mapping between written and spoken words is taught explicitly at the expense of making explicit letter-phoneme mappings. In the latter approach, children are taught to break words down into their component letters and 'sound them out.' More studies support a superiority of phonics approaches (Byrne 1998), but, of course, an exclusive choice of one or the other method is not necessary: many kinds of mixture approaches are possible. Note, however, that the optimal method depends on the particular spelling-to-sound and sound-to-spelling mappings of a language (Wimmer and Landerl 1997).

5. *Challenges*

In a world full of illiterates and dyslexics, the biggest challenge for cognitive psychology surely remains to provide the applied disciplines with the necessary and sufficient fundamental knowledge allowing to design efficient and reliable methods for diagnosis, teaching, training, and rehabilitation. Given the enormous, heterogeneous set of models and methods in the cognitive literature on literacy, another challenge is theoretical and methodological unification. For example, fundamental research on speech perception still remains relatively disconnected from research on reading and writing; research on implicit learning and working memory is still widely separated from research on literacy; more research on standards for model building and evaluation, as well as for evaluating diagnostic and teaching methods is needed, if we want to fully explain the conditions favoring optimal acquisition and mastering of literacy; finally, so far, too little effort has been spent on developing a formal framework for evaluating the sensitivity, reliability, or validity of cognitive tests relevant to literacy research, such as the ubiquitious lexical decision or the naming tasks.

See also: Literacy and Illiteracy, History of; Literacy and Orality; Literacy Education; Literary Texts: Comprehension and Memory; Oral and Literate Culture; Readability, Applied Psychology of; Reading, Neural Basis of; Reading Skills; Speed Reading; Spelling; Writing Instruction; Writing Process, Psychology of; Writing Systems; Writing Systems, Psychology of

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A. M. Jacobs

Literacy Education

Literacy is a relatively recent human invention, and goals of universal literacy within societies are even more recent. Furthermore, although a goal of universal literacy is in place in modern nation-states, it is far from universal, when one considers the vast number of languages for which writing has either not

been developed or for which literacy values have not been firmly established. Studies of the historical contexts of literacy within Western societies make clear that the development of literacy has been embedded in specific cultural 'transactions' (e.g., Resnick and Resnick 1985). The establishment of literacy values in 'developing' non-Western societies occurs within cultural contexts that vary greatly in a number of ways affecting their movement toward literacy (Olson and Torrance 2001).

Where universal literacy goals have been established, the manner of literacy instruction has been subject to change and debate. Although literacy instruction is an issue as inseparable from cultural contexts as the development of literacy itself, it is helpful to focus on the general components of the issue that derive from the distinctive technical nature of literacy—the fact that it has to do with the use of written language. This fact warrants a central place in questions of literacy instruction.

1. *The Definitions of Reading and Literacy*

Reading has been defined both narrowly and broadly. The narrow definition honors an important fact about the dependence of reading on language: *reading is the conversion of written forms into spoken language forms*. With this definition comes the concept of *decoding*, the process of converting printed word forms to spoken word forms. On the narrow definition, then, reading instruction is primarily about the teaching of the code—how the writing system encodes the spoken language system. This can be considered the system-based definition.

By contrast, broader definitions entail literacy as a concept distinct from reading in the narrower sense. In this broader definition, the concept of *literacy* entails the achievement of a broad range of skills embedded in cultural and technological contexts. In this extended culture-centered definition, reading may not even be a critical part of literacy. Thus, a person who can recite religious texts from memory without being able to read them may be included in such a definition (Wagner 1986). Other extended definitions imply functional, rather than cultural, norms. Literacy is 'using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential' (Kirsch and Jungeblut 1986). An extended functional definition is practically useful in specifying expectations for achievement and in helping to make clear the wide range of literacy tasks a society might present to its members. Further extensions of literacy are entailed by such phrases as 'computer literacy,' 'historical literacy,' 'scientific literacy,' etc. In effect, literacy in its broader senses refers to a level of achievement in some subject or specialty, an extension of basic skill to reasoning and discourse in a domain. This amounts to making 'literacy' co-extensive with 'education.'

