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11. THE DEVELOPMENT OF BASIC READING SKILLS IN CHILDREN: A CROSS-LANGUAGE PERSPECTIVE

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This chapter reviews recent empirical evidence for universal and orthography- or language-specific processes in the development of basic reading skills in school age children, suggesting that universal and orthography- or language-specific processes should be considered in tandem. The review focuses on three different aspects of reading, phonological processing, rapid naming, and morphosyntactic complexity, targeted in recent research on development of word recognition skills. Studies on L1 school children and studies of children who learn to read concurrently in their L1 and/or in a second language (L2) are examined within the context of variations in orthographic transparency. When children learn to read, characteristics of the spoken language interact with characteristics of the orthography. The chapter concludes that (a) individual differences in phonological processing skills, verbal memory, and rapid naming predict the development of reading in L1 and L2 children in various alphabetic and nonalphabetic languages; and (b) individual differences on such prerequisite skills can indicate smooth or problematic acquisition of L2 reading skills in children, regardless of oral language proficiency. However, task demands associated with learning to read in different orthographies vary and yield steeper or more moderate learning slopes. Regardless of the language and orthography combinations under study, children can develop reading strategies that help them read.

Writing systems can be classified into two categories morphography (or logography), used in languages such as Chinese and Japanese, and phonography (or phonetic script), used in languages such as English and Russian (Koda, 1989; Leong & Tamaoka, 1998). Some researchers argue that visual, phonological, and

morphosyntactic differences involve different demands on word recognition processes in different languages (Chen, 1992; Feldman, 1987; Frost & Bentin, 1992; Henderson, 1982; Koda, 1989; Leong & Tamaoka, 1998; Shimron, 1993; Taylor & Taylor, 1983; Tzeng & Wang, 1983). With regard to alphabetic languages, the orthographic depth hypothesis (Feldman & Turvey, 1983; Katz & Frost, 1992) has been used as a framework for discussing differences in word recognition processes. It has been argued that prelexical phonology plays a more important role in reading words in shallow or transparent orthographies, such as Spanish or German, that have a direct and consistent grapheme to phoneme correspondence, than in deep or opaque orthographies, such as English, where the mapping of letters to sounds is less consistent. More recent research suggests that this framework can be extended to nonalphabetic writing systems such as Chinese (e.g., Hu & Catts, 1998; Leong & Tamaoka, 1998; Shu & Anderson, 1997; Tan & Perfetti, 1998).

In recent years researchers have turned their attention to the study of the acquisition of basic reading skills in different languages and different orthographies. One cluster of studies involves investigations of word recognition processes in alphabetic languages other than English. These studies seek to understand how cross-linguistic differences at the level of the spoken word (e.g., syllable structure, the availability of specific phonemes, the structure of syllable onset, morphemic density) interact with differences in orthographic depth in the acquisition of word recognition skills. Another cluster involves the study of word recognition processes in nonalphabetic orthographies. Two theoretical positions underlie these research trends, one focusing on cross-orthography and cross-linguistic commonalities in the reading acquisition process, and one seeking to understand the impact of differences in linguistic structures and writing systems on the acquisition of basic reading skills. Some of this research literature has focused on adults learning to read in a second language (L2) (Akamatsu, 1999; Jackson, Chen, Ewald, Goldsberry, Kim, & Vanderwerff, 1999; Koda, 1999; Nassaji & Geva, 1999; Tan & Perfetti, 1998; Wade-Woolley, 1999).

Cross-orthography research on the reading acquisition process in children is a more recent phenomenon. Some cross-linguistic studies compare how elements in the oral language and underlying cognitive processes enable or hinder children s mastery of specific word recognition and spelling skills. Other studies focus on specific elements in the writing system or in the oral language that might facilitate or impede this development. The objective of the present chapter is to review recent experimental research evidence for universal and orthography- or language-specific processes in studies on reading development in school-age children. The review focuses on three clusters of component processes, phonological processing skills, rapid automatized naming, and

morphosyntactic complexity, whose role in word recognition processes in children has been targeted in recent years.[1] The chapter includes studies comparing children speaking different languages learning to read in their first language (L1) and studies concerned with children learning to read concurrently in their L1 and/or in an L2. The review consists of two main parts. The first part focuses on research where children learning to read in different L1s are compared. Discussion of studies supporting universal notions is followed by discussion of studies providing evidence for language- or orthography-specific processes. The second part focuses on studies concerned with bilingual or L2 children. Here too, studies providing support for universal principles are described, followed by studies supporting language- and orthography-specific trends.

