LEARNING A SECOND LANGUAGE

Min Wang

INTRODUCTION

In this age of globalization, the need for communication in a second or foreign language has dramatically increased (Committee for Economic Development, 2006). The number of English as a Second Language (ESL) learners in the world is estimated to surpass the number of English monolingual learners (Crystal, 2012). In the United States, from the 1997–1998 school year to the 2008–2009 school year, the number of ESL learners enrolled in public schools increased from 3.5 million to 5.3 million, or by 51 percent (National Clearinghouse for English Language Acquisition, 2011). The percentage of public-school students in the United States who were ESL learners was higher in school year 2012–2013 (9.2 percent, or an estimated 4.4 million students) than in 2002–2003 (8.7 percent, or an estimated 4.1 million students) (National Center for Education Statistics, 2015). Many ESL children have difficulty acquiring even the most basic English literacy skills and are therefore at risk for reading difficulties and school drop-out (see August & Shanahan for a detailed review, 2008). Second language learning has become one of the most important components of our educational system. Understanding the important theoretical issues and empirical evidence in research on second language learning is critical for improvement of second language education in both home and school settings.

Learning a language entails learning to comprehend and produce different levels of linguistic information, including word, phrase, sentence, and text level information. Word learning is an important first step in learning a language. Learning to read and write at the text level, on the other hand, requires not only word level knowledge but also sentence level knowledge, as well as experience and knowledge of the world. This chapter focuses on word level learning among second language learners, both adults and children. The three major constituents in learning a word are phonological, orthographic, and meaning-related processes (e.g., Plaut, McClelland, Seidenberg, & Patterson, 1996; Seidenberg & McClelland, 1989). The key development in word learning is the improvement of the qualities of orthographic, phonological, and meaning representations of a given word. In other words, learners develop fully specified and precise phonological, orthographic, and semantic knowledge about the word.
In this chapter, the nature and importance of each of the three constituents—phonology, orthography, and meaning—in learning a second language are examined. Meaning here is considered in terms of morphological information (i.e., units of meaning that comprise a given word). Indeed, morphological information is critical in processing meaning information in complex words (e.g., Shu, McBride-Chang, Wu, & Liu, 2006).

Phonological awareness generally refers to the ability to perceive and manipulate sound units of spoken language (Goswami & Bryant, 1990). According to Treiman and colleagues’ linguistic structure hypothesis (e.g., Bruck, Treiman, & Caravolas, 1995; Treiman, 1995; Treiman, Mullenix, Bijeljac-Babic, & Richmond-Welty, 1995), the syllable is at the top of the hierarchical structure of the English phonological system; it is the largest and most accessible unit. The phoneme is at the bottom of the hierarchical structure; it is the smallest unit and is a later-developing one for children. Between syllables and phonemes lie intermediate onset and rime units. Studies demonstrate the importance of processing both large and small phonological units for reading skills. For example, processing of relatively large phonological units in tasks such as rhyme and alliteration has been shown to be important for promoting young children’s learning to read (e.g., Bradley & Bryant, 1983; Bryant, MacLean, Bradley, & Crossland, 1990; Goswami & Bryant, 1990; see Bryant, 2002, for a review). Other studies have suggested that children’s skills at processing the smallest phonological units (i.e., phonemes) are powerful predictors of individual differences in learning to read and that training children in phonemic-level skills can benefit their later reading progress (e.g., Byrne & Fielding-Barnsley, 1995; Hulme et al., 2002; Lundburg, Frost, & Petersen, 1988; Muter, Hulme, Snowling, & Taylor, 1998). The role of phonological awareness in learning to read has received the most attention in the past two decades. Relatively less research has been devoted to studying the roles of orthographic awareness and morphological awareness.

Orthographic knowledge generally refers to individuals’ “understanding of the conventions used in the writing system of their language” (Treiman & Cassar, 1997, p. 631). One important orthographic skill is children’s ability to detect acceptable and unacceptable letter sequences and their relation to letter positions in words (Cassar & Treiman, 1997; Treiman, 1993). For example, Cassar and Treiman (1997) found that by late kindergarten, children have acquired some knowledge of the acceptable form and position of consonant doublets. These young children preferred spellings with final doublets (e.g., baff) to those with beginning doublets (e.g., bbaf). They also preferred spellings with acceptable doublets (e.g., yill) to those with unacceptable ones (e.g., yilh). Some researchers have argued that phonological and orthographic knowledge mutually facilitate each other and that grapheme-phoneme knowledge provides young readers with a powerful tool to bind the spelling patterns of individual and multiple letters with their pronunciations in words (e.g., Ehri, 1991, 1998). Empirical research suggests that this orthographic knowledge may contribute significantly to word recognition skill in children over and above phonological factors (e.g., Cunningham, Perry, & Stanovich, 2001; Cunningham & Stanovich, 1990, 1993).