Intermediate between the narrow definition of reading and the extended definition of literacy is the definition of literacy as reading and writing. This definition may entail the narrower decoding concept, but it adds comprehension, or the attainment of meaning, as the main feature of literacy. In the USA and Europe, reading as obtaining meaning from print has become the most common definition applied in the pedagogy of reading. Thus it may be considered the standard pedagogical definition.

In the face of these various definitions, some clarity is achieved by noting that the common meaning-based definition is *outcome* based, whereas the narrower decoding-based definition is *system*- and *process*-based. Thus to say that reading is the conversion of written forms into language forms, is to appeal to the relationship between *writing systems* and *language systems* and to the process of decoding elements of one system into elements of the other. By contrast, the pedagogical definition is focused on the outcome of comprehension, without regard to the system relationships or the process. The extended literacy definition is neither outcome- nor system-based, but rather is a culturally embedded definition that can complement either the system-based or the outcome-based definition.

In considering the most universal aspects of early reading instruction, it is useful to adopt both the pedagogical definition and the systems definition. The pedagogical definition is useful because it emphasizes a consensus on the major goal of reading, including children's reading. The systems definition is useful because it reflects accurately both the systemic foundation of reading and the related decoding ability that must be acquired by children to learn to read. The treatment of literacy in the sections below center on these two definitions.

2. *Reading and Writing Systems*

Writing systems, which are the result of human invention and refinement, vary according to their design principles even after centuries of convergent development. Conventionally, one distinguishes among alphabetic, syllabic, and logographic systems (Gelb 1952). Thus, English, Italian, Russian, and Korean are examples of alphabetic writing systems, in which graphic units associate with phonemes. Arabic, Hebrew, and Persian represent modified alphabetic systems, in which vowels can be omitted. Japanese Kana is a syllabary system, in which graphic units correspond to spoken language syllables. The logographic system is, at least among current systems, uniquely represented by Chinese (along with the Japanese Kanji adaptation of the Chinese system). In

such a system, the graphic units associate primarily with whole words or lexical morphemes.

Although Chinese approximates this logographic concept, its partial representation of morpheme level pronunciation suggests a different classification, as morpho-syllabic (DeFrancis 1989). Thus, in Chinese the compound character Ñó (pronounced yang 洋 and meaning 'ocean') has two components: the left component signifies that the character meaning has to do with water, while the right component is a character that when it stands alone is also pronounced as yang 羊 (Ñò, meaning sheep). This combination of meaning and pronunciation information inside a character is very far from perfect, but it is frequent enough to challenge the assumption that it is a pure logographic system. Indeed, pure logographic systems seem not to exist among current writing systems.

The significance of writing system analysis for literacy education lies in the following: the fact that writing systems vary in systemic design principles means that children must learn how their writing system works. Do the elementary units correspond to meanings? They do not in an alphabetic system—and not in a syllabary system. The child learning either of these systems must focus some attention on meaningless print units that correspond to meaningless spoken language units. Only in the case of Chinese is there the potential for learning mainly form-meaning mappings. And, as noted above, this mapping is only part of the Chinese system. It is fair to say that there is a universal challenge in learning to read that requires the learning of a relationship between form (written) and form (spoken) rather than between form and meaning.

It is important to note that this challenge is not a consequence of bad writing-system design. It is merely the price to be paid for system efficiency and productivity. Speech-based writing systems are productive in that they make infinite use of finite means (an inventory of syllable signs, an inventory of letters) to express all words and all possible words in a language.

3. *Learning to Read in an Alphabetic Writing System*

In learning an alphabetic writing system, a child comes to learn that letters and strings of letters correspond to speech segments. In principle, this learning might occur implicitly (through the extraction of print-speech correspondences in text) or explicitly (through direct instruction). The problem that has confronted reading instruction is how much success is to be expected from strictly implicit learning.