L1-Based Cross-Linguistic and Cross-Orthography Research in Children

Evidence for Universal Principles

Phonological processing. An extensive body of research literature on L1 reading skills development has shown that learning to read requires mastering the system by which print encodes oral language (Adams, 1990; Stanovich & Siegel, 1994). This mastery involves a variety of related skills such as establishing letter-name knowledge (Chall, 1996; Ehri, 1991) and various phonological processing skills (Adams, 1990; Wagner, Torgesen, & Rashotte, 1994). Phonological processing skills are typically assessed by measuring how individuals can conceptualize and manipulate sublexical elements (e.g., phonemes, syllables, onsets, and rimes) by deleting, counting, segmenting, or substituting elements (Shankweiler, 1999; Stanovich, 1993; Yopp, 1988). Various aspects of phonological processing assessed prior to the onset of formal reading instruction predict later reading achievement (Ehri, 1998; Elbro, 1996; Shankweiler, 1999; Torgesen, 1999). Deficits in the representation, retrieval, or analysis of phonological information are associated with persistent problems in the acquisition of word identification and decoding skills (Adams, 1990; Elbro, Borstrom, & Peterson, 1998; Shankweiler, 1999; Snowling, 1995; Stanovich, 2000; Stanovich & Siegel, 1994; Swan & Goswami, 1997; Torgeson, 1999). In addition, there is a reasonable agreement among researchers that over time the relationships between phonological processing and reading are mutually enhancing (e.g., Goswami & Bryant, 1990; Morais, Alegria, & Content, 1987; Wagner, Torgersen, & Rashotte, 1994).

Some research with children also suggests that the role of phonological processing skills in learning to read may be universal. Cross-orthography comparisons (e.g., Czech-English; Turkish-English; French-English) show that phonological awareness skills are important in

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learning to read in various alphabetic languages (Caravalos & Bruck, 1993; Durgunoglu & Oney, 1999; Oney, Peter, & Katz, 1997; Sprenger-Charolles, Siegel, & Bonnet, 1998, respectively). For example, in a study comparing Turkish and American 5 7 year old children, Durgunoglu and Oney (1999) replicated the finding reported consistently in the research literature that the ability to segment and delete phonemes in words is important for word recognition accuracy in Turkish and English. They found that knowledge of letter names and awareness of phonological units correlated with the ability of prereaders in both countries to decode words. Moreover, in both language groups children in grade one performed better on the phonological awareness tasks than children in senior kindergarten.

Relevance in nonalphabetic languages. Until recently, phonological information was considered less important in reading in nonalphabetic languages such as Chinese. This view was based largely on the assumption that Chinese orthography is a deep orthography with little correspondence between sound and symbol. Learning to read Chinese or Japanese characters was thought to be achieved primarily by visual memory and direct linkage of orthographic with semantic information. However, there is now strong evidence for generalized phonological activation not only in alphabetic languages but also in other writing systems.[2] Research has shown that early phonological skills are useful in predicting accurate word recognition in Chinese primary level children (Ho & Bryant, 1997a, b, c; Hu & Catts, 1998; McBride-Chang & Ho, 2000; Shu, Anderson, & Wu, 2000).[3] Ho and Bryant examined the development of phonological awareness of Chinese children and its relationship with their success in reading. They found that Chinese children, like English-speaking children, are able to detect relatively large sound segments (e.g., partial homophones) when they begin to acquire reading skills and that they gradually develop the ability to manipulate smaller units (e.g., rhymes and tones) (Ho & Bryant, 1997a). However, cross-linguistic comparisons indicate that Chinese children develop an awareness of initial consonants and rhymes later than their English-speaking counterparts. In other words, differences in oral and written language features of Chinese and English impact children s rate of development of phonological awareness differentially. In another study, Ho and Bryant (1997c) found that prereading phonological skills predicted children s reading performance in Chinese significantly two and three years later, even after controlling for the effects of age, IQ, and mother s education. The authors suggest that the main reason for this relationship is that phonological knowledge helps children to use the phonetic components in Chinese characters.

Support for universal aspects of reading development has also come from studies on dyslexic Chinese children. Early problems with phonological awareness in children are seen as reflecting less sharp

phoneme boundaries in speech perception (Fowler, 1991), or less distinct phonological word representations (Elbro, Borstrom, & Peterson, 1998). Some studies demonstrated the utility of training dyslexic children in various aspects of phonological processing skills (Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988). Dyslexic Chinese children have been shown to have deficits in processing phonological information just like their counterparts who learn to read in alphabetic languages (Ho, Law, & Ng, 1998; So & Siegel, 1997). Interestingly, in a recent study Ho and Ma (1999) demonstrated that training in phonological strategies is effective in improving dyslexic Chinese children s reading performance, as well.

