failure in learning the alphabetic system which relies heavily on phonological processing. In all the studies mentioned, basically, a group of kindergarten children was detected with low scores on phonological tasks as a sign of a possible lower level deficit. During a substantial period of time they were instructed in and practised metalinguistic games and exercises, sometimes including letter-sound correspondences, either individually or in small groups or in the class. The methods were very specific, i.e. aimed at prerequisites of learning how to decode (phonological awareness; recognition of letter forms). They started at the age of five, in some cases continuing into the first grade. The instruction was carried out by an expert remedial teacher (Bradley & Bryant) or by the classroom teacher (Lundberg et al.). Gains in later reading achievement were reported. Moreover, the effect on reading achievement was quite long-lasting (several years), as shown by Bradley (1987) and Olofsson, Lundberg, Frost and Petersen (1991). So, it seems worthwhile to run preventive programmes with children who are at risk of developing a lower level deficit. Although the effects were not very strong, quite a few students may be saved from Matthew effects. Unfortunately, preventive studies do not allow conclusions on the question whether the children really would have developed a lower level deficit if they had not received the extra and specific instruction. However, indirect evidence may be that after years there seemed to be more recognised dyslexics in the control group than in the experimental group (Lundberg, personal communication).

An interesting theoretical and practical issue was recently raised by Hatcher, Hulme and Ellis (1994) who propose the 'phonological

linkage hypothesis' which predicts that training in phonological skills in isolation from reading and spelling may be much less effective than training that forms explicit links between children's underlying phonological skills and their experiences in learning to read. Indeed, the experimental conditions of Bradley and Bryant, Cunningham, and Ball and Blachman that combined phonological training with the teaching of letter-sound correspondence had larger effects on phonological decoding than phonological training only or training of more general language activities. Consequently, the best way to prevent or at least decrease decoding difficulties at the kindergarten level seems to be to instruct both the phonological and the letter-sound prerequisites. Phonological awareness as such is a necessary but not sufficient prerequisite and should be supplemented by lettersound knowledge.

The question may be raised whether this idea is simply another way of saying that formal reading instruction needs to be introduced early when children show signs of lacking spontaneous development of phonological abilities and emergent literacy skills. From the preventive point of view this question is rather academic because it is trivial that it is better to install the right prerequisites for learning to decode before starting to read words, than to wait until the students at risk actually fail. However, there will be opponents who claim that direct instruction of subskills is not in harmony with the culture of informal, integrative learning based on child initiated activities that seems to be dominant in the classes for 4-6 year olds (e.g., Geens, 1994; Burgess, Huges & Moxon, 1994). On the other hand, it is clear that differences between children in relevant cognitive and psychosocial domains are apparent in the years before the start of formal learning. Furthermore, because very little, if any, individual instruction is given to young children at risk in regular classrooms before formal reading starts (at least not in The Netherlands, see Schonewille & Van de Leij, 1993), these differences will tend to increase over the years. Possibly, the solution is to provide extra instruction and learning experiences for the children at risk but use methods that are playful and enjoyable for the young children like the practices used in the aforementioned studies. As a consequence, some sort of system of early detection by running tests on phonological awareness should be used, and special training for low-achieving students should be organised.

Extra instruction as a supplement to formal instruction

If it is impossible to arrange extra instruction and learning experiences before formal reading starts, intervention still may be effective at a later stage. Hatcher, Hume and Ellis (1994) were able to provide evidence that, when formal reading instruction has started and students who fail to catch up with the main group are detected, the phonological linkage hypothesis also holds. In their intervention study, the condition 'reading with phonology' - typically a phonics-based method - was more effective in stimulating progress in word and nonword reading and spelling than the conditions of 'reading only,' 'phonological training only' and 'no training'. As was the case in the Bradley and Bryant study, the treatment was on an individual basis (40 30-minute sessions over 20 weeks), supplementary to classroom instruction. The authors conclude that interventions to boost phonological skills need to be integrated with the teaching of reading if they are to be maximally effective in improving literacy skills.

Direct instruction in the classroom

Although it seems obvious that individual instruction (see the studies of Bradley et al. and Hatcher et al.) is more effective than instruction in the classroom, for practical reasons individual instruction may be hard to accomplish. Fortunately, the teacher in the lower grades is also able to improve the instruction of reading when direct instruction and adaptive classroom management are used. Direct instruction means that the methods are highly structured, i. e., the use of regular assessments which lead to adaptive teaching, prescribed lessons that match the level of development of the students, groupwise instruction followed by individualized practice with corrective feedback by the teacher, classroom management by teaching the students self-regulatory behavior and of 'teacher-free' methods and tools (e.g. audio-cassettes, easy-to-read books). In most experiments, classroom instruction was supplemented by special treatment of the hard-to-teach by the classroom teacher. Improvements of achievement in decoding skills

and spelling in later grades have been reported (Becker, 1977; Gersten & Carnine, 1984; Carnine, 1989; Van der Leij, Clijsen, Struiksma & Damen, 1990). Although it is unclear whether all students with lower level deficits profit from the improvement of classroom instruction, direct instruction and adaptive classroom management seem to have a boosting effect on average achievement scores and the scores of poor (and of good) readers. It is presented as a profitable means to cope with most of the individual differences in the classroom.

Computer-assisted instruction

The possibilities of computer-assisted instruction to provide intensive interaction between the instructor and the students, and maximize the amount of instructional time (Guthrie, 1978), have been explored both in practice and in scientific research. Although it has been claimed from the start that computers may be quite powerful in providing additional practice on component skills of reading, for years the available software was not very effective (Torgesen, 1986). However, recently an increasing number of researchers have begun to use computers in experiments on the remediation of reading difficulties and some interesting results have been reported (e. g., by Frederiksen, Warren & Roseberry, 1985a, 1985b; Torgesen, 1986; Jones, Torgesen & Sexton, 1987; Olson, Wise & Rack, 1989).

A series of Dutch experiments may serve as an example because the experiments were highly comparable. The students were attending the same type of special school and showed the same sort of severe lower order deficit ('dyslexia'). Furthermore, their age (about 10 years) and reading backwardness (more than two years) were about the same across the experiments and they shared the same language. All experiments concentrated on training of decoding skills at word or at sublexical level.

At word level: One experiment showed that repeated presentation of the same words stimulated recognition of the practised words. Although accuracy was increased in all reading disabled students, some failed to learn to respond fast, showing their auto-

matization deficit (Van der Leij & Van Daal, 1989a; Van Daal, 1993) Interestingly, the effect of repeated reading is independent of meaning, as Van den Bosch (1991) was able to show that repeated presentation of nonwords triggered the same result. Obviously, the important connection to be learned at the word level is the connection between the orthographic structure of the word and its pronunciation. Another experiment indicated that overlearning the pronunciation first (without reading) facilitated accuracy of word recognition when the written form was presented afterwards (Van der Leij & Van Daal, 1989b). Lastly, word recognition and spelling is stimulated as well by typing responses as by reading aloud (Van Daal & Van der Leij, 1992). However, none of the practices at the word level revealed transfer to nonpractised words, so the effects were highly word-specific.

At sublexical level: Speech feedback at the single phoneme or at the segmented word level had some transfer effect, although it was rather small (Van Daal & Reitsma, 1993). In fact, practising the connection between the orthographic and the sound structure at the sublexical level was more successful than practising the orthographic structure only (Van Daal, Reitsma & Van der Leij, 1994). Adding the speed element by presenting words very shortly and asking the student to recognise given letter clusters, stimulated faster processing in otherwise nonautomatic readers (Das-Smaal, Klapwijk & Van der Leij, 1996; Yap & Van der Leij, 1994 b, Yap, 1993). However, the best results were gained when training included practices in the auditory mode (fast recognition of phoneme clusters within auditorily presented words), in the visual mode (fast recognition of grapheme clusters within flashed words), and in the connected modes (fast recognition of phoneme clusters within flashed words), blocked in that order. To return to the 'phonological linkage' hypothesis of Hatcher et al. (1994) described in an earlier section, the combination of phonological training and letter/phoneme cluster training indeed seemed to be the most effective. However, although dyslexic students were able to produce transfer to new lexical knowledge (words), progress in rapid nonword reading and transfer to phoneme detection speed were limited, indicating their automatization deficit.

Another example at the sublexical level is given by Van den Bosch (1991) who trained reading of nonwords under a flashed

130

word condition, in contrast to training without a time limitation for presentation. Using single presentations of nonwords, no lexical effects were to be expected, only effects on phonological decoding. The experiment indicated that training of nonword decoding under conditions of limited exposure duration was more beneficial to word processing skills (words and nonwords) than training without such time pressure or training which speeds up responding itself.

From this short description, the conclusion may be drawn that computer-assisted instruction is very beneficial to reading disabled students because stimulus and response conditions can be controlled and all kinds of feedback can be given. However, when reviewing and comparing the results more carefully, four main conclusions can be drawn (Van der Leij, 1994b). First, students with severe lower level deficits ('dyslexia') are clearly hard-to-teach because none of the experiments showed dramatic progress of the trained subjects although the computer-assisted instruction certainly provided an intensive interaction, was executed individually with immediate feedback, and in most cases involved considerable instruction time. Second, with respect to the question of how to remediate the deficient lower level components of reading, the results revealed that concentration on a variety of components did not seem to be the answer. Third, with respect to treatment of severe lower level deficits, single component practice seems to be more effective, e.g., sublexical speed training and reading flashed nonwords aloud. Fourth, transfer effects are limited. Instead, the effects of the instruction partly reflect the training conditions. For example: sublexical speed training produces progress on (non)word reading in the flashed but not in the unflashed condition.

It is important to note that in all the described experiments, severely dyslexic students were the subjects (on average 10 years of age, with a reading backwardness of at least two years, and a moderate, i.e., average, IQ). The results support the earlier expressed view of Stanovich (1986) that the lower level of severe dyslexia is hard to treat at a relatively late age. Therefore, 'top-down' interventions may be more beneficial than 'bottom-up' interventions. However, computer-assisted instruction is a very useful treatment when the reading difficulties are not so severe.

For example, Smeets and Van der Leij (1995) were able to show that a multicomponential computer-assisted programme indeed helps poor readers.

'Top-down' interventions

As stated before, lower level deficits may be associated with different aptitudes at the level of higher order skills, ranging from generally low to considerably high. When children show slow development in higher level skills, they need intervention at an early stage in order to prevent them from becoming generally backward in learning. Early means even earlier than the programmes to instruct the prerequisites for decoding which start at the age of five. If, for example, language development needs to be stimulated (training of vocabulary, listening comprehension, and metacognitive use of language in problem solving situations), early intervention at home and at preschool institutes have been implemented, in different countries, sometimes starting at the age of three. The aim of such programmes is not only to give the children a better start in reading programmes, especially with respect to reading comprehension, but also in other programmes like arithmetic. Children who have better developed higher skill abilities but suffer from a lower level deficit, do not need such early interventions. However, as a supplement to remedial programmes aimed at decoding and automatization skills, they need instruction in reading comprehension at a later stage to use as a compensation for their deficit.