Morphological knowledge generally refers to an understanding of the units of meaning within a complex word and the ability to reflect on and manipulate the meaning units (Carlisle, 1995). There are three major types of morphological structures in English: compound, inflection, and derivation. Compound morphology is concerned with the formation of new words by combining two or more stem morphemes (e.g., cupcake).
Inflectional morphology refers to the formation of new words in order to express grammatical features, such as singular/plural form (e.g., *one flower → two flowers*) or past/present tense (e.g., *explain → explained*). Derivational morphology refers to the formation of new words by adding morphemes to change the meaning of a stem morpheme without reference to the specific grammatical role a word might play in a sentence (e.g., the verb *teach* becomes the noun *teacher* by adding a suffix—*er*; however, the adjective *possible* remains an adjective, *impossible*, after adding a prefix-*im*). Children acquire these three types of morphological awareness at different rates. Acquisition of inflectional and compound morphology is completed earlier than derivational morphology and has been related to reading progress during the first and second grades (Berko, 1958). Mastery of derivational morphology emerges later and takes longer, and has been shown to contribute to reading skill in later primary grades (e.g., Nagy, Berninger, & Abbott, 2006; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003).

There is a close relation between morphological and phonological awareness. Researchers such as Carlisle and Nomanbhoy (1993) found that both phonological and morphological awareness contributed significantly to word reading in first graders, but the contribution of phonological awareness was greater. These results suggest that phonological sensitivity may provide a foundation for morphological learning. Since each morpheme is represented by a cluster of sounds, children must learn to segment the speech stream and identify those recurring sound units before they can identify the sound units that bear certain linguistic functions. Since two of the same morphemes can share the same or similar phonology, it is also possible that the observed morphological effect is indeed a sort of phonological effect.

Concerning learning a second language, recent research has focused on the importance of the aforementioned awareness of phonology, orthography and morphology in second language reading. Cross-language transfer, a concept used to refer to general facilitation from one language to the other language in second language learners, is an important theoretical framework in second language research (e.g., Durgunoglu, Nagy, & Hancin-Bhatt, 1993). Recent research has accumulated overwhelming evidence for cross-language facilitation from phonological and morphological awareness in one language to word reading in a second language. More importantly, these studies have shown that morphological awareness is important for reading a second language over and above phonological awareness (e.g., Deacon & Kirby, 2004; Deacon, Wade-Woolley, & Kirby, 2007).

A large volume of literature has documented the effects of differences in orthographic depth on learning to read and spell in different orthographies (e.g., Cossu, Shankweiler, Liberman, Tola, & Katz, 1988; Durgunoglu & Oney, 1999; Frith, Wimmer, & Landerl, 1998; Geva, 1995; Geva & Siegel, 2000; Goswami, Gombert, & Barrera, 1998; Shimron, 1999; see Ziegler & Goswami, 2005, for a review). For example, readers of a shallow orthography demonstrate an advantage in phonological awareness over readers of a deep orthography (Cossu et al., 1988). Goswami et al. (1998) found that children who learn to read in a less transparent orthography such as English are more likely to benefit from processing large orthographic units such as rimes than children who learn to read in a highly transparent orthography such as German. Native readers of Chinese, a logographic writing system, rely on syllable-level rather than phoneme-level phonological information and, more importantly, visual-orthographic information in character recognition (e.g., Chen, Flores d’Arcais, & Cheng, 1995; Perfetti, Liu & Tan, 2005; Perfetti & Tan, 1998; Zhou & Marslen-Wilson, 1996). This review examines
how cross-language differences in terms of orthographic depth have cognitive consequences for learning to read in a second language.

In second language research, cognitive researchers are interested in whether or not the two languages share an integrated lexicon. Models such as the Bilingual Interactive Activation Model (BIA) support an integrated bilingual lexicon in which the lexical access is non-selective (Dijkstra & Van Heuven, 1998). Models such as the Revised Hierarchical Model (RHM) suggest that the two languages may have both shared semantic representation and separated lexical form representation (including phonology and orthography; Kroll & Stewart, 1994). All of these models are based on research on adult second language learners exclusively, and are reviewed briefly in this chapter. These models have great potential to be extended to bilingual children.

In summary, this chapter provides an overview of the nature and importance of the three major constituents—phonology, orthography, and morphology—in learning a second language. Three major theoretical frameworks, cross-language transfer, cognitive consequences of cross-language orthographic depth differences, and bilingual mental lexicon, are introduced, and empirical research guided by each of these frameworks is reviewed. Future research directions are discussed.