Evidence for Linguistic- or Orthography-Specific Principles in Children s L1

Phonological processing. The fact that well developed phonological processing skills are implicated in the development of word recognition skills in different orthographies does not mean that developmental trajectories and sub-lexical processes associated with word recognition skills are identical across orthographies. This may be so because languages differ in degrees of transparency of the relations between the phonology and the orthography, and the fact that in some languages, such as Spanish and voweled Hebrew, the relation between phonemes and graphemes is much more predictable than in languages such as French and English. Treiman, Mullennix, Bijeljac-Babic, and Richmond-Welty (1995) studied the relations between spellings and sounds in C_1VC_2 words in English. They found that in English orthographic units consisting of the vowel and the final VC_2 units (i.e., rimes) had more stable pronunciations and were therefore more predictable than individual vowels or C_1V clusters. Treiman et al. maintain that the characteristics of English orthography encourage readers to use onset-rime word parsing. Based on a similar study, Peerman and Content (1997) report that in French, paying attention to rimes as well as to C_1V units enhances reading accuracy and is more conducive to accurate pronunciation of words than paying attention to individual grapheme-phoneme combinations.

Goswami, Gombert, and De Barrera (1998) conducted a series of experiments to compare the development of orthographic representation in children ranging in age from 7 9, all learning to read in their L1 (English, French, or Spanish). The researchers used three different types of pseudowords: (a) those that shared orthographic and phonological features with real words at the level of the rime (e.g., *cake-dake*); (b) those that shared only phonological features (e.g., *cake-daik*); or (c) pseudowords whose rime units could not be read on the basis of analogies with real words at the phonological or orthographic level (e.g., *faish, ricop*).

Children learning to read French or English were more accurate and faster when they read items such as *dake* or *daik,* where they could rely on familiarity with phonological and/or orthographic units, than when they had to read pseudowords such as *ricop*, where they could not rely on large-unit analogies with real words. The researchers conclude that children who learn to read in less transparent orthographies such as English and French are more likely to benefit from processing large orthographic units such as rimes than children who learn to read in highly transparent orthographies such as Spanish. They suggest that for children who learn to read in a highly transparent orthography, reliance on a letter-by-letter decoding is the most efficient reading strategy (p. 46). This strategy may lead children reading Spanish to read more slowly, but because of the high grapheme-phoneme consistency in Spanish, children can begin to read with high accuracy earlier than children learning to read French or English. On the other hand, the task facing children whose L1 is French or English is more formidable. When the pseudowords can be read on the basis of analogies with real words, their reading accuracy is enhanced. However, when they cannot rely on analogies with real word rimes, their error rates are higher than when they can rely on familiar orthographic and/or phonological elements. It should be noted that Spanish-speaking children may also rely on rime analogies, because reliance on rimes is probably an automatic process. However, because of the transparent nature of Spanish orthography, the grapheme-phoneme codes are mastered more easily by children learning to read Spanish than by children learning to read English or French.

Frith, Wimmer, and Landerl (1998) investigated word and pseudoword reading in German and English speaking 7 to 12-year-old children. At ages 7 9, English-speaking children made a higher proportion of errors than their German-speaking counterparts when reading pseudowords or words with low frequency. By age 12, both groups had equally fast decoding latencies of correctly read pseudowords, but English-speaking readers were still less accurate when decoding long and complex pseudowords. Vowels, which are the most inconsistent feature of English orthography, were often mispronounced in English, but hardly ever in German, where vowel pronunciation is consistent. In addition, word substitution errors occurred more frequently in English-speaking than in German-speaking children. This study suggests that because of low orthographic consistency children learning to read English tend to use complex and error-prone strategies in phonological recoding, whereas children learning to read in highly transparent languages such as German can carry out phonological recoding in an on-line fashion.

Some researchers argue that it is not rimes but other linguistic processes which help or hinder the acquisition of word recognition skill. Based on results of a longitudinal study of kindergarten children,

Sprenger-Charolles, Siegel, and Bonnet (1998) challenge the argument that French-speaking children rely on word analogies in early stages of learning to read. They did not find strong evidence for early use of analogies either in spelling or in reading. Instead, they found a strong reliance on grapheme-phoneme-correspondence strategies. They argue that the difference between languages at the sub-lexical level interacts with word recognition processes, maintaining that, unlike English, French syllables tend to be open, and the pronunciation of vowels is therefore not constrained by the graphemic environment. This feature of spoken and written French means that spelling-sound correspondences in French are not more predictable at the rime level than at the grapheme-phoneme-correspondence level. For this reason, they argue, grapheme-phoneme-correspondences in French are largely predictable, though perhaps not as predictable as Spanish, Italian, or German.

