Linguistics and Reading

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Much linguistic and psycholinguistic research has examined the structure and processing of spoken language. In this chapter, the focus changes to written language. The goal of the chapter is to review what is known about the processes involved in reading and in learning to read. How can skilled readers identify so many words so quickly? What is the best way to teach children to read and spell, and why do some otherwise normal children have such trouble learning to do so? Does knowledge of written language change people's basic intellectual or linguistic abilities? These and other questions will be addressed in the chapter.

Investigators from a variety of disciplines, including cognitive psychology, developmental psychology, and education, have contributed to research on reading. This mix reflects the fact that the study of reading is both theoretically interesting and practically important. Reading is a domain in which experimental psychologists can study fundamental questions such as how the knowledge stored in people's long-term memories affects their perception of the world. Reading is also a domain in which research findings have implications for important practical issues, such as classroom practice and the diagnosis and treatment of learning problems. It is no wonder, then, that a large amount of research has been carried out on reading. Much of this research has been done with readers of English, but other languages have been examined too. The discussion begins with a consideration of the cognitive processes that are involved in skilled reading.

Bottom-up and top-down processing in reading

Psychologists have distinguished two kinds of processing that are involved in reading and many other cognitive tasks. *Bottom-up processes* take in information

from the outside world—symbols of a writing system, in the case of reading—and deal with that information with little recourse to higher-level knowledge. With *top-down* processes, on the other hand, uptake of information is guided by people's prior knowledge and expectations. In most situations, bottom-up and top-down processes work together to ensure rapid and accurate performance.

Theories about the cognitive processes involved in reading differ in the emphasis that they place on bottom-up and top-down processing. Theories that stress bottom-up processing focus on how readers extract information from the printed page, claiming that readers deal with letters and words in a relatively complete and systematic fashion (e.g., Gough 1972). Theories that stress top-down processing claim that readers form hypotheses about which words they will encounter and take in only just enough visual information to test their hypotheses. In the words of Goodman (1967), reading is a psycholinguistic guessing game. Although this view was originally propounded some time ago, its influence continues to be felt in some quarters today.

An example may help to clarify the distinction between theories that stress bottom-up processing and those that stress top-down processing. Suppose that someone has just read, *Daylight savings time ends tomorrow, and so people should remember to change their* … According to the top-down view, the reader guesses that the next word in the sentence will be *clocks*. The reader checks that the word begins with *c* and, because her hypothesis has been supported, barely takes in the remaining letters of the word. Theories of reading that stress bottom-up processing claim that the reader processes all of the letters in the last word of the sentence, regardless of the word's predictability.

Studies of how people's eyes move when they are reading texts provide some insight into the roles of bottom-up and top-down processes in reading. Research has shown that the eye does not sweep across each line of text in a continuous fashion. Rather, the eye comes to rest for somewhere around a quarter of a second, in what is called a *fixation*, and then makes a rapid jump (called a *saccade*) to the next fixation. It is during the fixation that visual stimulation is taken in; little or no useful information is extracted during a saccade. Research shows that skilled readers fixate at least once on the majority of words in a text. They do not skip a large number of words, as the top-down view predicts, but instead process the visual information rather thoroughly. Readers do this, in part, because their span of useful vision is fairly small. For example, a reader who fixates the *a* of *daylight* will probably be able to see all of the letters in this word. He may or may not be able to see enough to identify the next word, *savings*, but he will be unable to see the letters in *time*. Thus, the eye movement data portray reading as more of a bottom-up process than a top-down process. (Rayner, Pollatsek, Ashby, and Clifton 2012 include a review of eye movement research.)

Comparisons of good and poor readers further support the claim that bottom-up processes play an important role in reading. If reading were a linguistically guided guessing game, as top-down theorists maintain, one would expect guessing ability to discriminate between good and poor readers. In that view, good readers are highly sensitive to context and use it to guide their uptake of print, whereas poor readers have trouble predicting the upcoming words in a sentence. However, research has shown that less skilled readers use context at least as much

as skilled readers (Stanovich 1980). Skilled readers' perceptual skills are so accurate and automatic that they do not usually need to guess.