**HISTORICAL OVERVIEW**

Cummins’s (1979, 1986, 1991) Linguistic Interdependence Hypothesis proposes that once an individual develops skills in the first language, he or she is able to transfer those skills to the second language. Although this hypothesis was not detailed enough to allow for empirical testing in its early form, recent second language researchers have refined and modified this hypothesis in the context of learning to read a second language (e.g., Comeau, Cormier, Grandmaison, & Lacroix, 1999; D’Angiulli, Siegel, & Serra, 2001; Geva & Siegel, 2000). The cross-language transfer framework has been greatly used in an emerging line of bilingual reading research that addresses the relations among phonological, orthographic, and morphological awareness and reading skills across various languages. For example, there is a great deal of evidence supporting a strong facilitation from first language phonology to second language reading in research in Canada on English-speaking children learning to read French (e.g., Comeau et al., 1999; Deacon & Kirby, 2004; Deacon, Wade-Woolley, & Kirby, 2007), Italian (e.g., D’Angiulli et al., 2001), and Hebrew (Geva & Siegel, 2000), and in the US on Chinese and Korean children learning to read English (e.g., Wang, Park, & Lee, 2006; Wang, Perfetti, & Liu, 2005).

In this line of research, children’s language and reading skills are tested in both first and second languages. Cross-language prediction between first language phonological, orthographic, and morphological skills and reading outcome in the second language are the focus of this line of research. The relations between phonological, orthographic, and morphological skills and reading outcome within the first and second language are also addressed. For example, a large body of literature has suggested that children’s skill at processing the smallest phonological units (i.e., phonemes) is a powerful predictor of individual differences in learning to read and that training children in phonemic-level skills can benefit their later reading progress. Second language researchers have attempted to address whether this is also true in acquiring a second language. However, a more important question in this line of research is whether there is cross-language prediction from phonology, orthography, or morphology in the first language to reading outcomes in the second language.
Although early second language researchers focused on learning a second language from a more universal perspective, in which second language learning follows a similar process for learners with different first language backgrounds, recent researchers have started to acknowledge the need to take into account the role of different first language backgrounds on the way a second language is learned. This line of research is greatly influenced by a theoretical framework called Orthographic Depth Hypothesis (e.g., Katz & Frost, 1992), which originated from monolingual reading research. This hypothesis posits that orthographies differ in terms of their degree of transparency in mapping between graphemes to sounds. A growing number of second language researchers have since given attention to the cross-language differences in terms of orthographic depth between the first and second language in studying second language reading. The cognitive consequences of cross-language orthographic depth differences have been mostly shown among second language learners with a logographic first writing system (e.g., Akamatsu, 1999, Holm & Dodd, 1996; Jackson, Lu, Ju, 1994; Wang & Geva, 2003; Wang & Koda, 2005; Wang, Koda, & Perfetti, 2003). In this line of research, English as the second language was the language under investigation; second language learners are more typically compared with native English-speaking counterparts. In some studies, second language learners with a nonalphabetic first language versus those with an alphabetic first language background are compared.

Since the 1990s, cognitive scientists who are interested in bilingual language processing have proposed a set of bilingual processing models for understanding the adult bilingual mental lexicon. These models are largely the extensions of monolingual-based interactive models (e.g., McClelland & Rumelhart, 1981). The Bilingual Interactive Activation Model (e.g., Dijkstra & Van Heuven, 1998) is such a model, which claims that the bilingual lexicon is integrated and that lexical access in non-selective. Another set of bilingual lexicon models (e.g., Word Association, Conceptual Mediation, and Revised Hierarchical Model) were proposed, however, to argue for an integrated but simultaneously separated bilingual lexicon, depending on whether it is the representation of lexical form information or semantic/conceptual information (e.g., Kroll & Stewart, 1994; Potter et al., 1984).

THEORETICAL FRAMEWORK

Cross-Language Transfer

Built upon earlier theoretical work by Cummins (1979, 1986, 1991), cross-language transfer is a widely used framework for second language research. In the current literature, the term cross-language transfer has been used in a general way to indicate the tendency of learners to utilize knowledge and experience gained from one language in learning another language (Kuo & Anderson, 2007). Some researchers suggest that cross-language transfer arises from the shared or overlapping features of first and second languages (e.g., grapheme-phoneme correspondences), and such transfer can occur between typologically related languages such as Spanish and English (e.g., Cisero & Royer, 1995).