Two kinds of 'top-down' intervention programmes have been investigated: early stimulation of higher level skills before formal reading instruction starts and direct instruction of reading comprehension strategies.

Early stimulation of higher level skills before formal reading instruction starts

Early intervention at home may be considered as the most basic approach. Theoretically, the focus should be at the higher level processes, i.e., metastrategic information, monitoring, the use of strategies in working memory, listening comprehension, vocabulary and general knowledge. Of course, improvement of the quality and quantity of informal instruction at home may be frustrated by ethical and practical limitations. On the other hand, the fact that home programmes are run in a lot of industrialised countries, can be regarded as a sign that this kind of intervention is promoted. An example is the Home Interaction Program Peaceful Youngsters (HIPPY), (Lombard, 1981), developed in Israel. The programme was aimed at families from low SES, ethnic minorities and included several years of informal instruction at home during preschool (kindergarten) years. The parents were supported by paraprofessionals (trained mothers from the same ethnic background). Using role-play as a method the mothers were taught how to stimulate their children by playing games and how to use instructional materials. The focus is on the mother-child-dyad as an interactive system and the mother as the agent of intervention. Other relevant examples of home programmes are described by Radin (1972), and Rescorla and Zigler (1981). Reported effects on the aptitude of the children are: higher school readiness, a gain in higher level processes, some gain in decoding and comprehension, and a higher level of secondary school enrolment. In addition, a higher self-concept/internal locus of control of the mothers involved in the programme is mentioned. However, the effects on the aptitude of the children tended to decline over a period of time (see for reviews, Eldering & Leseman, 1993). So far, replication of the results in controlled experiments is lacking, or the results are discouraging like the Dutch replication of HIPPY (Eldering & Vedder, 1993). Control over participants and methods is very hard to accomplish. Besides, some of the programmes seem to be aimed at too many different skills. Possibly, it is not very easy to transplant early intervention programmes across countries and cultures. Furthermore, it is not very clear which elements of the

treatment interact with aptitude processes. Nevertheless, the idea of early home instruction seems to be quite valid in the case of higher level impairments to decrease the discrepancy between aptitude acquired at home and at school and to prepare the students for their school career.

One way to control the execution of the programmes better is to carry out early stimulation in nursery institutes or at (pre)school. Although implemented with great enthusiasm, quite a few pre- and early school programmes aimed at the development of higher order skills have failed to reveal positive effects because of methodological problems (Sylva & Wiltshire, 1993). Still, some programmes have been evaluated positively, like Feuerstein's Instrumental Enrichment Program (Savell, Twohig & Rachford, 1986), Weikart's High/Scope Program (Weikart & Schweinhart, 1991) and Slavin's 'Success for All' (Slavin & Madden, 1993). Apart from intensity (e.g., four mornings per week, 30 weeks a year, two or more years), start at a young age (preschool: at an age of two or three), commitment of the parents and a low teacher/student ratio have been recommended (Royce, Darlington, & Murray, 1983).

With regard to prevention of reading difficulties, the results of most of the early 'top-down' programmes are not very clear-cut, possibly because the focus has been directed at too many skills in the cognitive, social and psychomotor domains, and the theoretical and empirical backgrounds were too vague. However, an example that is relevant to mention is 'Success for All'. The purpose was to stimulate (pre)literacy skills based on a highly structured curriculum that stimulated linguistic competence (development of conceptual knowledge, vocabulary, listening comprehension and emergent literacy). In combination with support of the parents, the emphasis was on working in small groups, co-operative learning and playing, permanent diagnosis and, most importantly, a system of tutoring: the creation of extra learning time for individual students who lagged behind and were instructed by a specialised, 'tutor'. The programme started in preschool years when the students were 3-5 years and continued to the age of 9 or 10. The reported results are impressive. In the first grade (when formal reading instruction started) the students of the experimental group differed from untrained controls in reading achievement by more than one standard deviation. A year later the advantage was even

134

greater (Slavin & Madden, 1993; Madden, Slavin, Karweit, Dolan & Wasik, 1993).

Direct instruction of reading comprehension strategies

Research projects have also been directed at the question of how to instruct somewhat older students at school to comprehend what they read (e.g. Bauer, 1987; Worden, 1987; Schallert, 1991). Basically, the programmes were aimed at the implementation of prior knowledge, vocabulary, metastrategy knowledge, monitoring, memory strategies, and motivation/ attribution. This may be done by direct instruction (in the classroom) or individual instruction and, possibly, by computer-assisted instruction. Reading comprehension is reported to improve by a combination of instruction of general strategies monitoring learning behavior, of specific reading comprehension strategies and stimulation of motivation (Bauer, 1987). However, the instruction period had to be long to be effective. Furthermore, long-term and transfer effects were not investigated properly. Still, these kinds of programmes seem to be very useful as a means to treat reading difficulties within a 'top-down' compensatory perspective.

One of the basic assumptions is that reading comprehension is not a matter of merely automatically extracting meaning from print but an active process which needs to be instructed (Reitsma, 1994). This is the case with normal students but more so with students who, for various reasons, lack the ability and attitude to get actively involved in reading comprehension. However, observational studies show that classroom teachers are interested in the product of reading - i.e., whether the students produce the right answers to questions at the end of a text - but not in the process that leads to the right answers (Durkin, 1979). They rarely seem to provide explicit instruction in the use of strategies for reading comprehension. Furthermore, in general it is doubtful that teachers adapt much of their instruction to the specific educational needs some of their students may have. These observations lead to three questions. Can the teacher be taught to instruct comprehension strategies to reading disabled students? Do students with varying rea-

ding difficulties benefit from the instruction? Can the classroom teacher adapt his instruction to the special educational needs of some of his students?

The answer to the first question is affirmative. Using the device of five workshop sessions, teachers of special classes of reading disabled students were trained in a study reported by Reitsma (1994) and Sliepen (1995). The teachers were taught how to incorporate explicit strategy instruction into their reading lessons and were guided to develop their own educational plans for their classes. As a result, explicit instruction and guidance of use of reading strategies increased and substantially less time was devoted to general management procedures. The teachers spent more time listening to questions and answers from the students and less time controlling and correcting the students' work. The quality of their instruction, rated on a scale by observers, improved dramatically.

The answer to the next question also seems to be positive. When an experimental programme was used, based on a combination of the principles of direct instruction and reciprocal teaching, low-achieving students profited both with respect to the knowledge they had about reading strategies, and to the scores on tests of reading comprehension in comparison to a control group (Reitsma, 1994; Walraven, 1995). The programme consisted of 13 lessons of about 30 to 40 minutes which were attended by three students. The instruction followed six phases focused on;

(1) repeating relevant knowledge from previous lessons
(2) explaining the aim of the new lesson
(3) modelling the use of a strategy
(4) guided practice
(5) independent practice
(6) paraphrasing the new information of the lesson

Apart from direct instruction, reciprocal teaching seemed to be the main cause of the fact that the trained students were more aware of the use of strategies in reading comprehension and used their own knowledge better in tests. Basically, reciprocal teaching requires that the teacher and the students take turns in the responsibility to guide the processes of constructing meaning from the text. Verbalization of the strategies to be used and discussion about the

strategies and the relevant information and answers are essential in this method (Palincsar & Brown, 1989).

The last question is hard to answer because little is known about the adaptation of the quantity and quality of reading comprehension instruction to the special educational needs of students within the classroom. The studies of Reitsma were experiments, using small groups of reading disabled students and teachers in special education. Although it is clear that quality and quantity of instruction generally have an impact on school achievement (Fraser, 1989) and that outcomes of special treatment programmes are better when students are taught in smaller groups (Spreen, 1988) or when tutors are used (Slavin & Madden, 1993), there seems to be virtually no research in natural and regular classroom settings with regard to the question whether the teachers are able to adapt their reading comprehension instruction without extra teachers and hours. Possibly, what is said about the effects of direct instruction of lower level skills in an earlier section may be applied to higher level skills as well: direct instruction is beneficial to all students, including (most of) the poor readers.

Discussion

In an earlier section it was assumed, that interventions should preferably be based on early detection in order to prevent the cumulation of negative effects. This assumption is strongly supported by the studies of Bradley and Bryant (1985), Lundberg, Frost, and Petersen (1988), Cunningham (1990), and Ball and Blachman (1988, 1991) which reveal positive effects of instruction of decoding prerequisites. Furthermore, the studies of Slavin and Madden (1993) suggest that the same conclusion holds for programmes of early stimulation of general linguistic skills. Because the picture seems to be that both 'bottom-up' and 'top-down' interventions are beneficial, children with all sorts of reading difficulties, may be helped at an early age.

However, three remarks should be made. First, the development and implementation of 'bottom-up' and 'top-down' programmes is not an overnight job. They cost a lot of developmental work, orga-

nization and extra input (teachers). Besides, the philosophy of early education should be changed from a culture of informal child initiated activities and 'laissez-faire, laissez aller' with regard to underachieving children based on maturation theories, to a culture of adaptive and more direct instruction based on learning theories. In some countries (like The Netherlands), this may take some time.

Second, early intervention is a necessary but not a sufficient condition for treatment because not all (prerequisites of) reading difficulties may be evident in the early years. For instance, the discrepancy between what is expected and what is achieved may increase with the years. Students who were within the acceptable limits in a former period, may be at risk of failure later on. The Matthew effect, described in an earlier section, goes even further and predicts that a lot of students who are poor readers will develop serious reading difficulties because of the interacting effects of not doing well and not being instructed well enough which results in decline of cognitive skills and motivation. Furthermore, difficulties with reading comprehension can only be detected properly when comprehension skills are needed. In other cases, internal compensation by a surplus in higher order abilities may mask an underlying lower level deficit which only becomes apparent when demands on fast automatic processing of written material are increasing (for instance at the secondary school level when foreign languages are introduced).

Third, there are students who are very hard-to-teach even when they receive proper treatment. Authors who have reviewed studies in the broader area of learning disabilities, come to the conclusion that the results are disappointing, but mention major methodological deficiencies in this body of research as a possible cause of the disappointing results (Spreen, 1988; Lyon & Moats, 1988; see also Fletcher, Foorman, Francis, Shaywitz & Shaywitz, 1994). In an earlier section we described the influence of computer-assisted instruction on the reading achievement of 10-year old, severely dyslexic students, and could mention only specific effects and practically no transfer of training. Possibly, methodological deficiencies account for the lack of effect. However, the experiments reviewed were highly comparable and based on an identical definition of reading disability, a relatively small range of subjects in age, reading backwardness and IQ's, and proper research designs.

Instead of methodological deficiencies, it seems to be more appropriate to assume that severely dyslexic students who have only average higher level skills may have structural limitations of their ability to automatize word decoding processes. Possibly, the increase of speed of processing letters and words is frustrated by a structurally limited throughput at the synaptic relays, as Been (1994) suggests. In addition to severely dyslexic students, many reading disabled students belonging to the Garden Variety because of lower IQ's, may be hard-to-teach, too, even when they receive intensive treatment. Indeed, a comparison between dyslexic and Garden Variety students of the same age and reading backwardness but with verbal IQ's of > 90 and < 90, respectively, showed that 12 hours of extra computer-assisted instruction did hardly produce progress in word decoding skills in either group (Smeets & Van der Leij, 1995).