The statement that bottom-up processes play an important role in reading does not mean that top-down processes are unimportant. Words that are predictable from context are fixated for less time and are skipped more often than words that are less predictable, although the effects are relatively modest (Rayner et al. 2012). These results may be interpreted to mean that readers sometimes use their higher-order thinking skills to predict the upcoming words in a sentence. However, the findings may alternatively reflect low-level associative processes within the reader's *lexicon* or mental dictionary. For example, readers may spend less time on c*ake* in the sentence *The guests ate the wedding cake* than in the sentence *The guests ate the large cake* because *cake* is automatically activated once *wedding* has been recognized. Whatever mechanism is responsible for context effects, it is important to keep in mind that the words that contribute most to the meaning of a text are usually not very predictable from context. For example, almost any adjective or noun could follow *the* in a sentence. Readers must be able to use bottom-up processing if they wish to gain new information from what they read—the goal of reading—as opposed to reinforce what they already know.

Word recognition

Many of the processes that are involved in understanding what we read are similar to the processes involved in understanding what we hear. With both written and spoken language, general knowledge about the world is often needed in order to make sense of and elaborate on the information that is presented. When reading about a wedding, for example, it is helpful to know about the kinds of activities that

usually take place on such occasions. The grammatical knowledge that is necessary to understand a sentence is also similar whether the words are read or heard. Differences do arise in some cases. In English, for example, appositional phrases (as in the sentence *The wedding cake, which was made by a well-known baker, was beautiful*) occur more often in written language than in spoken language. In Arabic, the gap between the structures of written and spoken language is quite a bit larger than it is in English. What mainly distinguishes reading from speech, though, is the need to identify words by eye. Readers must recognize printed words accurately and automatically, linking the printed forms to the representations that are stored in the mental lexicon. This process of written word recognition has been a central focus of reading research.

To understand the processes that are involved in the recognition of printed words, it is important to consider how printed words map onto speech. Although writing systems differ from one another in many ways, all full writing systems are based on language (DeFrancis 1989; see Chapter X, Writing Systems). In a *logographic* system, each word (roughly speaking) has its own symbol. In other systems, the written forms of words reflect their sounds in a systematic manner. In some cases, these links are at the level of the syllable. For example, each syllable (roughly speaking) in spoken Japanese has its own symbol in the writing system called *kana*. In alphabetic writing systems, the link between print and speech is at the level of individual sounds or *phonemes*. Some alphabetic writing systems, such as Italian and Finnish, exemplify the alphabetic principle almost perfectly, with each letter representing one and only one phoneme. Other writing systems, including English and French, do not have such simple one-to-one links between phonemes

and letters. For example, some English sounds have more than one possible spelling, as when the "k" sound is alternatively spelled as *c* (*cat*), *k* (*kit*), *q* (*quit*), or *ck* (*pack*). Also, some letters have more than one possible pronunciation. For example, *c* can correspond to "k" in the English *cabin* or the French equivalent *cabine*; it can also be "s" as in the English *circus* and the French equivalent *cirque*. Although such complications make the English and French writing systems more complex than some other alphabetic systems, they do not negate the value of the alphabetic principle. A skilled reader of English might pronounce *mook* to rhyme with *book* or *spook*, but he would never pronounce it as "vab." Certain deviations from the alphabetic principle are themselves principled, reflecting a tendency to spell *morphemes* (units of meaning) in a consistent fashion. For example, the English past tense ending is variously pronounced as "t" (as in *jumped*), "d" (as in *hemmed*) or "ud" (as in *wanted*), but in all three cases it is normally spelled as *ed*. As another example, the *a* in *health*, which makes the word exceptional from an alphabetic standpoint, reveals the relationship to *heal*. Other deviations from the alphabetic principle reflect a tendency to maintain the spellings of words that are borrowed from other languages. For example, French uses the un-Frenchlike spelling *sandwich*, which was borrowed from English.

Just as the printed forms of words reflect their linguistic forms, so the processing of printed words involves the recovery of the words' linguistic forms. Readers often access the phonological (or sound) forms of words as part of the recognition process. This phonological activation is covert, for skilled readers who are reading silently, but psychologists have devised clever ways to detect it. In one technique, people are presented with a category such as *type of food* and must then

rapidly decide whether various printed words belong to the category. University students sometimes misclassify words that sound like category members (e.g., *meet*) as members of the category, even when they know the words' correct spellings. People make fewer errors on words that look equally like a member of the category but that do not sound like one (e.g., *melt*) (Van Orden 1987). The results of these and other studies show that rapid, automatic word recognition is critical to reading success and that such recognition often involves activation of words' spoken forms. (See Frost 1998 for a review.)