Other researchers suggest that bilingual facilitation can occur at a more abstract or systemic level. Children are able to apply their metalinguistic skills in one language even to a typologically distant language, as in moving between English and Chinese (e.g., Kuo & Anderson, 2007; Wang et al., 2005). One of the powerful ways to demonstrate cross language transfer in educational psychology research is to reveal the
additional variance explained by a target language measure in one language (e.g., score on a phonological task in the first language) to reading outcomes in another language over and above the within-language predictors (e.g., score on a within-language phonological task in the second language).

Cognitive Consequences of Cross-Language Orthographic Depth Differences

Reading in different orthographies entails different phonological and visual-orthographic processes. One major theoretical framework for discussing differences in reading among alphabetic language systems is the Orthographic Depth Hypothesis (see Frost, 1994; Katz & Frost, 1992). According to this hypothesis, there are differences among alphabetic orthographies in terms of how regularly orthography and phonology can be mapped onto each other. In shallow orthographies, such as Spanish, Italian, and Serbo-Croatian, there is a relatively simple one-to-one correspondence between letters and sounds.

Conversely, in deep orthographies, such as English, there is a more complex or opaque relation between letters and sounds. The orthographic depth framework can be extended to nonalphabetic writing systems such as Chinese. Chinese is often referred to as a deep orthography (e.g., Hu & Catts, 1998). It is considered a logographic system, or, more accurately, a morphosyllabic system (DeFrancis, 1989; Mattingly, 1992; Perfetti & Zhang, 1995). Second language researchers have argued that the linguistic and orthographic differences among different language systems affect second language reading acquisition in adults, and that learners apply their strategies from the first language to the second language (Akamatsu, 1999; Haynes & Carr, 1990; Koda, 1994, 1999, 2000; Verhoeven, 1990; Wade-Woolley, 1999). Recent research has also shown some evidence among young ESL children of the effect of cross-language orthographic depth differences (e.g., Sun-Alperin & Wang, 2008; Wang & Geva, 2003).

Bilingual Mental Lexicon Models

Currently, all of the Bilingual Mental Lexicon Models are derived for the purpose of explaining adult second language learning. In general, the majority of these models agree that the two languages have shared semantic representations but separate lexical form representations, for example, English word horse and Chinese word 马 have shared semantic representation but entirely different phonological and orthographic forms. The main difference among these models is how words in second language are mapped to their respective meanings. The three major models are the Word Association Model, Concept Mediation Model, and Revised Hierarchical Model (see Figure 7.1). According to the Word Association Model (Figure 7.1a), words in the second language are linked to their translation equivalents in the first language, and there are no direct links between the second language words and their meanings. Consequently, the second language words access their meanings via their first language translation equivalents. According to the Concept Association Model (Figure 7.1b), however, the second language words are directly linked to concepts; there are no direct links between the second language words and their translation equivalents in the first language. Further, the second language words access their meanings directly, without the activation of their translation equivalents in the first language.
Given the differences between beginning second language learners and proficient bilinguals, Kroll and Stewart (1994) proposed the Revised Hierarchical Model, in which both word and concept associations are allowed (Figure 7.1c). In order to acquire the meaning of a new word in the second language, learners must depend on the translation equivalent of the word in the first language. Thus, there is a strong lexical link mapping second language to first language and a weak link mapping first language to second language. Initially, there was no link between the second language words and concepts, but the link begins to develop with increasing second language proficiency. The strength of links becomes more balanced when second language proficiency improves.

**CURRENT TRENDS AND ISSUES**

**Cross-Language Phonological and Orthographic Transfer**

Cross-language transfer of phonological skills in one language to reading in the other is the most studied topic in the line of research on cross-language transfer among second language or bilingual children. Durgunoglu, Nagy, and Hancin-Bhatt (1993) tested first-grade Spanish-speaking children who were enrolled in a transitional bilingual education program in the US on both Spanish and English reading skills. Their results demonstrated that children who could perform well on Spanish phonological awareness tasks were more likely to be able to read English words and pseudowords than were children who performed poorly on these tasks. The phonological awareness tasks included different linguistic units (the onset-rime and the phoneme) in Spanish words. Moreover, phonological awareness was a significant predictor of performance on word recognition tests both within and across languages (Cisero & Royer, 1995). Gottardo (2002) also found that Spanish phonological awareness explained the highest proportion of variance in English word reading for English-Spanish bilingual speakers. Several studies examining the effect of Spanish phonological processing on English word reading have echoed these findings (e.g., Lindsey, Manis, & Bailey, 2003; Manis, Lindsey, & Bailey, 2004). Similar findings were also shown in studies of native-English speaking children learning French in their French immersion programs in Canada (e.g., Comeau et al., 1999).