Rapid automatized naming. It is generally found that poor readers have a deficit in naming speed as assessed by rapid automatized naming tasks. For example, Manis, Seidenberg, and Doi (1999) demonstrated in their computational model that rapid automatized naming accounts for independent, distinct variance in predicting reading performance over and above phonemic awareness. Using a task called rapid automatized naming or RAN (Denckla & Rudel, 1976), researchers have shown that speed of naming objects, colors, and letters differentiates good and poor readers.

Yet there is some disagreement as to the extent to which rapid automatized naming is an aspect of phonological processing or is distinct from phonological processes. Researchers working within the phonological core deficit framework characterize poor readers as having deficits in various aspects of phonological processing such as phonological awareness, phonological coding in working memory, and the retrieval of phonological codes from long-term memory (Wagner & Torgesen, 1987; Wagner, Torgesen, & Rashotte, 1994; Wagner et al. 1997). They argue that poor readers deficit in rapid naming reflects an inability to retrieve phonological codes from a long-term store. Wagner et al. (1997) explain that with increasing skill and practice beginner readers become more fluent and their word recognition skills become automatized, resulting in a decrease in variability in naming speed and therefore in a decrease in the role of rapid automatized naming in explaining variance in word recognition. On the other hand, researchers such as Bowers and Wolf and their colleagues (Bowers & Wolf, 1993; Bowers, Sunseth, & Golden, 1999; Wolf & Bowers, 1999) acknowledge the importance of phonological processes in word recognition, but argue that slow naming speed is also an important characteristic of some poor readers; further, they held that this deficit does not arise from deficient phonological processing, but from a dysfunction in the precise timing

mechanism necessary for establishing unitized orthographic and phonological codes from visual input. These researchers proposed the double deficit hypothesis, according to which some readers are poor at phonological processing, others are primarily poor in naming speed, and some have a deficit in phonological processing as well as in naming speed.

Very little cross-linguistic research is available on direct comparisons of rapid naming in different languages. However, research on Dutch (de Jong & van der Leij, 1999) and German children (Wimmer, Mayringer, & Landerl, in press) suggests that rapid naming may play a more prominent role than phonological awareness in explaining and predicting individual differences in children who learn to read shallow orthographies. For example, in a recent longitudinal study of German L1 children, Wimmer et al. (2000) found that early, single naming-speed deficit measured at the beginning of Grade 1 was predictive of reading fluency at the end of Grade 3. This finding is consistent with the finding that dyslexic German children (whose primary problem is reading fluency and not reading accuracy) exhibit naming-speed deficits, but very few phonological awareness deficits (Wimmer, Mayringer, & Landerl, 1998; Wolf, Pfeil, Lotz, & Biddle, 1994). These results suggest that the relative role played by rapid naming and indices of early phonological awareness might differ across orthographies which differ in complexity. (It is yet not clear whether such differences may be related also to different approaches to reading instruction in the early grades.)

In the only cross-orthography study focusing on rapid naming available so far, Frith et al. (1998) found significant differences in word and pseudoword naming latencies between German-speaking and English-speaking children at age 8. In general, German-speaking children responded faster than English-speaking children. On short, one- and two-syllable items, the increase in reaction time from real words to pseudowords as well as from high- to low-frequency words was smaller for the German-speaking children than for the English-speaking children. On longer three-syllable items, English-speaking children performed more slowly than German-speaking children. Both language groups took more time to read long pseudowords than to read long real words. However, at age 12, there were no differences in naming latencies between the German- and English-speaking children. In other words, once children have become fluent and efficient readers, cross-linguistic differences in naming latencies for similar items disappear. This research demonstrates how differences in orthographic depth yield different trajectories associated with the development of efficient reading skills.

Morphosyntactic processing. Very little research is available on the impact of morphosyntactic aspects on word recognition in different

writing systems. The available research on processing morphosyntactic information embedded in words suggests that it is also important to study the complex way by which single-morpheme words can be transformed by language users on the basis of language-specific morphological and syntactic rules to form more complex words (Ben-Dror, Bentin, & Frost, 1995). This research indicates that the processes associated with word recognition may differ across languages not only as a function of the degree to which the phonology can be easily recoverable from the orthography, but also as a function of the nature and degree of complexity involved in unpacking words into their morphosyntactic constituents (Geva, 1999). Words in different orthographies vary in terms of morphosyntactic complexity. French is an example of a language where the orthography provides more morphological information than is available in the spoken language. For example, plurals are typically marked with the letter s added to the nouns, but the phoneme /s/ is typically not pronounced. The requirement to consider silent morphological elements in word spellings adds additional complexity to spelling. Senechal (in press) compared French primary school children s spelling of single morphome words with silent-consonant endings (e.g., *chat*) with spellings of more complex silent consonants. Children s sensitivity to the morphological information was examined. Children in grades two and four were tested on three categories of words: (a) regular words which do not include any silent letters; (b) morphological words where the final consonant could be deduced by using derivatives (e.g., *gentil, blanc*); and (c) deep words where there are no derivatives to indicate the consonants, so the silent consonant endings must be memorized (e.g., *prix, tabac*). Results showed that children spelled regular words best, and morphological words better than the deep words.