The three remarks lead to the conclusion that the assumption of early detection and prevention - although priority number one - should be extended to a recommendation of a longitudinal approach of diagnosis and intervention covering a longer age range than the early years. Furthermore, even when treatment is guaranteed for a long period of time, some students will stay very poor learners. The second assumption was that diagnosis should include analysis of the severity and nature of the lower level deficit - phonological processing and automatization of basic skills - and of the availability of higher level skills. Indeed, students with reading difficulties defined as word decoding deficits may vary in a lot of ways. Besides the relative severeness of the lower level deficit, their higher level skills may range from weak to strong. As a consequence, it is very important to include lower and higher level processing in the diagnosis. Lower level processing covers a wide range of skills linked to the phonological module (rhyming, phonological segmentation, sound blending), working memory (decoding and repetition of auditory information), word decoding (grapheme-phoneme and letter-phoneme cluster association, nonword reading) and automatization (rapid naming, fast and accurate articulation, word decoding without the use of attentional resources). Higher level processing involves the availability of several kinds of verbal knowledge (vocabulary, conceptual knowledge, 'word knowledge'), the use of cognitive strategies (meta-

cognition, word attack strategies, reading comprehension strategies), and general monitoring skills. However, it is not only a matter of testing the cognitive abilities of the students. As is noted by Stanovich (1986), motivation is a very important domain of individual functioning. Besides, environmental stimulation is considered to be decisive in the development of higher level skills by researchers who focused their attention on early risk factors at home, like Wells (1985) and Snow (1993), or at school, like Stanovich (1986). In addition to psychological testing, an analysis of environmental factors should be made, i. e. home factors like quantity and quality of informal education, language stimulation, and parental support, and school factors like the way instruction is adapted to the special educational needs of students. Intervention should externally compensate for lack of environmental stimulation.

The third assumption was that interventions should aim at 'bottom-up' remediation of word decoding problems and at the use of 'top-down' skills for reading comprehension, adapted to the individual aptitudes and needs of the students.

This assumption essentially is directed to the 'what', but not to the 'how' of special instruction. Reviewing the examples of intervention described in the former sections, it is striking that within a wide range of programmes and varying degrees and qualities of reading difficulties, the principles of instruction to satisfy the needs of the students are both quite simple and similar. To quote Guthrie (1978) in more detail now, 'bottom-up' intervention should be based on four principles:

(1) focus instruction on the deficient cognitive components of learning to read
(2) instruct children in all the components of reading
(3) provide intensive interaction between the instructor and the student
(4) maximize the amount of instructional time

There is little reason to assume that the methods of the treatment in 'top-down' areas should be based on other guidelines. Essentially, 'Success for all' (Slavin & Madden, 1993) is based on the same principles, albeit adapted to more general skills than reading.

Furthermore, as is shown in the studies of Reitsma (1994), the same principles hold for instruction of reading comprehension. However, in the case of 'top-down' intervention, it seems relevant to add an element to the second principle. It is very important to make the students active learners (in the pre-reading phase) or readers (when formal instruction has started). This can be done by the stimulation of self-regulatory learning skills that are instructed first and gradually internalized later on (using dialogue, verbalization, modelling, scaffolding and feedback).

In practice, these guidelines are very dependent of the intensive interaction between instructor and student - Guthrie's third principle. Still, other possibilities can be used. Reciprocal teaching may serve as an example. Because the students take turns in the responsibility to guide the processes of constructing meaning from the text, and of understanding and evaluating the text (Palincsar & Brown, 1989), the teacher does not necessarily participate in all the interactions. Furthermore, self-regulatory tools to monitor learning behavior (audio-cassettes; micro-computers; interactive video) may be useful to reduce the necessity of permanent instructor/student interaction. One of the possibilities computer-assisted instruction has, is to provide drill-and-practice while activating the student at the same time. The studies of computer-assisted instruction support this view by showing some effects of active participation in auditory segmentation processes, in speeding up visual detection processes, or in responding using the mouse or keyboard. However, as is summarized by Corno and Snow (1986), the most important general principle may be to adapt interventions to individual differences in aptitude and, therefore, in characteristics of the reading difficulties. Although tools have interesting possibilities, it is doubtful that the software can be the adaptivity of the human instructor.

Returning to the 'what' of special instruction, four broad domains are important:

(1) language and metacognition
(2) prerequisites of word decoding
(3) word decoding
(4) reading comprehension

When young children are not well equipped in 'top-down' skills necessary for learning at school because of environmental deprivation, stimulation of language and metacognition should get the first priority. This means not only an increase of conceptual knowledge, vocabulary and listening comprehension, but also learning to use language as a means of internal guidance of behavior (self-regulatory skills like monitoring and problem solving strategies) and as a means to reflect and communicate independently of the direct situation. Because a process of 'decontextualization' is involved, one could call this the initiation of the children in the first abstraction of reality.

The second priority should be the stimulation of prerequisites like emergent literacy (knowing what print is about, first writings), phonemic awareness (detection of the phonemic structure of language, e. g., by rhyming, blending, sound deletion) and letter-sound correspondence (recognising the basic letter-sound principle of the alphabet, using forms and other materials). Essentially, the fact that words may be represented by print is learned, so one could call this the initiation in the second abstraction of reality. All students who are at risk of developing 'bottom-up' reading difficulties should get intervention programmes on the prerequisites, independent of the quantity and quality of their 'top-down' skills. For practical reasons, tasks that trigger phonological awareness are decisive to detect children at risk.

Next, phonological decoding, word recognition and automatization of these skills should be instructed and practised according to the guidelines of direct instruction, starting within the classroom and, possibly, supplemented by instruction outside the classroom. From the very start, phonological skills need to be integrated with the teaching of reading if they are to be maximally effective in improving literacy skills. Computer-assisted instruction can be used in stimulating word decoding and automatization of word decoding, e. g., by practices that are directed at nonword reading and speed of processing. When reading backwardness is still within reasonable limits, positive effects are to be expected, but the amount of needed practice should not be underestimated. For the very hard-to-teach computer-assisted instruction should be regarded as a supplement to individual remedial teaching and compensatory practices of 'top-down' skills. Reading comprehension is the result

of the interaction of language, metacognition and word decoding. On the top of the first two abstractions - language and print - a third one is emerging: imagination of the meaning of the texts. It is very important that reading comprehension is directly instructed to the students and practised using methods which stress reading comprehension strategies in a communicative learning environment. Most students with reading difficulties are poor comprehenders. Some may have 'top-down' skills that can be used to compensate for their decoding deficits. Others may be impaired in 'top-down' skills and need to get help in understanding texts. They all need direct reading comprehension instruction that tries to install self-regulatory text attack skills.

Note 1. The automatization deficit hypothesis predicts that people who learn a writing system that is not based on grapheme-phoneme correspondence like Chinese, may also suffer from correlated automaticity difficulties in learning to read. In contrast, the phonological deficit hypothesis does not. It would be interesting to investigate the validity of the two lower level hypotheses in cross-cultural research.

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148

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149

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150

Chapter VII

TWENTY-FIVE YEARS OF LONGITUDINAL STUDIES ON DYSLEXIA

Hanna Jaklewicz

INTRODUCTION

Dyslexia defined

Specific reading and writing disorders have appeared as a topic of investigation since the time when Pringle Morgan (1896) described the reading difficulties of fourteen-year-old boys. Morgan named these disorders "congenital word blindness". The term "dyslexia" appeared in a paper by Hinshelwood in 1896 (Hinshelwood, 1896). This term was accepted by the World Organisation of Neurologists at the Conference in Dallas in 1968. Dyslexia was defined as specific difficulties in reading, even if a child has a normal intellectual level, measured by acceptable principles.

The Diagnostic and Statistic Manual of Mental Disorders - III Edition Revised (1987) distinguishes between Developmental Expressive Writing Disorders and Developmental Reading Disorders. This division is reasonable because developmental reading disorders (dyslexia) and developmental writing disorders (dysorthographia) might exist separately (Jaklewicz, 1980, 1982). This principle was maintained in DSM-IV. The basic criteria of DSM does not go far from the proposition from 1968; DSM gives more precise diagnostic criteria.

Overview of longitudinal studies

During the last years, longitudinal studies on reading and writing disorders reached the phase of recapitulation. These elaborations are difficult to compare because of the different criteria of diagno-

151

sis and the fact that the majority of investigations were carried out on samples which were not representative of the population and biased by selection errors.

Few authors noticed significant improvements in reading and writing in the disabled children who were provided with special training (Lovett, Ransby, Hardwick, Johns, Donaldson, 1989; Reuter-Liehr, 1993). Most authors reported that reading and writing disorders which were diagnosed at school beginning persisted to the end of the elementary education (Rutter, Tizard, Yule, Graham, Whitmore, 1970; Strehlow, Kluge, Moller, Haffner, 1992; Klicpera, Schabmann, Klicpera, 1993; Kurzweil, 1992).

My own investigation proved that reading and writing disorders had a relatively persistent character, whether the person went through special training or not (Jaklewicz, 1980).

One of the first follow-up studies on school career and social achievement of dyslexics were published by Rawson in 1968 (Rawson, 1968). A majority of the investigated persons completed higher education and took important positions in the American society. Rawson's studies can not be representative for the dyslexics population because the investigated boys were estimated as very intelligent (average IQ was 131), all of them passed the special training on reading and writing which was included in the school programme. This group consisted of boys from families with high social and financial positions. Strehlow et al. (1992) noticed the different issues of dyslexics' school career. Out of 59 dyslexics with an average IQ of 112, only six persons completed a college preparatory programme. The rest finished no more than nine obligatory years at school. The majority of them took jobs which did not satisfy them. Maughan, Grey and Rutter (1985) discussed in their follow-up the implications of writing and behavioral disorders in childhood on work histories. The authors noticed that emotional and social deviations have their sources in failure in school. Poor results in educational achievement limited the future satisfaction of professional work.

The problem of emotional and behavioral disorders associated with dyslexia seems to be very important. Matejcek (1994), on the basis of his longitudinal studies on dyslexia, attends to the emotional and social problems which might appear in dyslexics. In his opinion, the social and emotional disturbances are connected with

the children's basic problem-learning difficulties. The author suggests the same risk of sub-deprivation between unwanted and dyslexics because for these children the basic psychological needs are chronically unsatisfied.

My longitudinal studies revealed that emotional disturbances associated with dyslexia had an influence on the creation of some personality features and dissatisfaction in life (Jaklewicz, Bogdanowicz, 1982; Jaklewicz, 1992).

On the basis of my investigations I would like to prove:
- the relatively persistent character of reading and writing disorders
- the emotional, educational and social consequences, emerging from reading and writing disorders.

The studies were carried out from 1969 to 1994. The last one in 1994 was a study of children of former dyslectic parents.

METHOD

Selection of group[1]

The aim of the initial studies carried out in 1969 was to establish the incidence of dyslexia in the population of eleven-year-old children, pupils in fourth grade of elementary school. A representative sample of children, pupils in 71 elementary schools in Gdansk, was selected according to an error percentage of 5 and p=0.125 probability percentage of dyslectic children, with acceptance of an average number from European statistic expressed in decimal fraction. The representative sample constituted 390 children.
Characteristics of the representative sample:
- all children lived in Gdansk, all of them were pupils of the fourth grade in elementary school,

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1 Statistical data were elaborated by dr Baranska Zygmunta.