Limited research has been done on cross-language orthographic transfer. Wang, Perfetti, and Liu (2005) investigated cross-language phonological and orthographic...
transfer simultaneously, in one study among a group of Chinese-English bilingual children in grades 2 and 3 of their English and Chinese classes in the US. Comparable experiments in Chinese and English were designed to focus on phonological and orthographic processing. Onset, rime and phoneme awareness tasks were administered in English, while onset, rime and tone awareness tasks were administered in Chinese. The orthographic task in both English and Chinese was a choice task in which the children were asked to judge which of the two stimuli was more like a real English word or Chinese character. This task tapped into children’s sensitivity to various orthographic patterns in English and Chinese. For example, in English, ff does not occur at the beginning of a word, so the correct choice for the pair of stimuli ffef and bffe is bffe. In Chinese, in the pair 岷 and 笑, 笑 contains a legal radical in an illegal position. Word reading skill in both writing systems was tested.

The critical finding was that Chinese tone skill predicted English pseudoword reading over and above English phonemic processing skill. This finding suggests that even when children learn to read in two different writing systems, there is a level of phonological transfer (see Figure 7.2a). Tone is a suprasegmental feature of Chinese phonology that does not occur in the English phonological system. The four Chinese tones attached to the same syllable segment carry different lexical information. For example, the only difference between the syllable /man3/ and /man4/ is the tone. The first syllable with tone 3 corresponds to 滿 which means full, and the second syllable with tone 4 corresponds to 慢 which means slow. The predictive power of Chinese tone awareness for English pseudoword reading was interpreted as reflecting some shared phonological sensitivity in learning to read Chinese and English. Chinese tone and English pseudoword reading both require children’s attention to spoken word forms and their constituents—that is, the phonemes for English and tones for Chinese. The authors also suggested an alternative interpretation that a more general auditory processing skill is an underlying factor.

In a parallel study with Korean-English bilingual children in the US (Wang, Park, & Lee, 2006), Korean phonemic skill was found to contribute to English pseudoword reading after controlling for within-English variables, including English phonemic skill (see Figure 7.2b). In both studies, no significant contribution was found from orthographic skill in one language to reading skill in the other. For Chinese-English bilingual children, this suggests that there is a writing system-specific component in biliteracy acquisition in Chinese and English. This result reflects the contrasts in mapping principles and visual forms across the two writing systems. The consequence of these contrasts was difficulty in transfer of orthographic skills from Chinese to English. Wang and colleagues replicated these findings in a subsequent study that addressed the relation between phonological, orthographic, and morphological awareness simultaneously among Chinese-English bilingual children (Wang, Yang, & Cheng, 2009). For Korean-English children, this result reflects the differences in visual forms and possibly in orthographic transparency between the two languages. In summary, findings from the Chinese-English and Korean-English biliteracy studies suggest that there may be a joint function of shared phonological processes and language-specific orthographic skill. These findings are important in delineating the universal and language-specific processes involved in learning to read two languages simultaneously.

Tong and McBride-Chang (2010) used a slightly different orthographic task from the one used by Wang et al. (2005) and found Chinese visual-orthographic skills predicted English word reading even after accounting for phonological and morphological
awareness in 8- to 11-year-old Cantonese-L1 children in Hong Kong. Their task required children to distinguish legal and illegal character components as compared to the one used by Wang et al. (2005) that required children to distinguish legal and illegal characters that contain legal or illegal components. The difference in the pattern of the relation between orthographic skill and reading from the aforementioned two studies might be due to the fact that in comparison to the Chinese children in the US who learn to read Chinese via Pinyin system, which transcribes the pronunciation of characters phonetically, Hong Kong children are taught in school to read both Chinese and English using a “look and say” strategy that emphasizes visual analysis for word recognition.

In contrast to the non-significant contribution of Chinese or Korean orthographic awareness to English reading in Chinese and Korean children as shown in Wang and colleagues’ work, Sun-Alperin and Wang (2011) showed that Spanish orthographic awareness predicted English real word and pseudoword reading in Spanish children, after taking English phonological, orthographic awareness and Spanish phonological awareness into consideration. It is possible that the similarities between English and Spanish orthographies facilitated Spanish-speaking children’s performance on English real word and pseudoword reading, even though Spanish orthography is more transparent. Indeed, Spanish is more similar to English than is Korean; Spanish and English not only share the alphabetic principle, but are also based on a linear system with the Roman alphabet. The two orthographies share many similar features. For example, several of the shared graphemes between Spanish and English map onto the same phonemes, such as the /s/ as in *sit* (English) and *seis* (“six” in Spanish) or the /m/ as in *man* (English) and *mano* (“hand” in Spanish). Further, recent research showed that English orthographic skills in English-L1 children attending French immersion in Canada predicted L2 French word reading (Deacon, Wade-Woolley & Kirby, 2009). Likewise, French-L1 grade 8 children’s orthographic skills contributed unique variance to their L2 English orthographic skills in France (Commissaire, Duncan & Casalis, 2011).