There is some debate about exactly how readers derive the phonological forms of words from their spellings. Do skilled readers use explicit rules of the kind taught in phonics lessons, such as that *b* corresponds to "b", *sh* to "sh", and so on? Or do they rely on a network of implicit connections? Do readers use probabilistic patterns, such as that *ea* has a certain probability of corresponding to the "long e" sound (as in *steam*) and a lower probability of corresponding to the "long a" sound (as in *steak*), or do they use all-or-none rules that are not sensitive to a letter's context? Do the links between spellings and sounds operate only at the level of individual *graphemes* (letters and letter groups that correspond to single phonemes, such as *b* and *sh*) and phonemes? Or do people use rules that link sequences of letters, such as *ook*, to sequences of sounds?

Different theories about the spelling-to-sound translation process offer different answers to the questions described above. Theories of the *dual-route* type claim that skilled readers read words via both *lexical* and *nonlexical* routes. When using the lexical route, a reader looks up a word in her mental lexicon and accesses the pronunciation, if it has previously been stored there. When using the nonlexical

route, the reader assembles a pronunciation using rules that, according to most dual-route models, relate individual graphemes to individual phonemes in an all-or-none manner. Dual-route theories claim that both the lexical and nonlexical routes are involved in the reading of many words. For example a reader might retrieve the full pronunciation of *bun* from her mental lexicon while simultaneously gaining information about the word's pronunciation by combining the phonemes corresponding to *b, u*, and *n*. If the reader comes across an item that she has not previously encountered, such as *zun*, she uses the rules of the nonlexical route in order to decode it. Computer simulations of skilled readers that embody dual-route hypotheses have been developed for English and several other languages (Coltheart 2005; Ziegler, Perry, and Coltheart 2000).

Other models claim that a single route suffices for word recognition. Many of these models are *connectionist* in nature, seeking to explain single-word reading (and other aspects of cognition) in terms of networks of simple units that are connected to one another. Computer models of single-word reading include units that represent the input—the letters in a printed word and their order—and units that represent the output—the phonological form of the word. There are also *hidden units* that mediate between the input and output units. The computer program is taught to read by exposing it to pairs of printed and spoken words in a way that is thought to capture important aspects of a child's experience, including the fact that more common words are seen more often. The computer program generates a pronunciation for each word that is presented, compares it to the correct pronunciation, and adjusts the weights of the various connections so as to bring the generated pronunciation closer to the correct one. Over the course of

many exposures to words, the weights on the model's connections begin to approximate the structure of the vocabulary on which it was trained. For example, if a model is taught the pronunciations of *bit*, *boot*, *book*, *boost*, and *brook*, the learned weights come to capture the fact that words beginning with *b* have pronunciations beginning with "b" and that words with medial *oo* have pronunciations that contain either the vowel of *boot* and *boost* or the vowel of *book* and *brook*, with the latter occurring before final *k*. The models are thus not restricted to simple, context-free links between graphemes and phonemes. They may assign one pronunciation to a letter or letter group when it occurs in one position of a word or when it is preceded or followed by a particular letter, and a different pronunciation when it occurs in another context. Models that follow these general principles have been developed for several languages (Ans, Carbonnel, and Valdois 1998; Seidenberg 2007).

Some studies (see Treiman and Kessler 2007 for discussion) suggest that phonological activation does not take place at only two levels—that of the whole word (the lexical route of the dual-route model) and that of single graphemes (the nonlexical route). Patterns also exist at intermediate levels, not only in English but in other languages, and readers take advantage of these patterns. Readers are not limited to all-or-none rules that relate individual graphemes to individual phonemes and that do not take context into account. Given this, connectionist models have more promise than dual-route models as a way of explaining the performance of skilled readers. They may also help to explain the acquisition of word reading skills, the topic to which we now turn.

Learning to read

In a number of English-speaking countries, including the United States, two general approaches have been put forward about how children should be taught to read. (Rayner, Foorman, Perfetti, Pesetsky, and Seidenberg 2002). The first of these, the *whole language* approach, is based on the idea that top-down processing plays an important role in reading. If skilled readers use context to predict the upcoming words in a sentence, only processing the print to the degree that is necessary to confirm their expectations, then children should do the same. Children should focus on the meaning of what they read rather than laboriously sounding out the individual words. Just as children will master spoken language if they are spoken to by others and given the opportunity to respond, so children will become literate if their environment is filled with print and if they are encouraged to explore it. Teachers who use a whole language approach thus focus on the meaning and purpose of printed language rather than on the individual letters and sounds. Activities may include reading stories to children and helping children use the pictures or the context to figure out the words. Sounding out an unknown word is typically considered a strategy of last resort, and children receive little guidance on how to do this. Whole language teachers encourage the integration of reading and writing, expecting children to write independently from an early age and offering little or no systematic instruction in conventional spelling.

