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Reviewed work:

The Science of Reading: A Handbook. (2005). Margaret
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In assessing the relative contributions of cognitive psychology and applied linguistics to reading
research, Urquhart and Weir (1998) characterise the work of cognitive psychologists as
"a lot of data, obtained by well-established research methodologies and organised by means of
models, which not only make sense of the existing data but point to further areas of research" (p.
237). This statement could well serve as a succinct, if highly simplified, summary of the contents
of each chapter in *The Science of Reading: A Handbook*, a state-of-the-art overview of cognitive
psychological studies of reading. This densely-packed treasure trove of information about the
latest first language (L1) reading research is divided into seven sections: (1) fundamental
processes of word recognition in the brain, (2) learning to read and spell, (3) reading
comprehension, (4) disorders of reading and spelling, (5) reading in different languages, (6)
biological bases of reading, and (7) teaching reading. Each section is preceded by an editorial
comment and includes a number of chapters devoted to specific areas of investigation, covering
an impressive body of prior and current research. The author index forms a roll call of some of
the most eminent scholars and distinguished researchers in the psychology of reading, including
Max Coltheart, David C. Plaut, Linnea C. Ehri, Charles A. Perfetti, and the editors Margaret A.
Snowling and Charles Hulme, among many other notables.

The Science of Reading is a substantial work, with nearly 2,000 references, about a fifth of which
are post-2000, with a primary focus, it is acknowledged, on research into learning to read

English. It focuses on English because most reading research conducted so far has been in English-language settings. However, the growing number of studies on learning to read in different European languages as well as in Chinese, Hebrew, and other non-European orthographies are also reviewed.

Each chapter is arranged in a clear and logical format. It starts with a historical overview, including summaries of important findings, descriptions and definitions of key terms, models, and theories that have influenced the path of the most recent research. These are frequently followed by a discussion of findings on which there is a general consensus and others that are more controversial. The chapters then report on the most recent investigations, followed by a summary or conclusion that outlines the direction of on-going and projected areas of importance in the particular research area.

Reflecting the word- and pre-word basis of psychological research into L1 reading, the five early chapters deal with the fundamental question of how reading is accomplished in the mind as well as the current competing models of connectionism and dual-route processing. From an applied linguistic perspective, one of the most interesting aspects of these two models is that both conceptualise reading aloud as a process comprising two routes from orthography to phonology: a lexical and a non-lexical route. While the non-lexical route depends on an understanding of sound-symbol correspondences, the lexical route depends on a mental dictionary of automatically recognised words. It is not difficult to see how reading difficulties for learners of second language (L2) might be compounded by their deficiencies in either pathway, or hindered or enhanced by the pathways already established in their own mental architecture relating to reading in their L1. While word recognition and decoding are fundamental to all L1 psychological reading research, there has been little attention to this area in (L2) research (Koda, 2005, p. 37), partly due to an early emphasis on "top-down" views of reading in an additional language as well as the added complexity of such factors as the mature reader's previous reading background, experience, motivation, and linguistic and general aptitude. In order to help readers process L2 effectively, we need to develop a model of L2 reading that includes knowledge of how decoding takes place as well as the specific linguistic or processing difficulties. As Koda points out, there is a widespread erroneous belief that L2 reading comprehension skill improves as linguistic knowledge increases, yet L1 studies have shown that decoding abilities vary in beginning readers and that oral fluency does not necessarily translate into greater reading efficiency (p. 10). Indeed, the more psychologists discover about the complex interdependence of semantics, orthography and phonology in reading, the more astounding a feat learning to read in another language, or several other languages, appears.

While the early section of the handbook describes research into mental models of reading, the sections devoted to learning to read (six chapters), reading comprehension (three chapters), and reading in different languages (four chapters) stress the contribution of other factors, such as the nature of the individual learner, the environmental input, and the effect of training. The chapters which are most directly concerned with application of reading theory should be of great interest to applied linguists as well, as many of the findings raise questions that could be addressed in bilingual or L2 settings. Some areas of particular interest for L2 research are what the learner (L1 child reader) contributes, what makes a skilled reader, and how this knowledge can be used to

help those who are not succeeding in developing reading ability (e.g., Chapter 14, by Kate Nation, "Children's Reading Comprehension Difficulties").