Complicating the picture is that the consistency of the mappings between letters and phonemes varies within the family of alphabetic systems. The specific manner in which a writing system is instantiated is its orthography, which provided the details of the mapping system. Within the family of alphabetic writing systems, orthographies can be characterized as relatively deep or relatively shallow (Frost et al. 1987). A shallow system provides reliable mappings between letters and phonemes, whereas a deeper system sacrifices some reliability in its mappings, instead preserving more underlying morphology in its spellings. European languages, including Romance, Germanic, Slavonic, and Finno-Ugrian languages, tend to be coded by shallow orthographies. The letters reliably map onto phonemes.

English presents a problem of deep orthography to the learner: many letter patterns in English associate with more than one pronunciation. For example, the letter string 'ow' is read as /ow/ in the words *how* and *cow* and as /o/ in *low* and *tow*. Although the irregularity of English is widely lamented, many of the 'irregularities' turn out to be quite predictable, provided one takes into account more than a single letter. The rime unit—the vowel plus the syllable ending together—turns out to be pronounced very reliably in English (Treiman et al. 1995).

In either a shallow or a deep alphabetic system, the learner needs to grasp the alphabetic principle: letters are associated with meaningless speech segments, or phonemes. Deeper orthographies merely present more context-dependency in these associations.

3.1 *Phonological Sensitivity*

A major link to discovering the alphabetic principle is the child's phonemic awareness, the understanding (more or less explicit) that the speech stream can be segmented into a set of meaningless units (phonemes). Although awareness of phonemes is central to the alphabetic principle, researchers may speak more generally of 'phonological' sensitivity, which entails an appreciation of a broader range of information in the speech signal. Phonemic awareness, variously measured, shows a strong correlation with early reading success. Furthermore, training studies in which children receive explicit instruction in phoneme segmentation produce gains in reading. The research thus supports a strong causal link between explicit knowledge of phonemes and reading in an alphabetic system.

However, the causal relationship between reading and phonemic awareness appears to be reciprocal. First, adults whose cultural context does not include formal schooling may fail to show phonemic awareness (Morais et al. 1979). Second, Chinese children who learned to read Chinese without first learning the Chinese alphabetic (pin-yin) system fail to show phonemic awareness (Read et al. 1986). Third, longitudinal studies of first grade children learning to read

English find a reciprocal relationship, such that initial gains in simple phonemic awareness precede gains in reading, which in turn lead to further gains in phonemic awareness (Perfetti et al. 1987).

For fuller discussions of phonological sensitivity, see Rieben and Perfetti (1991), Liberman and Shankweiler (1991). For a summary of the evidence on the role of phonemic awareness and other factors in learning to read, see the National Research Council Report (1998).

3.2 Theories of Learning to Read

Progress in acquiring reading skills has been viewed typically as a series of stages (e.g., Ehri 1991, Frith 1985). Among the shared ideas across at least some of these theories is the assumption that the earliest stage of reading is characterized by an attempt to learn associations between visual features of graphic forms (not complete orthographic word forms) and spoken words followed by a subsequent stage of graphic-phonological decoding that brings on a truly productive capability in reading. The use of letter names as a bridge to phonology is an important beginning step (Ehri 1991).

Alternative theoretical accounts emphasize the incremental acquisition of decodable lexical representations, rather than discrete stages (Perfetti 1992, Share 1995). Important in these theories is the role of phonology in helping to establish word-specific orthographic representations.

The relationship between spelling and reading comes into the picture quite early. The initial expression of the alphabetic principle appears more often in spelling than in reading (Frith 1985). Indeed, children's attempts at spelling prior to formal reading instruction typically reveal a real understanding that the sounds of a word are to be found in the letters (Read 1971). This early realization forms the basis for later alphabetic reading, even if the earliest stages of reading—as opposed to spelling—appear to be based on partial visual cues or 'logographic' strategies (Frith 1985). Eventually, in nearly all languages, the learner confronts an important fact about spelling: typically, the mapping from pronunciation to spelling is less consistent than the mapping from spelling to pronunciation. Reading is more reliable than spelling. For a collection of papers on spelling in different languages, see Perfetti et al. 1998.