- the ratio of girls to boys was 103:100 (The ratio of women to men was 102:100 in the region of Gdansk in 1968.)
- the mean age was 11;2 years which was according to the average age of fourth-grade elementary school pupils
- parents' educational level, family structure and socio-economic status conformed to the national average.

The diagnostic criteria employed in the studies were as follows:
- specific reading and writing disorders occurred in children with normal intellectual level as defined by psychological tests and with normal visual and hearing abilities
- reading disorders are characterised by specific word deformation and reading speed retarded a minimum of one year to the age (class level)
- writing disorders are designated as specific errors in written test.

We assume that reading disorders are connected with writing disorders, so we used the term "dyslexia" concerning specific reading and writing difficulties.

Investigative procedures followed in selection of dyslectic children[2]. The procedures of the investigation consisted of the following:

1. Pedagogical examination:
   a) reading test for elementary school children
   The reading skills were estimated using a test designed by a Polish author (Konopnicki, 1961). It measures the speed and quality of reading for the pupils from I[th] to VIIth grade of elementary school. The speed level of VIIth grade is accepted as the normal speed of reading.

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2 Participants in examinations were Prof Marta Bogdanowicz, dr Wirginia Loebl and Barbara Lewandowska, M.A.

b) *written texts included copying a written model (pattern), written words dictated, written words previously remembered.*

The written texts were prepared according to the age (grade) of the children. It should be made without errors. Estimation of written errors: each written text from hearing, pattern and memory consisted of different numbers of written signs. It is assumed that in each pattern the number of written signs is 100%. In order to find the mean percentage of errors for each child the following formula was used:

$$\text{rate of errors in \%} = \frac{\text{total number of errors}}{\text{number of written signs X} \times \text{number of children}} \times 100$$

2. Psychological examinations:
Wechsler Intelligence Scale for Children (WISC), Cattell Personality Inventory

3. Medical examinations:
psychiatric, neurological, ophthalmological and phoniatric

After the three-stage examinations 50 children suffering from dyslexia were selected from the total sample.

A control group was selected from a representative sample of children who were free from reading and writing disorders. The control group consisted of 50 children.

Characteristics of the groups

Table 7;1. Distribution of sex in dyslectic and control group

Category	Dyslectic group frequency	per cent	Control group frequency	per cent
Female	11	12	27	54
Male	39	78	23	46
Total	50	100	50	100

Boys constituted 78% in the dyslectic group and 46% in the control group. Mean age of the children in the dyslectic group was 11;2 years, in the control group 10;8 years.

Table 7;2. Distribution of IQ estimated by the Wechsler Intelligence Scale for Children

Class limits IQ	Dyslectic group frequency	per cent	Control group frequency	per cent
85-100	25	50	16	32
101-115	19	38	24	48
above 115	6	12	10	20
Total	50	100	50	100

The intellectual level was normal in the two compared groups. The null hypothesis, that the two compared groups have the same distribution, can be accepted at a level of significance [$X^2 = 3.557 < X^2$ (0.05,2) = 5.991].

Table 7;3. Distribution of father's education in dyslectic and control group

Category of education	Dyslectic group frequency	per cent	Control group frequency	per cent
elementary	17	34	21	42
vocational	14	28	11	22
secondary school	13	26	11	22
higher school	6	12	7	14
Total	50	100	50	100

The educational level of the fathers did not differ in the two compared groups. The null hypothesis, that the two populations have the same distribution, can be accepted at the significance level [$X^2 = 1.03 < X^2$ (0.05,3) = 7.815].

156

Follow-up studies

The first follow-up studies were carried out in 1979 using similar techniques as those that had been used ten years earlier; 41 dyslexics (82%) were still available and 50 persons in the control group (100%). The mean age of the dyslexics was 21;2 years and 20;8 years in the control group.

The follow-up studies were completed in 1989. The individuals were asked to fill in a questionnaire which consisted of eighteen closed and two open questions. The questions referred to their interests, actual personal, financial and professional situation and an evaluation of their time in school.

Twenty-eight former dyslexics and thirty-two from the control group answered the questions of the questionnaire.

Children of dyslexics

The latest studies were carried out in 1993/94. There was an appropriate selection of the group. They were children of dyslectic mothers or fathers who were diagnosed in 1969. Children from II to IV grade of the normal elementary school were taken into the investigation. It included 22 children from 18 families with mother or father dyslexic.

Table 7;4. Dyslectic parents of investigated children

Category		Children investigated
dyslectic father	dyslectic mother	
15	3	22

Table 7;5. Sex and mean age of the children

Sex	Number	Percentage	Mean age
Female	6	27	
Male	16	73	8,9
Total	22	100	8,9

The ratio of boys to girls was 2.67

Table 7;6. Children of dyslectic parents. Stage of education

Primary school grade	Number of children
II	12
III	6
IV	4
Total	22

The children of a dyslectic mother or father were assessed with the same reading test and written texts as their parents twenty-five years ago. The same formula was used for estimating the ratio of errors, in percent.

RESULTS

The epidemiological study carried out in 1969 showed that the incidence of dyslexia in the population of eleven year old children, the pupils of fourth grade in elementary school, was 13.1 percent. The results of reading and writing assessment from the first investigation in 1969 and the follow-up in 1979 are presented in the Tables 7;7, 7;8, 7;9, 7;10.

Table 7;7. Reading speed. First investigation 1969

	Speed level	Number of person
I grade	70 phone/min	5
II grade	159 phone/min	30
III grade	261 phone/min	15
IV grade	306 phone/min	0
Total		50

All investigated children read below IVth grade level.

Table 7;8. Reading speed. Follow-up studies 1979

	Speed level	Number of person
I grade	70 phone/min	0
II grade	159 phone/min	2
III grade	261 phone/min	6
IV grade	308 phone/min	6
V grade	349 phone/min	12
VI grade	386 phone/min	10
VII grade	416 phone/min	5
Total		41

The follow-up studies proved that 36 persons still had difficulties in reading speed; only 5 persons read at a normal speed level.

Table 7;9. Number of errors in the written text. First investigation 1969

Kind of written text	No of written signs	No of errors	Rate of errors in per cent	No of persons
hearing	244	903	8,4	50
pattern	379	409	2,2	
memory	116	405	8,1	
	739	1716		50

50 children made 1716 errors from the 739 total written signs inclu-
ded in three written patterns. The majority of errors were made in
the text from hearing (dictation).

Table 7;10. Number of errors in the written text. Follow-up studies
1979

Kind of written text	No of written signs	No of errors	Rate of errors in per cent	No of persons
hearing	244	503	5.0	41
pattern	379	21	0.14	
memory	116	165	2.0	
	739	689		41

After ten years, 41 persons made 689 errors for, in total, 739 written
signs included in three written patterns. The rate of errors made in
the written text from hearing was 5.0. The null hypothesis, that the
same population made the same number of errors in the written
texts after ten years, can be rejected at the significance level [$X^2 =$
$153.4 > X^2$ $(0.05,2) = 5.991$]. The hearing errors maintained their
relatively persistent character. They constituted 52% in the group in
1969 and 73% in 1979.

The differences in school achievement between dyslexics and the
individuals from the control group are presented in Table 7;11.

Table 7;11. School achievement level

Category of education	Dyslectic group frequency	per cent	Control group frequency	per cent
elementary	15	30	2	4
vocational	28	56	11	28
secondary school	6	12	19	38
students	1	2	15	30
Total	50	100	50	100

30% of the dyslexics had completed only primary school level in contrast to 4% in the control group. 15 persons in the control group (30%) have undertaken higher studies, but only one person from the dyslectic group. The null hypothesis, that the two compared groups have the same distribution in educational level, can be rejected at the significance level [X^2 = 32.29> X^2 (0.05,2) 5.991].

Neurotic disorders and some personality features

The earliest study carried out in 1969 had shown that a majority of the dyslectic children displayed neurotic symptoms (78% versus 12% in the control group). School phobia dominated among the dyslectic children whereas mono-symptomatic neuroses were more common in the control group.

The follow-up studies revealed that 49% of the dyslexics still showed neurotic symptoms connected with a fixed attitude of anxiety. In the control group we found 9% with neurotic symptoms still prevailing.

The Catell Personality Inventory showed some characteristic features of the dyslexics' personality:

- high level of anxiety and fear
- feelings of inferiority
- lack of independence in making decision
- difficulties in making social contacts.

The last studies in 1989

The 1989 studies had an inventory character and dealt with the dyslexics' present professional and social position, and an evaluation of their present life.

Twenty-eight former dyslexics, twenty-two men and six women, answered the questions included in the questionnaire. Thirty-two persons, twenty men and twelve women, from the control group took part in the investigation.

Only answers characteristic of the former dyslexics' live were comsidered.

Nobody from the dyslectic group occupied an "important" professional position and nobody took an active part in social life, compared to the majority of the control group who had reached an independent professional position. All dyslexics regarded their school-years as the most difficult time in their life, compared to the control group who remembered this period as joyful. A majority of the dyslexics thought that they did not realise their ambitions and plans made in childhood; they did not achieve satisfaction from their professional work.

The dyslexics had a limited range of interest. They did not experience any intellectual needs. All dyslectic persons who answered the questionnaire had got married. They estimated their marriage as a happy one. A problem which exists in all families is a difficult financial situation. Their families were characterised by a nuclear structure, contact within the family was very closed. The men found in this union satisfaction as responsible and important persons. The former dyslectic women took up a subordinate role in the couple. They found their satisfaction as good housewives, mothers and sexual partners.

Children of dyslectic parents[3]

The group investigated consisted of twenty-two children of dyslectic parents, fifteen fathers and three mothers, who were included in the longitudinal studies.

Estimations of written errors were made with the same patterns which were used twenty-five years ago. The written texts produced by the twenty-two investigated children showed that twenty-one of them (91%) had difficulties with correct writing from a pattern, and from memory, but mainly from hearing. The ratio of hearing errors made by children in second grade was 23.5%, in third grade 13.9%, and in fourth grade 8.6%. The errors were characteristic for children with specific writing disorders, i. e., the pupils from the lower

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3 Participant in the examination was Anna Olszewska, M.A.

grades mainly had difficulties with distinguishing phonemes, and the older pupils had difficulties with spelling.

Reading achievement was measured by the same tests which were used twenty-five years ago. The results showed that the reading skills of twelve of the students were one to two years lower than expected according to their age.

The studies carried out among the children with dyslectic parents showed that writing skills are substantially poorer than normal. Only one child's writing abilities corresponded to his age. Reading skills were lower than normal in twelve children (55%) in the investigated group.

DISCUSSION

The first investigation carried out in 1969 showed that incidence of dyslexia in the population of eighteen-year old pupils was 13.1%. This result approximated findings obtained by other authors at that time.