The contribution of higher order morphosyntactic processes to word recognition may be more central in the development of word recognition skills in highly inflected languages such as French, Dutch, Hebrew, or Arabic. These languages may be relatively transparent orthographically, but morphosyntactically deep (Geva, Wade-Woolley, & Shany, 1997). Other languages, such as Chinese, can be characterized as orthographically deep but morphosyntactically transparent. For example, Chinese words do not have to be unpacked to uncover grammatical elements that indicate number, gender, tense, or degree (Li & Thompson, 1981; Hoosain, 1991). Based on research on reading processes in a study of elementary school Hebrew-speaking children, Shimron (1999) suggests that perhaps in some languages skilled readers may be more tuned to semantic and syntactic sources of information, and that perhaps in some languages semantic/syntactic word decomposition takes place en route to word recognition (p. 317). In this vein, Assink and Kattenberg (1994) have shown that the ability of Dutch children to

integrate syntactic information with spelling accuracy increases gradually with age, and that higher order oral language processes contribute to orthographic knowledge.[4]

L2 and Bilingual Cross-Linguistic and Cross-Orthography Research

Evidence for Universal Principles

Phonological processing. Of the various aspects of phonological processing skills studied in the L1-based research literature, one aspect, phonological awareness, has received considerable attention in the research on second language (L2) or bilingual learners. Research focusing on normally achieving bilingual children (Bruck & Genesee, 1995; Cisero & Royer, 1995; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Geva, 2000a; Geva, Wade-Woolley, & Shanny, 1993; Sénéchal, 2000; Wade-Woolley & Geva, 2000) shows that phonological awareness skills in L1 and L2 correlate with each other, transfer cross-linguistically, and can predict word recognition and spelling development in children s L1 and L2. For example, Comeau et al. (1999) provided evidence for cross-language transfer of phonological awareness and its impact on word decoding. In their study of Anglophone children in a French immersion program, phonological awareness in English, the L1, was as strongly related to word decoding in L1 as was phonological awareness in French, the L2; likewise, phonological awareness in the L2 was as strongly related to word decoding in the L2 as was phonological awareness in the L1.

Research focusing on children learning to read in L2 (Comeau et al., 1999; Durgunoglu, Hancin-Bhatt, & Nagy, 1993; Geva, Yaghoub-Zadeh, & Schuster, 2000; Gottardo, Yaz, Siegel, & Wade-Woolley, 2000; Wade-Woolley & Siegel, 1997) shows that phonological awareness skills can be measured reliably in the L2, and that individual differences in phonological awareness measured in the L1 or the L2 predict individual differences in the development of accurate word recognition and word decoding in the L2. In a study involving ESL children with Punjabi as L1, Chiappe and Siegel (1999) demonstrated that both phonological awareness and phonological recoding discriminated between good and poor readers. Similarly, Wade-Woolley and Siegel (1997) found that phonological processing (measured with phonological decoding and phoneme deletion tasks) predict L1 and ESL children s English spelling performance. In another study involving L1 and L2 reading development, Gottardo et al. (2000) administered parallel measures of phonological, syntactic, and orthographic processing skills and reading to English as L1 children and ESL children whose L1 is Cantonese. They too found that, in spite of differences in orthography, phonological skills were correlated across L1 and L2, and phonological skills in both L1 and L2 were correlated with L2 reading. Moreover, individual differences in phonological skill in L1 and

L2 explained individual differences in reading in the L2, even though Cantonese is not an alphabetic orthography while English is. This research adds to a growing body of evidence for cross-language transfer of phonological processing.

The results of this line of research are especially noteworthy because of the strong belief among educators that oral language proficiency drives the development of word recognition skills in L2 (Geva, 2000b). This belief is supported with regard to reading comprehension (Geva & Petrulis-Wright, 2000; Geva & Ryan, 1993; Verhoeven, 2000). However, evidence coming from the studies noted above, as well as from studies focusing on children learning to read concurrently in their L1 and L2 (Durgunoglu et al., 1993; Geva & Siegel, 2000; Gholomain & Geva, 1999) shows that well developed phonological processing skills help children to read and spell in the L2, and that general linguistic proficiency in the L2 is only marginally related to accurate word recognition and decoding skills in the L2.