Therefore, it seems that cross-language transfer of phonology to reading is universal across different languages. Branum-Martin, Tao, Garnaat, Bunta, and Francis (2012) provided a more detailed discussion in a recent meta-analysis about cross-language transfer of phonological awareness in bilingual children that is dependent upon languages, age and psycholinguistic grain size involved. However, cross-language transfer of orthography to reading may be language-specific. It is difficult to transfer orthographic knowledge to reading across different writing systems such as Chinese and English (but see Tong & McBride-Chang, 2010) as well as between different alphabetic scripts such as Korean and English. Nonetheless, such transfer is more likely to occur.
across similar scripts within the same alphabetic writing system such as Spanish and English, French and English. The findings of cross-language phonological transfer in second language reading obviously have important educational implications. Classroom teachers need to pay attention to second language learners’ strong first language skills and be aware that these strong first language skills can be transferred to second language learning. In other words, teachers can make full use of the students’ first language skills as a facilitator or springboard to develop their second language literacy skills (see Durgunoglu, 2002, for discussion).

Cross-Language Morphological Transfer

Very limited research has so far addressed the transfer between morphological awareness in one language and reading in another language. Wang, Cheng, and Chen (2006) examined the contribution of morphological awareness to Chinese and English reading skill after taking into account phonological awareness among Chinese-English bilingual children in grades 2 to 4. Two tasks assessing morphological awareness were used, a compound structure task and a derivational morphology task, in both Chinese and English. In the compound structure task, the child was presented with a riddle followed by two choices. The child’s task was to choose the better answer to the riddle. For example, “Which is a better name for a bee that lives in the grass: a grass bee or a bee grass?” In the derivational awareness task, children were asked to complete a sentence based on a clue word. For example, for the clue word farm, the sentence to be completed was, “My uncle is a _____” (farmer).

Results showed that English compound awareness contributed to Chinese character reading and reading comprehension after taking into account Chinese-related variables. It seems that bilingual children are able to apply their knowledge about shared morphological structure from one language to reading in another language. In a parallel study on Korean-English bilingual children (Wang, Ko, & Choi. 2009), morphological awareness of derivational structure in one language uniquely predicted a significant amount of variance in reading real words in the other language, suggesting that morphological awareness facilitates word reading across different alphabetic orthographies.

Bindman (2004) studied the cross-language relation between morphological awareness and reading skill in 6- to 10-year-old native-English speakers learning Hebrew as a second language. Bindman included morphological and syntactic tasks (e.g., word analogy and sentence cloze tasks). After taking into account age and vocabulary, morphological awareness in Hebrew was shown to be significantly related to the consistent representation of roots in the spelling of derived forms in English (e.g., know-knowledge). This result supports the cross-linguistic role of morphological awareness in spelling by children learning to write in two different alphabetic orthographies.

Deacon and colleagues (Deacon, Wade-Woolley, & Kirby, 2007) tracked the relations between performance on a past tense analogy task, an index of morphological awareness, and reading of English and French in a group of 58 French immersion children across grades 1 to 3. Early measures of English morphological awareness at grade 1 were significantly related to both English and French reading at grade 2 and grade 3, after controlling for several variables. Later measures of morphological awareness at grade 2 in French were significantly related to English and French reading at grade 3. These relations persisted even after controlling for several variables. Results of this study suggest that morphological awareness can be applied to reading across
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orthographies. The cross-time contribution of morphological awareness to reading across orthographies points to a potential causal relation between the two (see Lin & Wang, 2012 for a more detailed review on cross-language morphological transfer among bilingual children).

Cognitive Consequences of Cross-Language Orthographic Depth Differences

A number of adult-based studies have demonstrated the effects of linguistic and orthographic differences in second language reading for learners with a nonalphabetic first language background (e.g., Akamatsu, 1999; Haynes & Carr, 1990; Holm & Dodd, 1996; Jackson, Lu, & Ju, 1994; Koda, 1999, 2000; Wade-Woolley, 1999; Wang, Koda, & Perfetti, 2003). Results of these studies are consistent with the notion that logographic readers learning to read English tend to rely more on orthographic information and less on phonological information for word identification than English readers do.