Longitudinal studies have shown that the natural development of dyslectic children had taken a different course than that in the control group. These differences came to light in their educational achievement and their social status. The children in the two compared groups started their school career with similar backgrounds. Family structure, social and financial status, parents' educational level, were similar in the two compared groups. The intellectual abilities of the dyslexics did not really differ from the non-dyslectics compared. So, there rose the question: what cause determined the differences in fate of dyslectic children?

It seems that two factors play an important role:
- general learning disabilities caused by reading and writing disorders and a lack of support in the school milieu,
- emotional disturbances associated with these difficulties.

The follow-up studies confirmed the initial assumption that reading and writing disorders had a relatively persistent character. These persistent difficulties influenced the school events. Poor re-

sults in elementary school reduced the dyslexics' chance for further education. In the light of these facts it is evident that a majority of the dyslexics finished their education in primary school. That fact limited their chance for higher professional education and a higher social position.

The school life of dyslexics, who were included in my research, was difficult at the beginning, because at that time the problem of dyslexia was nearly unknown in this country, as well as in the pedagogical context.

The school results of the dyslexics were always poorer than those of their peers without reading and writing disorders, in spite of the time they spent on learning. The bad results in school achievement stopped them from obtaining a good position in the peer group. They could not inspire respect in peers. In consequence, they were rejected by them. This was one of the important factors which caused their lower self-estimation.

Parents who could not understand their child's learning difficulties were disappointed in their ambitions and expectations connected with the child. Their not-accepting attitude towards the child deepened his emotional difficulties. This difficult emotional situation initiated a neurotic defence mechanism.

Childhood and adolescence of most of the dyslexics were accompanied by neuroses with anxiety predominating in the clinical picture. Primary fear of school triggered a mechanism of fixation and a generalised phobic attitude towards all situations in life. Anxiety had a decisive influence on the formation of some personality features. Their personality had been created under psychologically difficult circumstances in which their psychological needs were chronically dissatisfied. Matejcek (1994) defined this situation as a risk of psychological sub-deprivation.

In the latest studies carried out in 1994 I wanted to confirm the hypothesis that children of dyslectic parents constitute a risk group of dyslexia.

The problem of family occurrence of dyslexia was signalled in the first consideration on dyslexia by Hinshelwood (1896). Since the early fifties researches on etiology of dyslexia have been centered on the genetic investigation (Hallgren,1950).

Only one child out of twenty-two investigated did not have any difficulties in writing, and ten children had no problems in reading. The rest of the investigated children showed specific difficulties in reading and writing which were indicated in written texts and reading tests, according to their level of age (grade).

My preliminary study suggests that children of a dyslectic father or mother constitute a risk group of dyslexia. This statement has an important value for educational and psycho-medical intervention.

A prevention programme for children in a risk group of dyslexia might give them possibilities of normal intellectual, social and emotional development. How important it is, can be seen in a re-view of the longitudinal studies.

A prevention programme for children from a risk group of dyslexia

The main aim of this prevention programme would be not only to give the children the chance of better education but also to prevent them from emotional disturbances as well.

The programme includes the following:
- psycho-educational training for the parents
- special training for the dyslectic children
- psychotherapeutic treatment for the child and his family
- special training for a teaching team.

The special educational training for children from a risk group of dyslexia should begin before the children enter primary school. It is obvious that the parents have to be included into this prevention process. Astonishing was the fact, shown in my investigations, that dyslectic parents did not notice their children's difficulties which were the same as those they used to have at the beginning of their school years.

This statement determines the first point of the prevention pro-gramme. The parents are included into the psycho-educational training which gives them basic knowledge about specific reading

and writing disorders and prepares them for helping their child overcoming the first failures at school.

A dyslectic child, because of his vulnerability, needs his parents' acceptance and emotional support during his whole school time. So, the next step in the psycho-educational training would be to give the parents knowledge of how to meet the psychological needs of the vulnerable child.

As is well known, dyslectic children usually show disharmony in developmental functions, mainly in speech and psycho-motor skills. Therefore,
- basic polysensoric stimulation by visual and auditory stimuli precedes speech and motor skills training,
- speech training and motor skill stimulation are adapted to the child's potential. It mainly consists of structural play.

We observed good results with the Bon Départ method adjusted to dyslectic children (Jaklewicz, Bogdanowicz, Loebl, 1973, Bogdanowicz, 1975). This method is designed to train co-ordination of psycho-motor functions. The therapeutic sessions are conducted with children in groups. This aspect of Bon Départ is very important. A child learns how to work with others and, thus, acquires the first social experiences.

The emotional disturbances linked with the first failure at school have an important influence on the future life of dyslexics. Therefore, the psychotherapeutic support is very essential in the prevention programme for the child and his family. Psychotherapy should include:
- individual therapy
- therapy in group
- family therapy

The teaching team at school plays a basic role in the dyslectic child's conduct. Therefore, the teaching personnel is made part of in the programme. They participate in special training for teachers. Such training improves not only their abilities in special teaching methods for dyslectics but especially their psychological knowledge about the emotional and social problems of dyslectic children.

The prevention programme for children from the risk group of dyslexia is adapted to the situation and circumstances in which the child exists, but it always has to include the child, his parents, and the teaching team.

The state educational system, naturally, influences the future education of the dyslectics. It is very important that they are given some privileges. The school authorities should be informed about the prevention programme and its effects; they should also be made aware of the urgent need for such preventive measures to be taken.

During the last years, educational laws have been changed, to such extent that they might facilitate dyslectics' entering secondary school. Studies carried out between 1990-1994 (Wszeborowska, 1995) in the same region showed that dyslectic individuals who started secondary school are able to obtain satisfactory results. And, what is more important, they did not show the same anxiety as a characteristic feature of the personality, which I discovered in my studies.

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.167

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169

Chapter VIII

READING DISABILITY AND ITS TREAT-MENT

Mogens Jansen

Introduction

This chapter outlines how - in all probability - different groups of disabled readers can be observed and what may cause the reading handicap of the individual. After a comment on each of the mentioned groups some *possible* educational suggestions are put forward which will, no doubt, be adjusted in practice to the general and specific educational traditions of the individual country.

There are many terms

For the last hundred years it has been known that a few persons, who were otherwise well-functioning as regards learning, had very great difficulties in learning to read. Others had to work disproportionately hard to reach even a fairly acceptable reading level, viz. the disabled readers and the most heavily reading handicapped among the reading retarded. However, gradually both educators and researchers have become aware that also other persons than the specifically severely disabled readers do not live up to their reading potentials - even if they may read relatively well.

Different researchers and educators have used different terms to describe disabled readers, for instance "word-blind", "dyslexics", "reading retarded", "weak readers" and "functional illiterates".

Add to this the group of very severely reading disabled persons who must be characterized by neurologically conditioned difficulties as for instance alexia. Incidentally, the term "alexia" does not cover the same condition in different countries and is largely out-

side the scope of this chapter which takes education as its starting point.

Levels of reading development

And *reading researchers* with otherwise very different angles of approach often agree that reading develops through characteristically different developmental levels.

In the reading development of, by far, the majority of pupils there seems to be a developmental pattern: levels A, B+C and D (Figure 8;1; cf. also later).
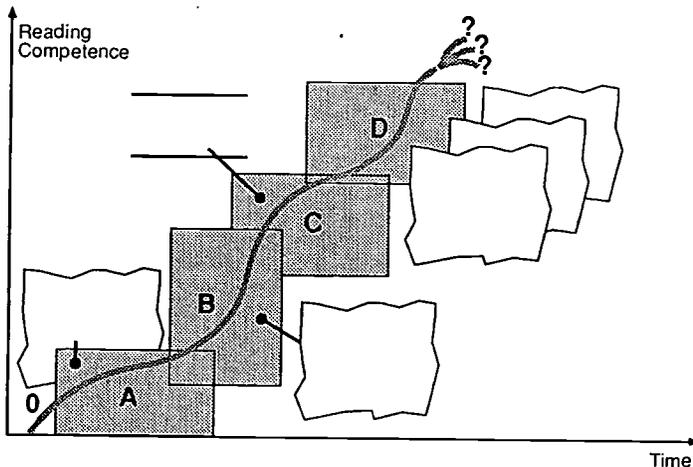

Fig 8;1.

At 0   picture books, rhymes, jingles, stories and reading aloud are essential elements.

At A   very easy books, pictures with very simple texts and small stories are essential. The instruction calls for 'inspiration', systematics, and time.

At **B** the central texts are children's books of fiction - very easy and specially adapted children's books as well as new and classic children's books appealing to the individual pupil. The instruction must involve many "reading materials" providing rich experiences. Above all, the books must be accessible to the individual pupil.

At **C** it is essential that the books build up concepts, that children's books of fiction do not aim below the pupils age, and that accessible books of non-fiction are abundantly available.

The pre-comprehension is central.

The *purpose* of the reading must be considered - and different ways of reading must be introduced; this also makes demands on the books of non-fiction (and on the instruction!).

At **D** many different kind of books are read. The purpose are still experience and knowledge. The reading is varied. Reading functions fully in the everyday life.

The three boxes indicate a dictionary, an engaged text of non-fiction - balancing between fiction and non-fiction - and a book of fiction - which might be by Karen Blixen, Selma Lagerlöf, or Alexander Killand - to mention three Scandinavian writers of fiction.

The rate at which the reading development proceeds (from level A towards level D) varies greatly. As far as the reading disabled persons are concerned, the reading development is often very slow indeed, and some of the disabled readers do not get very far into the reading development. However, the reading levels apply to everybody. Some do not get past level B, others (the illiterates) remain at level A.

When the disabled readers get past level A and B+C, they will no longer be characterized as reading handicapped. Therefore, level D and levels above D (abt. 15 years) are not mentioned in this chapter.