Rapid automatized naming. Another emerging strand of research exploring universal processes in learning to read focuses on the role of individual differences in rapid automatized naming in explaining individual differences in basic reading processes of children learning to read concurrently in two languages, as well as children learning to read in L2. Second language learners are less proficient in the L2, so it is reasonable to expect that they may be slower at naming speed tasks than their L1 counterparts. At the same time, just as individual differences in naming speed predict reading in L1, individual differences in naming speed in L2 learners predict reading in L2. For example, in a longitudinal study, Geva et al. (2000) compared precursors of word recognition skills in 6 to 8-year- old ESL children and children learning to read in English, their L1. Results indicated that vocabulary knowledge, a measure of language proficiency, was not a significant predictor of word recognition in English. Yet phonological awareness and rapid naming explained a substantial amount of variance on word recognition in English in both groups.

Another study involving bilingual Farsi-English primary level children (Gholamain & Geva, 1999) has shown that rapid naming predicted accurate word and pseudoword reading within and across-languages in grade 1 5 English-Farsi bilingual children. In that study, rapid naming of letters and colors in Farsi significantly predicted performance on the English reading tasks, and conversely, rapid naming of letters and colors in English significantly predicted word-based reading tasks in Farsi. Likewise, Geva (2000a) examined the contribution of phonological processing skills and rapid automatized naming within a longitudinal framework to performance on basic reading skills of bilingual

English-Hebrew children in Grades 1 and 2. In that study, phonological processing and rapid naming were significant predictors in both languages. However, phonological processing played a more prominent role in English, the L1, while rapid automatized naming played a more prominent role in Hebrew, the L2. This pattern of results, as well as the fact that children s basic reading skills were more accurate in Hebrew, a language with a shallow orthography, suggest that the universalist/transfer and orthography-specific frameworks should be considered in tandem, and that sources of individual differences such as phonological processing and naming speed interact with orthographic complexity and exert a different influence on reading acquisition in different languages. Note that this conclusion echoes the one reached by Frith et al. (1998) with regard to German children. At the same time, these studies of ESL and bilingual children suggest that, even in the absence of L2 proficiency, it is possible to reliably measure naming speed; they further imply that performance on naming tasks in the L2 may be a rather sensitive index of individual differences in word recognition, not only in the L2 but also in the L1, probably because in the weaker language children are less likely to have reached automaticity.

Evidence for Language- or Orthography-Specific Principles in L2 Learners

Phonological processing. Interest in studies focusing on the role of specific phonological processing skills in learning to read in different L2s is a rather recent phenomenon. As noted earlier, evidence suggests that phonological awareness skills measured in L1 and L2 correlate with each other and can predict word recognition and spelling development in children s L1 and L2. For example, Geva (2000a) examined the extent to which similar processing demands (phonological awareness, rapid naming) might underlie correlations between parallel first language (English) and second language (Hebrew) decoding and word recognition skills within a longitudinal framework. Both phonological processing and rapid naming were significant predictors of word recognition and pseudoword reading. However, phonological processing played a more prominent role in English, the L1, and rapid naming played a more prominent role in Hebrew, the L2. Geva suggests that perhaps phonological processing skills are relevant for a shorter period when children begin to learn to read in a transparent orthography, such as voweled Hebrew, than when they learn to read in a more opaque writing system such as English.

Languages vary in the linguistic units that are salient and these may affect the pattern of development in phonological awareness (Caravalos & Bruck, 1993). One study relevant here was conducted by Durgunoglu and Oney (1999) who asked how Turkish children s

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understanding of the internal structure of spoken words might be influenced by two factors: (a) aspects of phonetic complexity at the syllabic level; and (b) changes to the internal structure of spoken Turkish words as a result of the requirement to attend to vowel harmony restrictions typical of Turkish. Vowel harmony restrictions in Turkish require language users to constantly monitor subword linguistic units. Turkish words are also made more complex morphemically due to post-inflections. Based on comparisons of American and Turkish first grade children, Durgunoglu and Oney conclude that cross-linguistic differences in development of phonological awareness in young children reflect the characteristics of such spoken language parameters.

The rate of acquisition of basic reading skills in L2 or bilingual children is not identical across different orthographies, and there is evidence to suggest that it may be affected by differences in orthographic depth (Frith et al. 1998; Geva & Siegel, 2000; Geva et al. 1993; Gholamain & Geva, 1999). For example, in three separate studies focusing on children with English as L1, Geva and her colleagues (Geva & Siegel, 2000; Geva et al. 1993, 1997) found that word recognition and pseudoword decoding skills in L1 (English) and L2 (Hebrew) were highly correlated, but that contrary to what might be expected, accuracy rate was higher in Hebrew, the L2. Moreover, children s error patterns in English and Hebrew were orthography-specific. The authors maintain that these differences reflect the fact that decoding voweled Hebrew can be executed in a linear manner, while English cannot (Katz & Frost, 1992).