4. Teaching Reading in an Alphabetic System

Given the theoretical understanding of learning to read and the wealth of data that supports central features of these accounts, especially the role of phonological awareness and the need to acquire letter string–phoneme string mappings, the goal of beginning reading instruction for alphabetic systems seems clear. Children need to learn that the letters of their alphabets map onto speech segments of their language; if they lack phonemic awareness, then some instruction in phonemic awareness as part of reading instruction is implied. Phonemic awareness instruction linked to reading instruction seems to be more effective than isolated phonemic awareness instruction.

However, in English-speaking countries—and to some extent in European countries—there has been a history of assertive ambivalence about teaching directly what the child needs to learn. This history is captured in the phrase 'The Great Debate,' the subtitle of a review of teaching methods by Jeanne Chall (1967). The question has been, to what extent—if at all—should beginning instruction focus on teaching directly the correspondences between letters and 'sounds' (phonemes)? The logical answer to this question appears to be that these correspondences, and the alphabetical principle that they instantiate, should be the central initial focus of instruction. However, the tendencies of actual practice have been otherwise. A variety of alternative pedagogies have emphasized instead meaning-focused struction built around story reading, exposure to print, and enhanced language environments. These alternatives are too varied to capture with a single characterization. For example, in the original Great Debate, the alternative to direct instruction was 'whole-word' (also called 'look-say') teaching (Chall 1967), in which basal readers and limited (and later) 'phonics' instruction were typical components. In the last 20 years, the dominant alternative has been 'whole language,' a broad philosophical approach without specified components, except for prohibitions against direct teaching of decoding.

Chall's original conclusion, based on a careful analysis of some 22 programs, classroom observations, and reviews of published studies, was that children who were taught in direct code-based instruction (i.e., decoding-emphasis or 'phonics') classrooms tended to have higher achievement in the first three grades than did children in whole-word classrooms. Although initially whole-word classrooms showed better on measures of comprehension and reading rate, the advantage of decoding-based instruction became highly general, encompassing spelling, word recognition, and comprehension. This conclusion, in its general form, was confirmed in later, less comprehensive reports.

Adams (1990), in a study requested by the US Office of Educational Research and Improvement, provides a review of a number of these research reports and, more generally, an evaluation of teaching methods in the context of a review of the research. Furthermore, Adams (1990) puts the Great Debate in its historical context and helps to explain why there has been so much resistance to the direct teaching of decoding. An emphasis on meaning and comprehension not only

coincides with the main goal of reading, it is also appeals to beliefs that the child's experience in school learning should reflect purposeful learning in authentic contexts. In that spirit, a use of commercially published children's literature as the main or exclusive reading material has become characteristic of whole-language classrooms. Modern advocates of direct instruction point out that there is nothing incompatible between these meaning values and good decoding instruction (often called 'phonics'), which aims to provide the child with the basics of the letter-sound system quickly, while introducing real reading with comprehension at the same time.

The US National Research Council (NRC; the research arm of the National Academy of Sciences) revisited this issue in its report, *Preventing Reading difficulties in Young Children* (National Research Council 1998) The NRC report concluded that research shows that beginning reading 'depends critically on mapping the letters and the spellings of words onto the sounds and speech units that they represent.' Directly counter to the idea that somehow comprehension can proceed on its own, the report adds that 'Failure to master word recognition impedes text comprehension' (p. 321). An additional feature of the NRC report is its emphasis on early language and literacy experience prior to school. It is clear that coming to school with certain relevant skills (e.g., some degree of phonological sensitivity) and dispositions (e.g., an interest in books and stories) eases the burden of school instruction. It is equally clear that if schools are to retain the major responsibility for literacy instruction, they need to organize their efforts to level the variability among children in at-home literacy preparation. Such efforts, organized along the lines supported by research, would aim to ensure that children acquire the ability to decode words and have sufficient opportunity to gain fluency and to read with comprehension.