Figure 8;2 Hansen, Thomsen and Varming, (1993) aims to illustrate the levels of the reading development as seen by seven reading researchers; this grouping is applied officially in Denmark (Pagaard et al, 1995) mainly inspired by reading researchers such as Jeanne S. Chall, Ingvar Lundberg, and Mogens Jansen.
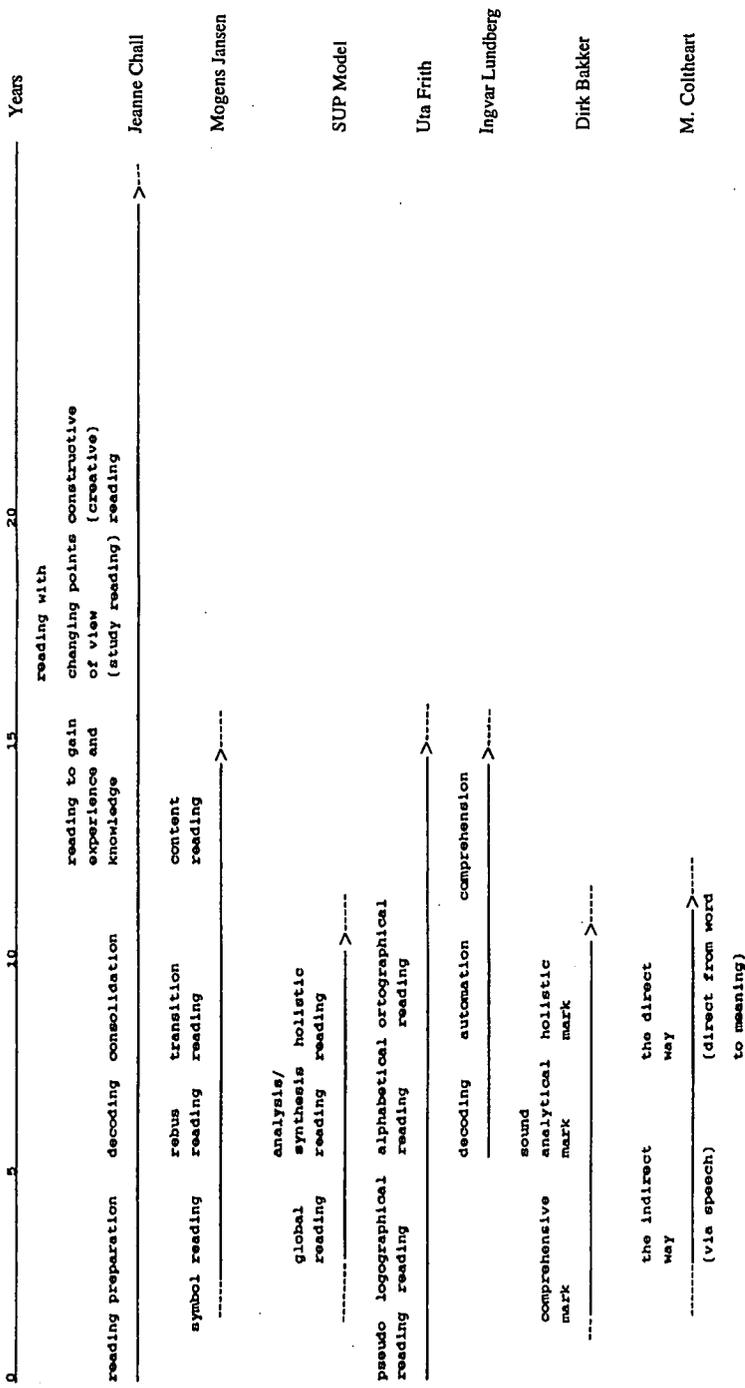
172

Years

0   5   10   15   20

Jeanne Chall

reading preparation   decoding consolidation   reading to gain experience and knowledge   reading with changing points of view (study reading)   constructive (creative) reading

Mogens Jansen

symbol reading   rebus reading   transition reading   content reading

global reading   analysis/ synthesis reading   holistic reading

SUP Model

Uta Frith

pseudo reading   logographical reading   alphabetical reading   ortographical reading

decoding   automation   comprehension

Ingvar Lundberg

comprehensive mark   sound analytical mark   holistic mark

Dirk Bakker

the indirect way (via speech)   the direct way (direct from word to meaning)

M. Coltheart

Fig 8:2 Levels of Reading Development

173

It should be pointed out that a clear distinction between A, B, C, and D is not possible. Also, the education must constantly be adjusted to the present reading competence, the different teaching materials available, and, not least, the local educational tradition which cannot be altered from one year to another.

The first one of these levels (abt. 0-5 years) is a reading preparatory phase. The researchers' names for this phase differ, but none of them doubt *that* it exists, *that* it has a number of specific characteristics, and *that* it is of *more or less* the same extent: This "phase of decoding", "the analytical-synthetic reading" (also other names are used) corresponds to level A in Figure 8;1.

"The phase of consolidation", "the phase of automation", "the phase of transition" (abt. 10-15), is the next stage in the reading development. In Figure 8;1, it corresponds to B and C. Often educators will, *from their daily practical experience*, point at two different 'levels' during this period.

Some will put B and C together into one "level". But at level B the work involves a very high degree of easy reading, mainly fiction, the contents of which can be understood spontaneously from the prerequisites of the individual reader.

Even *seemingly* simple fairy tales like Hans Christian Andersen's "The Princess on the Pea" or "The Tinder-Box" can be read, experienced and understood at fairly many levels. It is at level B that Astrid Lindgren, E.B. White, and Jules Verne often captivate the readers.

"Word-blind", dyslexics

The vocable "word-blind" (= "dyslexic") is a widely used term in Scandinavia. Here "word-blind" has gradually become an accepted term in the everyday life on par with handicaps like "severely hard-of-hearing" or "extremely weak-sighted". By way of example, it is becoming socially accepted to go to the post office or other large public institutions, present a "word-blind card" issued by the private association of the word-blind themselves, and obtain assistance to complete forms. Figure 8;3 shows the international version of the Danish word-blind card. There is a similar Norwegian and a

less widely used English word-blind card. To get help in Denmark, it normally suffices to *mention* that one is word-blind.
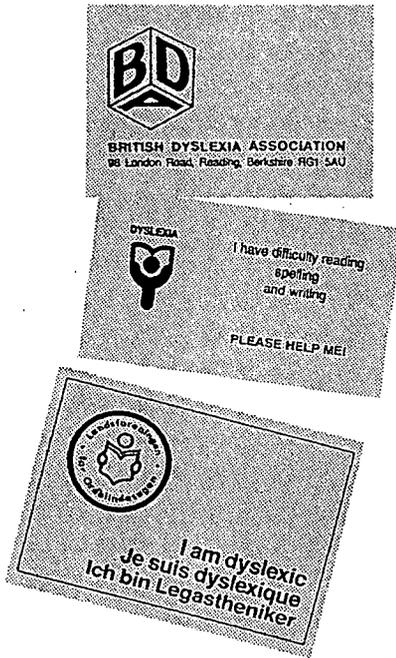

Fig 8;3.

In other words, the term "word-blind" covers a wider area than the professional use of the word "dyslexic".

As a rule, the word-blind (= the dyslexic person) can be characterized as having a quite normal function in many fields - e.g. seeing and hearing like everybody else. The verbal memory is often weak, and as regards the auditive perception it is seen to be quite difficult for the person in question to distinguish between closely related speech sounds, especially when several people are talking at the same time, making the speech sounds unclear.

In most cases, word-blindness/dyslexia is hereditary, affecting approx. four times as many boys as girls. The expectations of the close family can be a strain; a sentence like the following "the boy is probably word-blind like his father" is often heard - much more often than "the girl ..." or "... like his mother".

It belongs to the picture that dyslexia can be such a considerable strain on a person that he or she reacts "inappropriately", negati-

vely, on demands for reading. See Figure 8;4 which, incidentally, seems to illustrate a negative development known within largely all groups of reading handicapped - all teachers will know it as "the vicious spiral", fewer teachers will know 'the good spiral' which ought to be almost as frequent.
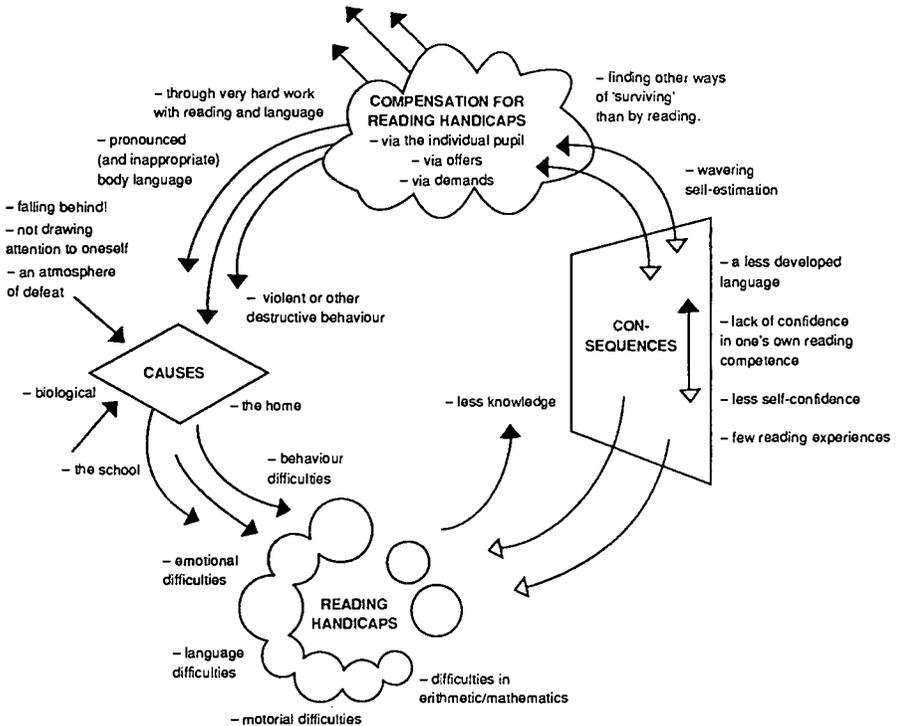

Fig 8;4.

In most cases, it is not possible to diagnose dyslexia, until the pupil has had reading instruction for e.g., 6 months or one year. In the course of schooling the distance to his/her peers will increase as far as reading is concerned.

However, the point at which it is possible to make a diagnosis, sufficiently precise to say "The child is dyslexic", also depends on the demands of the relevant school system as to pupil age, curriculum, materials applied, teacher and parent expectations (and, not least, pupil expectations).

176

One cannot dismiss the fact that the expectations from one generation to the next are strong and may occasionally increase the genetic aspects. It is generally accepted by the vast majority of researchers and teachers that hereditary factors cannot be left out of account.

However, in a know-how-based and meritocratically functioning society it is the difficulty in reading which is the predominant problem.

Education of the word-blind, the dyslexics

The word-blind will remain reading disabled throughout life; therefore the person concerned must *learn to compensate* for the handicap, and this must be reflected in the daily education. Naturally, the word-blind child (or the word-blind young or adult who received an insufficient education during childhood) can be taught with positive results, as long as there are no expectations that the word-blind will learn to read as well as everybody else.

The starting point of all education of word-blind individuals is that the surroundings must be aware that the person in question needs a great deal of support and that the expectations should be adjusted to the prior conditions of the individual pupil. Incidentally, this applies largely to all education: the expectations of parents, teachers, the whole environment, play an important role (cf. e.g., Mejding, 1994).

All the following descriptions of proposals for education of reading handicapped build mainly on Northern traditions of education. It goes without saying that such descriptions, which are merely examples of constant development - and constant adjustment - of the education of reading handicapped, cannot be "documented" as is the tradition in reading *research*.

The reading retarded

The reading difficulties which the reading retarded person faces can hardly be explained as determined by hereditary factors - at least in rare cases only and mostly in connection with a *slow* lin-

guistic development: often indistinct speech is characteristic. Often, although not always, there have been problems during pregnancy, complications during delivery, and perhaps serious illness during the first years of life.

In practice, reading retardation covers two quite *different* 'subgroups' of pupils. For both groups, the first difficulties to appear are almost exclusively linguistic.

However, as this handicap, as far as the first-mentioned group is concerned, is remedied in school by means of an appropriate education which is both compensating and developing, the reading retarded pupil will largely become able to keep up with the rest of the class.

The energy and "the educational perseverance" that this reading retarded pupil has to muster in order to surpass the handicap must often be continued in both middle range training and higher education; in these cases the prognosis is good. The educational possibilities are quite favourable. Still, it is certainly *not* ordinary for a reading retarded person to become a librarian or enter into a similar education which requires comprehensive and precise reading!