Evidence for L1-specific influence has been noted not only with regard to the effect of orthographic depth on the development of decoding and word recognition accuracy but at an intra-word, micro level. For example, it is productive to examine at a micro-linguistic level the role that the availability or absence of specific phonological representations in the learners L1 might play in the acquisition of specific elements in the L2. A recent example of this approach comes from a study by Wang and Geva (1999) who studied spelling development in Chinese ESL children. They focused on the spelling of words containing the phonemes / / and / / that do not appear in Chinese phonology. On an auditory discrimination task, 6- to 7-year-old Chinese ESL children had trouble in discriminating the phoneme th from neighbors such as /v/ and /z/. Error analyses showed that in spelling words such as ship and teeth in Grade 1, these ESL learners made significantly more predictable L1-specific phonological errors than their classmates who were English speaking children. Over time, as their English proficiency improved, the frequency of such L1-specific errors gradually diminished, and by the end of Grade 2 the spellings of the normally achieving Chinese ESL children on these items resembled that of their English-as-L1 counterparts.

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Rapid automatized naming. Very little research is available on the role played by rapid naming in L2. One exception is a longitudinal study by Geva (2000a) which focused on bilingual English-Hebrew children. Whether tested in English or Hebrew, phonological processing tasks and rapid naming of objects, letters, or colors, were significant predictors of word recognition and pseudoword reading in Grade 1 in both languages. Phonological processing continued to play a significant role in predicting basic reading skills in English in Grade 2. However, by Grade 2 rapid automatized naming continued to be a significant predictor of Hebrew (the L2) reading, but phonological processing skills ceased to be significant in predicting accurate reading in Hebrew.

Wimmer et al. s (in press) study also provides tangential evidence for orthography-specific processes concerning the role of rapid naming. They report that when German children had to read foreign (i.e., English) words, both a phonological awareness deficit and naming-speed deficit predicted difficulties in accurate reading. However, when the same children had to read German words, deficits in phonological awareness did not predict reading accuracy or reading fluency, while naming-speed predicted reading fluency (but not reading accuracy). Wimmer et al. suggest the one difference between the German-based findings and English-based findings has to do with the developmental locus of the impairments. In children learning to read English, the negative effect of a phonological awareness deficit occurs early and affects the acquisition of phonological coding in word reading, and further slows down the build-up of the orthographic lexicon. In the case of regular orthographies such as German, the early acquisition of phonological coding in word reading develops more smoothly. In these languages the negative effects of factors which underlie the early phonological awareness deficit and the early naming-speed deficit occur later, when reading fluency and orthographic spelling become important.

Morphosyntactic processing. Evidence for cross-orthography differences that may influence the ease with which spelling develops comes from a recent study by Cormier and Landry (2000) of French immersion children in grades 1 3. French is a more opaque language with regard to the morphology of the plural form than English. In English, with a few exceptions, plurals are represented as either *s* or *es*, and are always articulated. In French there are three forms *s*, *x*, and *aux* for marking the plural of nouns. The French *s* and *x* are unarticulated, as is the *-x* in *aux*. The researchers studied the development of sensitivity to markers of plural morphology in English-speaking children's spelling in French immersion classes in Canada. Their results confirm the observation that phonological mechanisms are at work when children begin to learn to read and write in L1 or L2 involving alphabetic codes. Moreover, they found that children in French immersion programs have

difficulties in spelling the silent morphemes marking plurality in French, whereas spelling of voiced or regular marking is more accurate. They also found that auditory analysis shared a substantial amount of variance with spelling, whereas syntactic awareness was only related to the spelling of plural morphemes in English. In a second study, French-speaking children also performed poorly on spelling the irregular *aux*. In other words, difficulty with *aux* is common to children learning to spell in French, whether it is their L1 or their L2. Specific phonological and orthographic characteristics of French plural morphemes hinder the development of accurate spelling of plural forms in French, regardless of whether it is children s L1 or L2, and there is an advantage to learning to spell articulated morphemes over unarticulated morphemes.

Conclusion

Languages vary in the sub-lexical linguistic units which are salient when children learn to read. In some languages the syllable is a salient unit whereas in other languages sub-syllabic units such as onsets and rimes, consonant clusters, and morphosyntactic elements such as plural markers are salient. At the same time, some languages are associated with orthographies that are transparent and easy to decode. Other languages are associated with more opaque or deep orthographies. When children learn to read, characteristics of the spoken language interact with characteristics of the orthography. One of the conclusions one can draw from this review is that phonological awareness plays a significant role in the acquisition of word recognition skills in different alphabetic and nonalphabetic languages. When elements in the spoken language map easily onto the writing system, the learning curve may be steeper than when the spoken language does not map easily onto the orthography. In other words, the impact of phonological awareness may prevail longer in less transparent orthographies than in shallow orthographies.