Holm and Dodd (1996) found that ESL university students from Hong Kong did not differ from the other ESL groups with alphabetic first language backgrounds in reading and spelling real English words. These ESL groups included Chinese Mandarin readers who were taught Chinese characters via Pinyin. Pinyin is an alphabetic transcription used in Mainland China to assist children in learning to read Chinese characters. Hong Kong students learn to read Chinese characters via a whole-word or look-and-say method. Hong Kong ESL students were significantly less competent than all other ESL readers on a set of phonological awareness tasks, as well as in reading and spelling pseudowords. It is apparent that ESL students’ first language experience had a significant impact on their ESL reading and spelling. Hong Kong students’ whole-word character learning experience did not impede their reading and spelling real English words. However, it negatively affected students’ reading and spelling English pseudowords where fine-grained skills on grapheme-phoneme correspondence were required.

In Wang et al. (2003), alphabetic and non-alphabetic first language effects in English word identification were systematically investigated via comparison between native Chinese and Korean college students learning to read English as a second language. English proficiency was matched between the two groups. This is an important control, which was not given enough attention in previous research. The ESL learners’ relative reliance on phonological and orthographic information was examined. Van Orden’s (1987) semantic category judgment task was selected to test the involvement of orthography and phonology in reading for meaning. In the semantic category judgment task, the participants were asked to judge whether the target word is a member of a category—for example, whether rows is a flower, or whether tow is the end of your feet. The critical manipulation in this task was the phonological and spelling similarity of the target words to the category exemplars—for example, rows is phonologically similar to the category exemplar rose for flower, whereas robs is orthographically similar to rose. The effects of phonological and spelling similarity would reveal the degree to which second language learners with a nonalphabetic versus an alphabetic first language background rely on phonological or visual-orthographic information in visual word recognition.

The second task was a phoneme deletion task developed by Hart and Perfetti (2000) and shown to correlate with reading skill for adult readers. This task requires phoneme deletion in an English word, followed by a spelling of the new word that results from
the deletion. The uniqueness of this task is that the deletion of the required phoneme in the word leads to a new word with a different spelling form from the original one. For example, removing the /t/ sound from *might* creates a word *my*, which has a distinct spelling from *might*. This feature requires the participants not only to manipulate the individual phonemes in the word, but also to accurately access their spelling knowledge of the new word.

In the semantic category judgment task, the Korean ESL learners made more false positive errors in judging stimuli that were homophones to category exemplars than they did in judging spelling controls. However, there were no significant differences in responses to stimuli in these two conditions for Chinese ESL learners. Chinese ESL learners, on the other hand, made more accurate responses to stimuli that were less similar in spelling to category exemplars than those that were more similar. Chinese ESL learners may rely less on phonological information and more on orthographic information in identifying English words than their Korean counterparts.

Further evidence supporting this argument came from the phoneme deletion task, in which Chinese subjects performed more poorly overall than their Korean counterparts and made more errors that were phonologically incorrect but orthographically acceptable. The researchers suggest that cross writing system differences in first languages and first language reading skills influence could be responsible for these ESL performance differences. These findings received support from neuroimaging work by Tan and his colleagues (e.g., Tan et al., 2001; Tan et al., 2003). Their work has shown that reading Chinese resulted in more activation in some brain areas that are responsible for coordinating and integrating visual-spatial analyses of logographic Chinese characters compared with reading English. More importantly, they also showed that when Chinese-English bilingual subjects performed a phonological task on English words, areas that are responsible for spatial information representation, spatial working memory, and coordination of cognitive resources were most active. Areas mediating English monolinguals’ fine-grained phonemic analysis were only weakly activated. These findings have been supported in recent neuroimaging studies (e.g., Cao, Tao, Liu, Perfetti, & Booth, 2013; Nelson, Liu, Fiez, & Perfetti, 2009).

Haynes and Carr (1990) compared Chinese ESL and native English-speaking American undergraduates’ visual efficiency skills in making visual same–different matching judgments on orthographically irregular (i.e., illegal) four-letter strings, orthographically legal four-letter pseudowords, and real four-letter words. The orthographically illegal letter strings were found to be the most difficult to judge and real words were the easiest for both groups. In order to further examine whether the two groups contrasted in efficiency gains when the stimuli were more familiar, the authors computed “lexicality effect” (word efficiency–pseudoword efficiency) and “orthography effect” (pseudoword efficiency–letter string efficiency). The results revealed that the Chinese ESL readers benefited relatively little from orthography and relatively more from lexicality, compared to their American counterparts. Similar results were obtained by Koda (1989) for Japanese-speaking ESL adults. She found that Japanese ESL readers, literate in Kanji symbols (borrowed from Chinese), performed better in recalling strings of unpronounceable letters than in recalling strings of pronounceable letters. Koda maintained that phonological inaccessibility is less debilitating for logographic readers (e.g., Japanese) than for alphabetic readers.