Previously it was not altogether uncommon for a reading retarded person to take, e.g., a law degree. There was much to be read in such a study, but very *precise* reading - and a well-trained memory! - helped a great deal.

As information technology develops, quite a few reading retarded persons enter into an education that encompasses information technology in a wider sense. Also in this field there are demands for a fairly precise reading which is occasionally, but not always, rather comprehensive and which requires engagement, diligence and precision in the daily work - things that this first group of reading retarded constantly practise. The *indirect* help that e.g. computers can give to the user, the data operator, is a great support to the reading retarded.

Another group of reading retarded gradually become so pressed by the demands made upon them early in school that they also lose the desire for reading.

This group of reading retarded young people can often be characterized in that they have become "sad", sometimes even defeatist, when faced with difficulties in school. They experience that their reading competence fails to develop at the rate and to the ex-

178

tent which is expected - too optimistically - by the surroundings, and which the reading retarded herself or himself really wants - because "I know I can do it, if only ...". In the first place the responsibility is then placed with the surroundings; gradually this group of reading retarded experience that it is 'their own fault'.

As far as this issue is concerned, the reading retarded form a contrast to the dyslexics whose handicap is acknowledged (both by the pupils themselves and by their surroundings), as the pupils grow older.

Education of the reading retarded

For both groups of reading retarded it is a characteristic feature that they have difficulty in decoding at - perhaps - all linguistic levels, or, in any event, at the initial levels. The imprecise spoken language presents an additional strain.

For largely *all* pupils the first school years are extremely important to their later schooling. But particularly for the linguistically rather late-developed reading retarded pupils the reading education of the first school years is of paramount importance. Here both dyslexics and reading retarded are afflicted. But the latter group is hit hardest, because their difficulties are often seen as 'scamped work' - "they ought to pull themselves together".

When viewing the difficulties of the reading retarded in relation to age standards (expressed by grades) it leaps to the eye that the linguistic development of these pupils is generally delayed in comparison with the rest of the class. Persons working with education of reading retarded emphasize that exactly this is a general condition. Others mention that not altogether seldom also one or more isolated malfunctions can be observed; by way of example, various perceptual and motor functions as well as behavior and emotional functions (cf. Figure 8;4), may be specifically strained. Especially the two last-mentioned factors are often connected with the previous education of the reading retarded persons concerned.

However, particularly the verbal memory and the auditive perception of the reading retarded are often poor. In many cases, their visual and spatial perception could decidedly be better.

The handicap "reading retardation" can hardly be observed until the first or second year in school. However, the question of how soon it can be diagnosed depends, to a certain extent, on the same factors as apply to dyslexic pupils:

- How does the teacher *teach* during the first years of education?
- Are these pupils and their difficulties taken into due consideration? If so: How?
- How do the pupil's surroundings react?
- How does the pupil react?

(Magnusson & Nauclér, 1989).

The weak readers

The handicap of the weak reader can hardly be explained from specific hereditary factors. With some reluctance, the classroom teacher, perhaps the psychologist, may mention the possibility of an intellectually straining (social) inheritance. In these cases, it may be a question of a general intellectual retardation, or a certain intellectual weakness. Often a family tradition of a very weak 'social ambition' is seen. Quite often, psycho-social problems are seen, fairly often physical illnesses and in rare cases mental disorders.

As *one* of several consequences of the 'weak reading', emotional difficulties and psychiatric malfunctions may occur.

The reading difficulties are very often seen as *comprehension difficulties;* the pupil can often be characterized as "lagging a few years - or more - behind his or her peers", also in other subjects than reading, especially when it comes to comprehension of the read material - and also in mathematics and other subjects building on vocables and concepts that are complex and difficult to understand.

If the person is motivated to read a lot, the reading disability can be overcome, but only to some degree and especially if the reading matter is conceptually accessible. In some instances, the reading disability appears to be surmounted completely - at least on a

superficial level. In all events, also in these cases the environment seems to be essential.

Often the visual and spatial as well as the auditory perception are normal. Generally, we know too little as regards the verbal memory. In some cases, a diagnosis can be arrived at in grade 2. At later stages during schooling the problems generally appear to be more distinct - especially in connection with school work involving reading which calls for knowledge of certain concepts. This reader often has problems with (especially) reading in the content area.

Education of the weak readers

As will appear from the above, the weak readers often have difficulty in getting past level B in their reading development (cf. Figure 8;1). They seldom master level C.

Functional illiterates

Originally, the description *functional illiteracy* was used by UNESCO to characterize that although these persons *had* learned to read, some of them used their reading to such a limited degree that 'the reading function' either did not develop into a utility level - or simply 'disintegrated' (Dalby et al., 1983). In these instances, no previous disorders are established and the reading handicap could hardly be a matter of heredity. But the fact that neither the surroundings, nor the family, nor the classmates showed an interest in reading was an essential negatively motivating factor (van Peer, 1991).

The mental functions of the functional illiterates are normal, although, of course, in many of the persons concerned frustrations can be observed as a reaction to the reading handicap - which is, at least during the youth, experienced as extremely distressing. Verbal memory as well as auditory, visual, and spatial perception and sensory functions are all quite normal.

Expressed very briefly, lack of stimulation and support in the nearest environment is very distinct in these cases. When the diag-

nosis *functional illiteracy* is made, it is often impossible to disregard the non-existent (or at best modest) support from the environment. However, in some cases the engagement of the home in the reading of the child is considerable - and still the reading competence is weak and the utility reading poor (Jansen et al., 1993; Chall, 1995; Chall, Jacobs & Baldwin, 1990; Chall & Snow, 1987).

In some countries, e.g. in Scandinavia, a fairly marked flow of refugees (in certain cases immigrants) from countries where particularly groups of women and elderly people include quite a few practically illiterate people, has accelerated the problem of functional illiteracy. An attitude which is common in *some* of these groups (though certainly not all) is still a limited acceptance of young girls and women using their reading at home or elsewhere, for that matter (Jansen & Østergaard, 1993).

In the course of the latest decades, a new group of functional illiterates have become more and more visible in some countries, viz. the second generation immigrants. In some (few) cases they can be characterized by a lack of attachment to their parents' culture and, at the same time, by a modest degree of identification with the culture of the country in which they and their parents now live. Such conditions almost unavoidably lead to problems of both a social and educational nature, and they often become functional illiterates.

It is a characteristic feature that for persons in this group the reading competence does not function - or functions only poorly - in relation to the demands of the everyday life. Gradually problems crop up in connection with reading in the content area and other reading requiring knowledge of particular concepts, as well as in connection with utility reading.

Occasionally, some pupils can be characterized as functional illiterates even if they have functioned well in many areas and are still functioning quite well. However, their reading is often described as 'external' or 'shell-like'. This phenomenon is probably due to the fact that their pre-comprehension is too inferior to support an acquisition of the contents of more sophisticated texts. And the more diversified the texts to be read - above all non-fiction texts - the more difficult it is for the individual "to read with comprehension". It is not possible to arrive at a diagnosis till grade 4, i.e., *at the earliest* when the pupil is *abt.* 11 years old.

Education of functional illiterates

It is characteristic that, at least at the beginning, they come to a standstill at level C, cf. Figure 8;1. And quite often they do not proceed with literature *relevant to their age group* at level B.

"I don't read so much any more. In fact, I almost don't read at all," is a common remark when teachers plan to arrange education for these pupils. So far the school has not been a great help and ought to assume responsibility for a large part of the functional illiteracy. However, many of the functional illiterates experience that it is mainly 'their own fault'.

In all events, the functional illiterates *must* be encouraged to read *a lot*, especially books of non-fiction. Their surroundings (family, friends, and colleagues) must learn that a 'functional illiterate' does have the possibility of becoming largely as good a reader as everybody else - it only takes a lot of reading (= practice).

In these cases, some teachers put control questions to the read material. Generally, it is much more necessary to use reading matter (= books, weeklies, papers, specialist literature, etc.) which the functional illiterates themselves find meaningful or perhaps even interesting to read.

This is a well-known phenomenon in countries with a know-how-based trade and industry like the U.S., France, United Kingdom, and Scandinavia. Torsten Husén's expression - that the years of youth seem to be a national disaster (Husén, 1989) - is both appropriate and frightening.

Alternative theories and their educational consequences

Hardly anybody teaching disabled readers or any researcher who has approached this subject has been able to avoid *alternative* theories. These are often extremely 'alternative'.

From time to time such theories emerge. They are often mentioned, not least in dailies and weeklies with regular reports of "the positive story from the everyday life" and viciously characterized by the attentive reader as descriptions of "the happy cripple of the day (or week)". A few days after such a charming little story, teachers or researchers usually question the alternative theories

and their educational consequences; they tend to disappear automatically - and crop up again a few decades later in some other connection. In their wake, miraculous cures sometimes appear - some only apparently credible, others obviously bizarre.

However, the fact that reading handicaps are invisible handicaps suggests that 'something can be done' for these people. They just need some minerals, or vitamins, or magic passes - or special sound treatments with electronic music - or they must drink more water, consume mountains of butter, use special sunglasses - or whatever.

For the researcher it is impossible to reject such theories on the basis of serious research involving a considerable amount of time and work. *On the other hand, it is not incumbent on the researcher to prove that one alternative theory or another is not valid. The burden of proof lies with the person who presents the theory* - whether serious or alternative.

As long as the reading disabled person is not directly strained by a miraculous cure, the parents, or, in the case of an adult, the person herself or himself must decide *whether* a miraculous cure should be tried. However, it is always the duty of the educator to inform about what is known concerning such miraculous cures.

Furthermore, it is the duty of the educator to receive the pupil well on his or her return to the ordinary education - probably in an even more depressed state than before because now the reading handicapped has suffered *yet another* defeat.

It is impossible to comment on but a fraction of the 'alternative' theories, that have seen the light of day, and even more impracticable to take an educational position on all the suggestions for relief of reading handicaps that have been put forward. There will be more such theories coming - in every country.

For this reason, an alternative angle of approach for treating reading handicaps is merely mentioned here. Neither research problems in connection with reading handicaps, nor educational problems which might be caused by these theories are described.

Silver (1987) sums up a number of the most common miraculous cures, cf. "A Review of the Current Controversial Approaches for Treating Learning Disabilities" (cf. also Dalby et al., 1992).

Exactly in this century reading in most countries has changed dramatically - and the possibilities of the reading handicapped have been reduced

In many ways the extension of texts and their still more complex contents have changed during this century, especially when it comes to visual appearance. This again means a serious difficulty to the disabled reader.

As an example, in the course of just a hundred years, daily papers as well as weeklies and monthly magazines *seem to* have become far more visibly accessible than previously, also to others than the social group of good readers. The amount of pictures has increased, captions carry a larger part of the comprehension of the text in question. 'Boxes of facts', tables, and graphs must be read in the same way as ordinary text.

The structure of the pages of the dailies meets the requirements of the ordinary reader to be able to read the paper without mastering distinctly different reading techniques; the reader may skim the paper, scan some of the texts, look at the pictures, skip the pages of no interest, etc.