Cross-orthography and cross-linguistic interest in the role of rapid naming has emerged only recently. This cognitive-linguistic process exerts its role regardless of differences in linguistic or orthographic complexity and often appears to coexist with phonological awareness. Moreover, a review of research available to date suggests that rapid naming is a significant predictor in learning to read in different L1s as well as when children learn to read in L2. However, it appears to play a more dominant role relative to phonological awareness in studies involving transparent orthographies than it does in studies involving opaque orthographies.

Prior research on reading development in bilingual children has indicated that individual differences in L1 and L2 basic reading skills can be partially accounted for by individual differences in phonological

processing skills, verbal memory, and rapid naming, and that these skills transfer from L1 to L2 and from L2 to L1. The present review suggests that (a) these linguistic and cognitive measures can predict the development of reading skills in L1 and L2 children in various languages; and (b) individual differences in such prerequisite skills can be indicative of smooth or problematic acquisition of ESL reading skills, regardless of oral language proficiency.

However, task demands associated with learning to read in different orthographies vary and yield steeper or more moderate learning slopes. Differences related to orthography-specific characteristics may hinder or facilitate the development of specific skills. Children may even read more accurately in their L2 than their L1 when the L2 is associated with a shallow orthography. Similarly, it seems that underlying prerequisite skills such as phonological awareness may be more transient when normally achieving children begin to learn to read in a transparent orthography than when they learn to read in a more opaque writing system such as English. Moreover, specific linguistic elements may challenge the novice learning to read in an L1 or L2. Yet caution should be exercised in attributing persistent difficulties in learning to decode and spell to difficulties with isolated and demanding linguistic elements. Regardless of the language and orthography combinations studied, children develop reading strategies that help them to read.

Notes

1. The scope of this review does not allow us to address other aspects of word recognition such as orthographic knowledge, lexicality, and visual processes. For recent research evidence on lexicality effect in Chinese children see Shu, Anderson, and Wu (2000).

2. With regard to Chinese the debate currently concerns the extent to which visual processes involved in character recognition are mediated via verbal processes (see, for example, Hu & Catta, 1998; Huang & Hanley, 1994; McBride-Chang & Ho, 2000).

3. Recent adult-based studies also show that phonological processing takes place in Chinese word recognition (Perfetti & Tan, 1998; Perfetti & Zhang, 1991, 1995; Perfetti, Zhang, & Berent, 1992; Tan, Hoosain, & Siok, 1996; Weeks, Chen, & Lin, 1998; see Tan & Perfetti, 1998; for a review).

4. Relatedly, Shimron and Sivan (1994) have shown that the resources required to unpack inflected words in Hebrew text exert a powerful influence on the reading of Hebrew by adult native speakers.

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This article reports on a 2-year longitudinal study that investigated the development of basic reading skills in two cohorts of grade 1 English-as-a-second-language and English-as-a-first-language primary level children. Contrary to what might be expected, measures of vocabulary knowledge in English and nonverbal intelligence were not significant predictors of word recognition in either language group. However, individual differences in phonological awareness and in rapid naming of letters, both measured in English, explained substantial amounts of variance in word recognition performance at intervals of 6 months and 1 year later in both groups. Results indicate that, in spite of the absence of fully developed proficiency in the L2, it is feasible to use these measures as reliable indicators of normal and problematic development of basic reading skills for children learning to read in the L2.

Goswami, U., Gombert, J., & Barrera, L. (1998). Children s orthographic representations and linguistic transparency: Nonsense word reading in English, French, and Spanish. *Applied Psycholinguistics, 19,* 19 52.

These researchers used pseudowords that share orthographic and phonological features with real words at the level of the rime (e.g., *cake-dake*), that shared only phonological features (e.g., *cake-dake*), or pseudowords whose rime units could not be read on the basis of analogies with real words at the phonological or orthographic level (e.g., *faish, ricop*). Children learning to read French or English were more accurate and faster when they read items such as *dake* or *daik*, where they could rely on familiarity with phonological and/or orthographic units, then when they had to read pseudowords such as *ricop*, where they could not rely on large-unit analogies with real words.

Ho, C. S.-H., & Bryant, P. (1997c). Phonological skills are important in learning to read Chinese. *Developmental Psychology, 33,* 946 951.

This study found that phonological skills assessed in young prereaders significantly predicted children s reading performance in Chinese two and three years later, even after controlling for

effects of age, IQ, and mother s education. The authors suggest that the main reason for this relationship is that phonological knowledge helps children to use the phonetic components in Chinese characters.

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