The chapters by Ehri (Chapter 8, "Development of Sight Word Reading: Phases and Findings") and by Perfetti, Landi and Oakhill (Chapter 13, "The Acquisition of Reading Comprehension Skill"), among others, stress the importance of word identification and meaning retrieval as critical to the development of reading comprehension skills. Reference is made to the estimate that 90% of the words in a text must be known for comprehension to be effective (Nagy & Scott, 2000). The role of higher level factors (inferencing skills) is also thoroughly discussed in light of the experimental evidence so far, concerning factors which may correlate with reading comprehension skills. It is not difficult to see the relevance of this line of investigation to studies of L2 reading comprehension, especially given the re-emerging importance of vocabulary acquisition in L2 reading research. Thus, the section devoted to reading comprehension especially deserves close attention for anyone embarking on L2 reading research.

The section devoted to reading in different languages (Chapters 15 to 18) is also fascinating, as it highlights the role of orthographies. For example, English has a *deep* orthography, due to its lack of regularity and consistency compared to other European and non-European languages, which constitutes yet another source of difficulty in learning to read (see Chapter 15, by Ram Frost, "Orthographic Systems and Skilled Word Recognition Processes in Reading"). Some of the insights from this section include the fact that mismatches between assumptions about reading based on mastering the orthography of the L1 may also play a role in L2 reading difficulties, while phonological-orthographic regularities contribute greatly to facilitating reading different scripts.

The significance of the social setting in developing literacy is dealt with specifically in Chapter 10, "Social Correlates of Emergent Literacy" by Philips and Lonigan, which acknowledges the impact of socio-economic factors and home environment, particularly the crucial importance of parental interest and stimulation. Although the research reviewed is firmly rooted in an empirical scientific approach with a positivist orientation, throughout the many chapters of the handbook social factors affecting reading achievement are far from discounted. They are backed up with relevant study findings and the need expressed for more data and investigation relating to this important aspect of reading development.

A large section of the handbook (Chapters 19 to 23) reviews studies of dyslexia and other reading disorders, whether in English or other languages, among the deaf, those with genetic disorders such as Down syndrome and those who have suffered neurological damage. One of the most interesting outcomes from studies on dyslexia in different languages in this section is expressed by Caravalos as "the hope of relating reading problems in all languages to a universal impairment in phonological processing" (Chapter 18, "The Nature and Causes of Dyslexia in Different Languages," p. 355).

In what is perhaps the most purely scientific section of the handbook, "The Biological Bases of Reading," Chapters 24 and 25 are devoted to brain imaging and genetics of dyslexia. They review many fascinating studies involving families and twins and provide some evidence of genetic liability for reading difficulties, which it is hoped can be overcome by increasing

accurate reading practices through timely intervention. This point is described in the handbook's final two chapters. Chapter 26 ("Teaching Children to Read: What Do We Know about How to Do It?"), by Snow and Juel, is a particularly interesting one for applied linguists. It traces the history of reading curricula in North American schools, as they related to beliefs about the theoretical basis of learning to read. Based on what is now accepted as the "correct" model for reading acquisition, the "whole word" psycholinguistic guessing game model associated with Goodman has been discounted, in favour of decoding (phonics) along with reading for meaning. The authors conclude, based on the substantial body of research conducted in US and UK settings, that instruction in "small [phonological] units…is helpful for all children, harmful for none and crucial for some" (p. 518), although they also discuss how swings of the educational pendulum based on public opinion and political expediency have sometimes turned against such an approach.

The Science of Reading is a challenging text, particularly for those unfamiliar with the scientific basis for L1 reading research, but the effort of delving into its pages is well-repaid, especially for the sections related to learning to read and spell and reading in other languages. Every chapter is masterfully and clearly written, a source of endless information and thought-provoking research questions, which leaves the reader with unstinted admiration for the research so far accomplished. A clear and thorough glossary of terms is appended to the main text in addition to the exhaustive reference list mentioned above. Without a doubt, this handbook provides a benchmark for all L1 reading researchers and holds out an example for L2 reading research. To follow up the recommendation of Urquhart and Weir (1998, p. 240) that L2 reading researchers find out more about the work and methods of cognitive psychologists, this volume would make an excellent starting point.

References

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