While previously only the very practised and good reader used to possess such a reading competence, most readers of today manage the different reading strategies, though still not exactly the reading handicapped who often read so poorly that they do not know what to skim or scan or skip, or what captions are essential, etc. (Jansen, 1991).

Today reading is far from being the only or the most essential source of experience and knowledge for everyone; and the reading of today has become more than reading of largely connected, most often fictional, text.

But reading is still taking place, and the disabled reader will still be interested in reading - as long as the failures in reading have not killed every motivation.

The good reader is fully aware that also books of fiction have changed. Reading used to be equal to reading of a text from the first to the last page. Often the type-print of the book was difficult to read. Now the front page of the book is most often an eye-catching illustration, and its layout aims to comply with the reading

competence of the various potential groups of readers. The back of the book is an appetizer in the form of a brief presentation, perhaps a summary of the book - though -when it comes to detective novels - naturally without revealing the plot!

The (no longer) new way of presenting also texts of fiction may be supportive to the disabled reader, though in most cases far from enough. The disabled reader - though now often attracted by the reader-friendly form of the books of fiction - is unable to read these books which are, in fact, still difficult.

However, especially the books of non-fiction have changed:
- they increase in number;
- they contain many pictures;
- the captions have become more important, and
- the books of non-fiction can be read in fragments according to the interest of the reader.

Often the reading handicapped cannot get started at all - and the defeat is total: The difficulties emerging in connection with reading of papers and weeklies multiply as concerns books of non-fiction.

Especially for the smaller language areas, this development of the reading matter has proved to be serious when it comes to both dailies, weeklies, and monthlies, to books of fiction and non-fiction - and to almost all other forms of printed text: The financially determined co-printing of books and specialist magazines controls the choice of pictures and thus greatly the contents.

It is more than a curiosity that, for instance, the Northern vikings can be found in a single comment, very discreetly placed in the corner of a page of a French book about - exactly the vikings.

In picture books and elementary texts it has become a common feature that motor-cars drive in the middle of the road in order to accommodate both countries with traffic on the right and countries with traffic on the left; this does not present a particular difficulty to the disabled reader; but all readers will find that such details - or essential elements in the book - render it less reliable than it ought to be.

However, in order to exploit a larger market (= be used by people in more countries speaking different languages) the

"characters" - mainly in books for young children - have often turned into animals who, incidentally, often address the reader in a condescending manner. They do not appear as persons of different colour, different hair style, different housing, etc., but exactly as animals that can be 'used' in almost any country - rather unimportant as they are in their markedly general neutral appearance.

The reading handicapped is able to abstract from e.g. green bears harvesting non-descript blue fruit and living in non-descript huts with a chimney. Mainly the older reading disabled children and the young disabled readers who (may) master the texts of these books look upon them as unpleasantly infantile (Jansen, 1990). Texts like that do not lead the reader on.

The subjects of other serious books of non-fiction meant for the somewhat older children and the young and adults offer - especially to persons from small language areas - a wider knowledge of the American Civil War or the activities of the Romans in England than of the culture of their own country which they know so well that when attacking a text they have a spontaneous pre-comprehension.

All this is essential to *all* readers, especially to the youngest. But to the reading handicapped it is assuming the dimensions of a catastrophe. Their pre-comprehension is not utilized. They are not skilled in applying different reading strategies - they cannot, as a matter of course, skim or scan a text, catch a word or a picture and go on exactly at the point where they *need* to go on. And when they are presented with texts like the above-mentioned, the result of such a reading education may very well prove negative.

The above-mentioned situation is seldom described in connection with reading handicapped within larger language areas like e.g. English, German, and French. However, the difficulties, with which the reading handicapped within larger language areas are faced in connection with texts of this nature, multiply when it comes to readers within small language areas. In particular, the described conditions are strenuous to the best functioning part of the reading retarded and to the functional illiterates; both these groups of readers are progressing fairly well - or they have the pre-requisites to get started well. However, they are brought to a stop in their reading development by texts building on pre-requisites which - as readers - they do not possess. Furthermore,

these texts are often structured in a way that differs from what is the custom within their own language area.

Reading and Disabled Readers in the future?

If someone would like to predict how things will become - how the future will be - there is every reason not to do so! We often remember the future so badly. However, we should not just "put up with the future"; it must be planned, and to a certain degree it *can* be planned (Kaufmann, 1974).

In this connection it should not be forgotten that reading development in the different countries *has been* and still *is* so different that it does not make much sense trying to predict some *common* features - not even for comparable countries within the North Western culture group in Europe.

By looking at the sketches in Figure 8;5 and seeing what has happened at least in the northern countries in Europe within the field of reading since 1950 the reader may at least be able to sketch some considerations for himself:

At that time (= in 1950) the general aim of reading instruction was to teach the children and the young to read relatively big and connected children's books, juvenile books, and adult books.

During the next decade (the 1960's) reading of a few big books (and extracts of these) was gradually supplemented with reading of several smaller books; to a certain extent, specialist literature entered the instruction.

In the course of the next decade (the 1970's) the teaching of reading was marked by reading of more books (and extracts from them), often smaller books, sometimes also special books, and not seldom books of non-fiction and journals (and extracts from these).

Often reading of photocopies was also reading of fragments of texts - often rather initiated and difficult reading matter. Reading of photocopies was clearly different from the reading of one complete and connected big book. Another thing is that also visually these copies were in many cases much poorer to read than the books. Also regarding contents, reading had now changed: from being reading of a long connected text, reading was now often reading of very short texts without any introductory comments,

and more often than not the conclusions were not among the pages of the books that were copied: "Read chapter 3, and pay special attention to the captions" could very well be a piece of homework - chapters 1, 2 and 4-11 simply not being accessible to the pupils!

At the same time, the children and the young had to be able to read both fiction and non-fiction - and, not least, a mixture of the two - just like during the previous decade; and still the big books of fiction stood on the shelf - and everybody expected them to be read, too. Such expectations still exist:

For reading has not changed *from* reading of one big book to reading of several smaller books - and further to reading of photo-copies.

At the end of the 1970s reading became the reading of 1 + 2 + 3 + ...? (See Fig 8;5.) Naturally, such reading matter had been known for a great many years, but now it became part of the everyday life and partly also of the reading education. In offices and associations and in public and private institutions a multitude of photocopies appeared during the following decade - and during the next years they spread to educational institutions.

If no education was established on the basis of the new require-ments, many less good readers had reading problems and the rea-ding handicapped had very grave problems: How could they learn to read in a number of difficult ways, e.g. skimming, scanning, rea-ding intensively, extensively, etc. How could they learn to read articles in weeklies, magazines, technical literature, and books of non-fiction when they were not *taught* how to distinguish between captions, texts, and legends in the letterpress?

The new and much larger reading demands resulted in more disabled readers among children as well as young and adults. Those who had previously been characterized as reading handi-capped were now described as such to a pronounced degree: Even the number of reading retarded who had previously been able to learn to read - and particularly the number of functional illiterates - has increased markedly since 1980 - in some contexts almost explosively.

Now eduction must build on the texts of everyday life, not on the textbooks that so rapidly become obsolete and do not appropriately introduce the reading education which is now necessary.
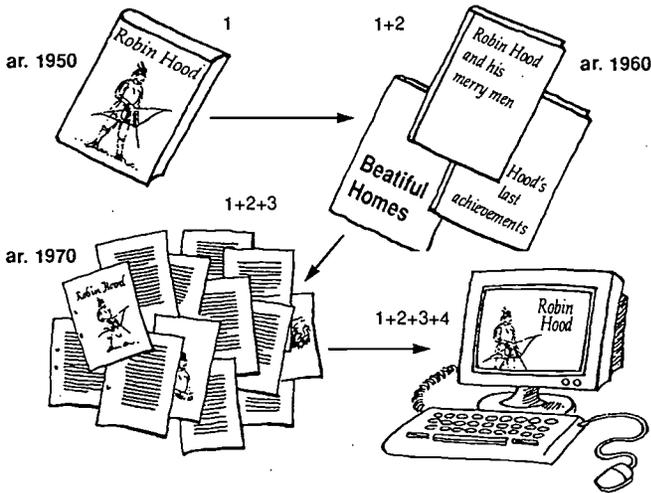
Fig 8;5.

During the last decades, the solid book, the traditional printed medium, has been supplemented with radically different media. Educational possibilities as e.g. computers and CD-ROM enter the picture.

This drawing dates back to 1985, and already ten years later it was obsolete; it was made prior to the CD-ROM and prior to what is going to replace the CD-ROM. The development within education - and reading - does not linger at the world of yesterday (Medieudvalget, Det danske Statsministerium, Betænkning nr. 1311, 1996), so why should reading requirements? So far, reading requirements have increased constantly, and the distance between reading education and reading requirements has grown.

The development of reading education (and reading research!) may focus on *processes* as well as on the products existing and arising within a framework, as, e.g., the classroom or the family - educational guides or sets of reading materials for the class.

'An ecological dimension' (Bronfenbrenner, 1980) can be inserted by pointing out the additional importance of relationships between "textbooks" (in a wider sense) which are also essential. Some of these "textbooks" are mentioned above, e.g. the family or the class-room; these are 'systems' including the individual child (Wanting, 1993; Seilmann, 1993).

'An ecological system' may also include an adjoining or surrounding system - e.g. the educational guide or the sets of materials used in the class just now. In some cases, such a surroun-ding system is central, that is to say, by determining what may (or may not) occur in the specific situation when the reading of the pupils is considered.

Systems like these may reach far beyond and - apparently - alto-gether away from the reading of the child; this is true of, e.g., the education and the occupation of the parents, the possibilities provi-ded by such background factors, and the demands made by them (Husén, 1989). If not, serious problems will crop up, especially for those of the young who are in some insufficient education or other:

The young have not *learned how to use reading*. "The education of the young is a catastrophical area" (a quotation from Husén, 1989), exactly because reading education has been insufficient ever since the years of childhood, perhaps even since the very first school years. Thus, the number of functional illiterates may very well become a social strain - and to a degree which only a few foresee.

The relations between society and school, between family and institutional structures, between TV and other media, etc. play an important part. Even if such systems may be far from what is understood by reading educational areas, their influence is not dis-continued. It may become more diffuse. Perhaps in some cases this influence is effective in an opaque manner through other systems, but it may very well still be there - and even be strong.

Concluding remarks

The aim of the chapter has been to place *reading* in 'something' that might be called *an ecological connection* - and exactly *seen especially from the possibilities of the reading handicapped.*

The purpose has been to illustrate the relations between some of the many factors influencing the reading matter, the reading education, the reading research in connection with different societies, primarily in order to describe reading as *the* dynamic factor within social development that *reading* also constitutes (Gates, 1968).

It is not only a question of new reading possibilities arising in the society - they also influence the society in which they arise and develop.

And *also today* each individual reading handicapped is entitled to a reading education that is just as adequate and appropriate as one or two generations ago.

Literature

The article builds mainly on Northern language literature as regards structuring of the groups who are reading disabled, especially on part III of a larger composite work about reading mentioned below, Dalby et al., 1992.

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196

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6/96)