A second class of approaches to literacy instruction, known as *phonics*, stresses the bottom-up processing of letters and words. In this view, learning to read and write is quite different from learning to understand and talk. Spoken language is deeply rooted in biological evolution and is as old as the human species itself. All normal members of the species learn to speak and understand without

explicit tuition, provided that they are exposed to a spoken language. The situation is quite different for written language. Writing is a cultural achievement dating back some five or six thousand years; it is found among some groups of people but not others. Learning to read, advocates of phonics claim, usually requires explicit instruction. Children must learn to convert unfamiliar printed words into their familiar spoken forms by learning that *b* is pronounced as "b," that *c* may be pronounced as "k" or "s" depending on the identity of the following letter, and so on. This sounding out process is slow and laborious at first, but it becomes fast and automatic with practice. The phonics approach thus focuses on individual letters and sounds, repetition, and practice. Content and interest are not the only criteria for choosing reading materials; the words must also be easy to decode. For example, a story about a *bug* that eats *fish* would be preferred to a story about a *worm* that can *talk*, as *o* does not have its typical pronunciation in *worm* and *a* and *l* do not have their typical pronunciations in *talk*. Advocates of phonics maintain that the focus of initial reading instruction should be on the reading of individual words. Books designed for young children have simple grammar and vocabulary, and children will be able to understand the meaning if they can decode the words.

In practice, many programs include a blend of whole language and phonics activities. For example, children who are receiving phonics instruction learn about the meaning and function of print by reading (or being read) interesting stories. Use of writing for communication of reading can be emphasized in phonics classrooms as well as in whole language classrooms. The central question is whether early reading instruction should include instruction in phonics. The answer to this question, most researchers now agree, is that it should. Bottom-up skills are

important for reading, as discussed earlier in the chapter, and most children need systematic instruction in order to develop these skills. Across a large number of studies, programs that include attention to phonics tend to yield better results than programs that do not (Ehri, Nunes, Stahl, and Willows 2001).

Still, dissatisfaction with conventional phonics instruction remains. Part of the reason is that phonics instruction is sometimes carried out using drills and worksheets that children find boring. But teachers can go beyond such techniques, helping students to become word detectives who search for patterns in the written language. Students can learn that the patterns they find hold for many words but, in languages like English, not all.

Another problem is that some children have trouble grasping phonics instruction and, even after months of instruction, may be able to read only a few words. Why are some children slow to benefit from phonics instruction? One contributor is a lack of *phonemic awareness*. Children's attention is normally on the meaning of what they hear and say, not on the individual words and sounds. In order to understand how the spellings of words in alphabetic writing systems map onto their spoken forms, children must pay attention to smaller units of sound. For example, a child who cannot analyze the spoken form of *bat* as containing three units of sound, the first of which is the same as the first sound of *boy*, will not understand why the printed form of *bat* contains three letters, the first of which is the same as the first letter of *boy*. A number of tasks have been developed to assess a child's phonemic awareness, ranging from counting phonemes (how many sounds do you hear in "bat"?) to comparing phonemes (do "bat" and "boy" start with the same sound?) to deleting phonemes (what do you get if you take the "b" sound away

from “bat”?). Children’s performance on such tests is a good predictor of their later reading success, and instruction that is designed to improve phonemic awareness benefits reading in alphabetic systems (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, and Shanahan 2001). (Phonemic awareness is less important for non-alphabetic systems, and readers of such systems do not develop the skills in this area that are found among readers of alphabetic systems; see Read, Zhang, Nie, and Ding 1986.)

To teach phonemic awareness, one can take advantage of the fact that awareness of phonemes is the endpoint of a long developmental process. The process begins with awareness of words and syllables and progresses to units that are smaller than syllables but larger than phonemes, including initial consonant clusters (e.g., the “bl” of “blast”) and rimes (e.g., “ast”). Phonemic awareness may be taught gradually, following this progression. For example, children can play games in which they clap once for each syllable in a spoken word before they proceed to the level of phonemes. Phonemic awareness instruction is particularly successful when it is closely integrated with reading instruction, allowing children to learn how the sounds that they are isolating in speech are represented in writing (Ehri, Nunes, Willows et al. 2001).