Although the debate about teaching reading may appear to be about methods of teaching and the research that helps decide which methods are effective, this appearance is probably misleading. Arguments for a whole-language approach (and against the teaching of decoding) have embraced philosophical stances and professional advocacies that have little to do with effective teaching and learning and their research basis. Traces of these philosophical and professional advocacies issues can be seen in the professional teaching publications. The effect of this has been to make research appear irrelevant to the debate. See Stanovich (2000) for a researcher's perspective on this problem.

However, at the close of the twentieth century, there are indications that a stronger consensus has emerged in favor of research-guided practice. There is also an emerging consensus that teaching preparation has been a neglected part of the problem. Strong recommendations to improve both the college education and the 'in-service' training of teachers in the USA have come from recent studies suggesting low levels of teacher preparation in the foundations of reading. Improved teacher training, including more knowledge about the research foundations of reading, was a major recommendation of the NRC report.

5. *Reading Instruction in an International Context*

The questions of how to teach reading are general across languages, writing systems, and national and cultural contexts. However, the English language case is special to some extent. Among alphabetic systems, English is exceptional in its depth and its vocabulary, both its size and its mixed linguistic origins. These two facts are related—a large vocabulary from mixed roots can be expected to produce more spelling variability and hence a less reliable spelling-to-speech mapping. One might wonder whether the facts of English spelling have contributed to the debate on how to teach reading.

In non-English-speaking countries, the debate either has been lacking or appears in a milder form. Among European countries speaking Germanic languages, the tendency is toward the teaching of letter-sound correspondences, although there appears to be variability; e.g., Denmark has placed less emphasis on decoding, the Netherlands and Germany somewhat more. Among Romance language areas, decoding instruction has an important part of beginning reading instruction in Italian and Spanish but not in French.

Indeed, there may be at least a superficial relationship between the reliability of an orthography (its shallowness) and the approach to instruction. Where the mapping from graphic unit to speech unit is highly reliable, whether syllabic or alphabetic, decoding tends to be taught—in Japan, as well as in Korea and most Romance, Germanic, and Slavonic language areas of Europe. In general, children in these language areas are explicitly taught grapheme–phoneme or grapheme–syllable correspondences and are encouraged to use phonological recoding (i.e., 'sounding-out') as their primary word recognition strategy (Feitelson 1988, Mayringer et al. 1998, Reitsma and Verhoeven 1990). The high consistency of these orthographies reinforces the use of phonological coding, allowing most attempts at decoding to produce an accurate word pronunciation.

It is in English-speaking countries, including the USA, the UK, Australia, and New Zealand, where the debate on reading education has been the most heated and where nondecoding methods (particularly whole-language) have been prominent (Turner 1995). This is not an exclusive quirk of English, however. France and French-speaking Switzerland have also tended to emphasize non-decoding approaches. On the orthographic reliability continuum, French orthography

can be characterized as somewhat less reliable than Italian and Spanish, especially in the direction of sound-to-spelling. With these examples, one might be tempted to conclude that the reliability of the spelling-to-pronunciation mapping is a major influence on whether education emphasizes decoding. Certainly, arguments against phonics instruction have sometimes used observations about the 'irregularity' of English spellings as a reason not to teach spelling-sound correspondences. However, it would be misleading to conclude that it is the reduced reliability of an alphabetic orthography that explains failures to teach decoding. Teaching practices are strongly determined by traditions that develop around professional (teacher training), philosophical (child development beliefs), and the marketing of instructional materials. One needs to examine the specific influences that have guided practice contexts within a political region.

In the light of a resistance to teaching decoding, the case of Chinese is especially interesting. Chinese writing presents a high contrast to alphabetic systems—even those with reduced reliability in letter-sound mappings. Even with the presence of phonetic compounds, only a minority of characters give fully accurate information about their pronunciation. Furthermore, for a learner to use this information, he or she must already know the pronunciation of the character that serves as the phonetic cue. Thus, the basic learning procedure is to memorize characters (and the radicals), relating them to spoken words and their associated meanings. This means a logical approach to teaching reading in Chinese would be whole-word or look-say methods. Indeed, until after World War II, this whole-character method was how Chinese children learned to read. Students were taught to recognize individual characters by means of flash card drills and writing practice.