Another reason why children may have trouble benefiting from phonics instruction may be that, when they first begin to learn to read, they may believe that the links between printed words and concepts are arbitrary (Ehri 2005). For example, young children may think that the color and overall shape of the McDonald’s logo, not the letters it contains, are important in allowing it to symbolize what it does. Children must break away from the idea that printed words are holistic

symbols in order to learn that their parts (the letters and letter groups) map onto the parts of spoken words (the phonemes) in a systematic fashion.

Yet another stumbling block to conventional phonics instruction involves the teachers rather than the students. Many teachers have little or no opportunity to learn about linguistics and the structure of written language. As a result, they may not provide optimal instruction (Moats 1994). Because teachers are themselves good readers, they tend to think about language in terms of how it is spelled rather than how it is pronounced. They may find it hard to put themselves in the place of a child who does yet know the conventional writing system. For example, a teacher may think that there is "short i" sound in the spoken form of *girl* because the spelling of this word contains an *i*. However, the spoken word does not actually contain the same vowel as *bit* and it would be misleading to suggest to a child that it does. As Moats (1994: 99) states, "lower level language mastery is as essential for the literacy teacher as anatomy is for the physician. It is our obligation to enable teachers to acquire it."

To summarize, reading instruction that includes explicit and systematic attention to phonics generally works better than instruction that does not. However, there is room for improvement in phonics programs. Improvement can occur by better preparing children to benefit from phonics instruction and by better preparing teachers to teach it.

Learning to spell

One aspect of whole language programs that is attractive to many teachers and parents is the focus on writing. In many whole language classrooms, children write each day in personal journals. Correct spelling is not stressed, with children

instead being encouraged to invent spellings for words they do not know. It is assumed that invented spellings like *bo* for *blow*, *grl* for *girl*, and *wet* for *went* will give way to conventional spellings as children learn to read and that systematic instruction in spelling is not necessary. However, research shows that children are less likely to learn words' spellings from the reading of meaningful, connected text than from the study of isolated words. Research further shows that the correlation between reading ability and spelling ability is far from perfect: That is, there are a number of people who are good readers but poor spellers. For most children, learning to spell requires something above and beyond immersion in a sea of print. The benefits of spelling instruction are not confined to spelling itself. Such instruction can also foster reading and phonemic awareness. For example, as children practice spelling consonant clusters like *bl* they learn to analyze these clusters into their component phonemes. Spelling instruction, like reading instruction, requires a teacher who is knowledgeable about children's errors and the reasons behind them. For example, a teacher who knows that the middle part of *girl* is a syllabic "r" sound rather than a "short i" sound followed by a separate "r" will understand why young children frequently misspell this word as *grl*. (See Treiman and Kessler 2014 for further discussion of how children learn to spell.)

Dyslexia

Even with good instruction, some children who are developing normally in other respects have great difficulty learning to read and spell. Such children are said to have *dyslexia*. Their comprehension of oral language may be adequate, but their reading comprehension is poor. In most cases, impaired reading comprehension is associated with difficulties at the single-word level, difficulties that also show

themselves in poor spelling. The popular view is that children with dyslexia see letters and words backwards. As a result, they may misread *was* as *saw* or day as *bay*. Similar errors occur in spelling, as when children write *bit* as *dit* or even *tid* (in what is known as *mirror writing*). However, research reveals that such mistakes do not constitute the majority of reading or spelling errors among dyslexics. Moreover, typically developing children sometimes make the same kinds of errors when they are first learning to read and write. Most researchers now believe that, in the great majority of cases, dyslexia does not reflect low-level perceptual problems that extend beyond the reading domain. Dyslexia is, instead, a linguistic problem (Vellutino and Fletcher 2005).

If dyslexia is a linguistic problem, what kind of linguistic problem is it? The most widely accepted hypothesis is that dyslexics have weaknesses in the phonological component of language (Vellutino and Fletcher 2005). Specifically, dyslexics have difficulty becoming aware of the phonemic structure of spoken language and thus have trouble learning about the way in which spellings map onto words' sounds in alphabetic writing systems. Dyslexics' phonological problems also extend to remembering words and to producing them quickly and accurately. These problems are, in part, genetically based. For example, if one member of a pair of identical twins exhibits reading problems then the other member has an elevated chance of showing similar problems (Olson 2008).

If dyslexia stems from linguistic weaknesses, particularly weaknesses in the area of phonology, then teaching must attempt to remediate the linguistic problems. Instruction that centers on low-level perceptual skills, such as exercises designed to improve eye tracking or binocular coordination, does not appear to be successful

(Vellutino and Fletcher 2005). What is needed, instead, is an intensive reading program that includes a liberal dose of phonics. In one successful program of this kind, as described by Gaskins (1998), children with reading problems spend over four hours a day in literacy activities. These activities are designed to help the children focus on the sounds in spoken words and how these sounds are represented with letters. The children are taught to use his knowledge in reading and writing connected text as well as in reading and spelling individual words

The effects of literacy

Does learning to read change people's basic cognitive or linguistic abilities? Some have suggested that literate individuals and societies differ greatly from non-literate ones, the former being more abstract, more rational, and more skeptical. Although research has not supported these grand claims, it has provided empirical evidence that literacy has certain cognitive consequences (see Stanovich 1993). For example, university students in the United States who read extensively have larger vocabularies and more knowledge about the world than their peers who do little reading in their free time. Opportunities to learn new words tend to arise more often while reading than while watching most sorts of television programs.

Learning to read also appears to deepen and alter people's knowledge about language. Awareness of phonemes develops hand in hand with learning to read and write an alphabetic system. Thus, preliterate children and alphabetically illiterate adults tend to do poorly in tasks requiring access to the phonemic structure of language, although they do better on rhyming tasks and syllable-level tasks (Morais and Kolinsky 2005; Read et al. 1986). Another effect of alphabetic literacy is to color people's ideas about the sounds of language. For example, seeing that words like

went and *elephant* contain an *n* in their spellings, children may come to conceptualize "n" after a vowel as a separate unit of sound rather than as part of the vowel, as they did previously (Treiman, Zukowski, and Richmond-Welty 1995). Pronunciations of words may also change under the influence of spelling, as when people include a "t" in their pronunciation of *often*. If people's ideas about spoken language are indeed influenced by their knowledge of written language, it may be difficult for linguists and psycholinguists to study the structure or processing of spoken language without considering written language.

Conclusions and Future Directions

Many modern linguists believe that speech is the primary form of language and that writing is secondary. This view implies that investigations of language and language processing should focus on spoken language and that there is little to be gained from studies of written language. This chapter has presented evidence, to the contrary, that the study of written language processing is interesting and informative in its own right. There are many questions to be answered about how people relate print to speech and about how children can best be taught to do so. This is an area in the study of language that has important real-world applications. Moreover, it appears that written language takes on a life of its own once acquired, influencing the representation and processing of spoken language. The study of writing and written language processing can no longer be ignored within linguistics.

One emerging area of research, which has not been covered in this chapter for reasons of space, concerns the brain bases of reading. In recent years, researchers are increasingly studying the areas of the brain that are involved in reading. They are asking how the patterns of brain activation in people with reading

problems may differ from the patterns shown by other people and how patterns of brain activity may change as a function of reading instruction. A second emerging area of research is cross-linguistic studies of reading and spelling and their development. As mentioned earlier in this chapter, much research has looked at English and other alphabetic writing systems. It is important to study a broad variety of languages in order to develop theories that are not limited to a particular language or type of writing system, and researchers are currently attempting to do this. A final trend involves the strengthening of links between research and education. The teaching of reading and spelling should be based on evidence about what works, not on fads, and scientific evidence of the sort reviewed in this chapter has an important role to play in education.

Suggestions for further reading and study

The books listed below contain authoritative information about various aspects of reading:

R. Malatesha Joshi & P. G. Aaron (eds.). 2006. *Handbook of orthography and literacy*. Mahwah, NJ: Erlbaum.

Elena L. Grigorenko and Adam J. Naples (eds.) 2008. *Single-word reading: Behavioral and biological perspectives*. New York: Erlbaum.

Keith Rayner, Alexander Pollatsek, Jane Ashby, and Charles Clifton, Jr. 2012 . *Psychology of reading* (2nd edition). New York: Psychology Press.

Margaret J. Snowling and Charles Hulme (eds.). 2005. *Science of reading: A handbook*. Oxford, England: Blackwell.

A good on-line resource, with much practical information about literacy development and instruction, may be found at: http://www.literacyencyclopedia.ca/index.php?fa=home.show

The Society for the Scientific Study of Reading sponsors conferences dealing with the issues discussed this chapter, particularly those related to reading acquisition and instruction. This society also publishes a journal, *Scientific Studies of Reading*. The Psychonomic Society, an organization for cognitive and experimental psychologists, includes a number of researchers who study reading and word recognition. Journals in the field of experimental psychology, *including Journal of Memory and Language* and *Journal of Experimental Child Psychology*,

regularly publish research on reading, and *Reading and Writing* devotes itself to this topic.

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