However, in implementing goals of universal literacy, the Chinese added an initial bootstrapping alphabet-based procedure. Children now spend their first eight weeks of school learning a 26-letter alphabet (*Pin Yin* in mainland China, including Hong Kong, and *Zhuyinfuhao* in Taiwan). The instruction focuses on learning grapheme-phoneme correspondences (and phonemic awareness), so that after the first eight weeks of school, the child can read words and sentences written in the alphabet. Then, individual Chinese characters are introduced, accompanied by their Pin Yin counterpart. Gradually, the Pin Yin are removed for familiar characters and then for all characters (Sheridan 1992). A similar system is employed for teaching Japanese children to recognize the Chinese characters (Kanji), which are used together with the syllabic scripts in standard written Japanese. When the kanji are first introduced to children, their pronunciation is written out below the characters in the syllabic script. In both the Japanese and Chinese cases, even with Pin Yin, children spend substantial time with individual characters, including practice at writing characters. One of the most dramatic differences between the educational practices of both China and Japan and those of the North America and Europe is the amount of time children spend on 'homework' (Stevenson and Lee 1990).

It is interesting that the Chinese use an alphabetic system for no other purpose than as an initial teaching device to help children acquire the Chinese system. Not only does this illustrate the value of a speech-based system, its brevity suggests the possibility that preparation for basic decoding can be accomplished in a relatively short time.

6. *International Aspects of Functional Literacy*

Finally, in considering international contexts, it is useful to reconsider the definitions of literacy. The foregoing has assumed the systems and pedagogical definitions of reading. Instruction has been about how to enable children to learn how their writing system maps onto their language. Implicitly, the issue is also about how children can learn to obtain meaning from printed language. The reasonable assumption is that, with the acquisition of decoding skill, a reader's ability to comprehend printed language will be limited only by his or her ability to comprehend spoken language.

However, consistent with broader definitions of literacy, expectations about communicative functioning increase in literate contexts. It is implicit in schooling in Western societies that learning to read enables a broader range of communicative competencies and literate interests. These competencies then become expressed not just in print but in spoken language. Literacy becomes more than being able to read. Its acquisition promotes a range of behaviors, dispositions, and skills that represent broader individual and cultural interests.

These broader aspects of literacy—part of its extended definition—are a source of widespread concern internationally. As local and national expectations for 'functional literacy' become identified, gaps between achievement and performance become visible. Questions of equal opportunities for participation in the economical and social benefits of literacy become salient. Certainly, coming to know the details of how one's writing system represents one's language is the central prerequisite for literacy, even in this broader sense. But both within the technologically advanced countries of Europe and North America and within developing and recently autonomous regions of the world, the development of functional and participatory literacy faces serious obstacles. One shared problem is the target language for reading instruction. Both in developed and developing countries, instruction in a single national language—either the politically privileged or majority language (in the case of Europe, North America, and some countries of South America and Asia) or the language of the former

foreign occupying country (in the case of African countries)—may present cultural and cognitive obstacles to literacy goals.

For additional discussions of functional literacy in this broader sense, see Verhoeven (1994). For papers specifically addressing the obstacles faced in countries without a long history of universal literacy, see Olson and Torrence (2001).

See also: Eye Movements in Reading; Illiteracy, Sociology of; Literacy and Illiteracy, History of; Literacy and Orality; Literacy, Cognitive Psychology of; Literacy Education; Mathematical Education; Reading Skills; Spelling; Writing Instruction; Writing Process, Psychology of; Writing Systems; Writing Systems, Psychology of

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C. A. Perfetti and R. Sandak

Literary Texts: Comprehension and Memory

Nothing seems more effortless and automatic than being swept up in the pages of a good book. In reality, the cognitive processes that underlie the comprehension of literary texts are quite complex, and discourse psychologists are beginning to expose some of these

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