Wang and Geva (2003) found a similar pattern of performance in a spelling task even among young Chinese ESL readers whose logographic first language experience was very limited. The difference between spelling performance on pronounceable
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and unpronounceable letter strings, controlling for visual similarity, was significantly smaller for Chinese ESL children than the difference for English-speaking children. These findings together seem to suggest that logographic readers rely less on phonological information from the graphemic form in order to access its lexical representation than do alphabetic readers. On the other hand, for alphabetic readers a direct analysis of phonological information from the graphemic form is necessary for encoding subsequent lexical representation.

Bilingual Lexicon

Potter et al. (1984) reported the earliest study that tested the Word Association Model and Concept Mediation Models by contrasting bilinguals’ performance on a translation task from first language to second language and a picture-naming task in their second language. The Word Association Model hypothesizes that translation from the first language to the second language is faster than naming a picture in the second language. Since there is a direct link between first language and second language words, translation from first to second language does not need to activate the shared meanings of those words. By contrast, when naming a picture in the second language, one has to go through the links between concepts and the first language word, and then go through from first language word to the second language word. The Concept Mediation Model hypothesizes that performance of the two tasks is similar, because both the first language and second language words are mediated by the concepts. Participants showed similar performance on a translation task and a picture-naming task, which is consistent with the Concept Association Model. Potter et al. found similar results for both proficient and less proficient second learners, but their results were challenged by other studies. Kroll and Curley (1988), for example, tested beginning learners with very low second language proficiency and found that translation was faster than picture naming for beginning learners.

de Groot and Hoeks (1995) examined Dutch–English–French trilinguals who were more proficient in their second language (English) than in their third language (French). In a translation task, the participants were to translate first language Dutch words into either second language English or third language French. The critical experimental manipulation was word concreteness. The Concept Mediation Model predicts that concrete words would facilitate translation compared to non-concrete words. The Word Association Model predicts the same performance on the two types of words. Interestingly, there was a concreteness effect in first language to second language (Dutch-to-English) translation, thus supporting the Concept Mediation Model. However, the concreteness effect disappeared in first language to third language (Dutch-to-French) translation, thus supporting the Word Association Model. There seems to be a possible developmental shift for adult second language learners: from reliance on word association at an early, less proficient stage to concept mediation at a later, more proficient stage.

Sunderman and Kroll (2006) tested the developmental aspect of the Revised Hierarchical Model regarding accessing the concepts from second language lexical forms. A translation recognition paradigm was used, in which native English speakers with high or low Spanish second language proficiency were asked to judge whether the second word in a pair was the translation equivalent of the first word (e.g., cara–face, where face is the English translation equivalent for the Spanish word cara). The first word in the pair was in the second language. The critical condition involved pairs that were not
translation equivalents, but were related to the first word (first language) or the second word (second language) either in lexical form or in meaning (e.g., cara—card, cara—fact, and cara—head). Results showed that all participants experienced interference for lexical form related (e.g., cara—card) and meaning related stimuli (e.g., cara—head), but only those with low second language proficiency experienced interference for distracters that were related to the lexical form of the translation equivalents (e.g., cara—fact). Learners with low second language proficiency needed to access the meaning of second language words through first language translation equivalents, whereas participants with higher second language proficiency did not. Therefore, the mediator role of second language proficiency was supported.

Chen, Wang and Perfetti (2011) used a lexical decision experiment to investigate cross-language activation in compound processing in a group of Chinese-English bilingual children. The compound words/nonwords in one language contained two free constituent morphemes that mapped onto the desired translations in the other language, such as tooth(牙) brush(刷) and fire(火) mountain(山). A significant interaction between the lexicality of the target language, English, and that of the nontarget language, Chinese, was found, but not in the direction of target language being the Chinese. This finding, as the researchers suggested, supports asymmetric cross-language activation between the first and the second language. When the target language is English (the second language), constituents of the compound in English and their translation equivalents in Chinese are activated. Further, the compound of the translated constituents is activated as well. In other words, the translated constituents are recomposed into the corresponding compound word in Chinese. For example, when a child heard a real English compound word toothbrush, he/she decomposed the word into tooth and brush. Then the Chinese translation equivalents of the two constituents—牙 (tooth) and 刷 (brush)—were activated and recomposed into 牙刷. Since 牙刷 is a real Chinese word, it helped the child to judge toothbrush as a real word in English. On the contrary, when a child heard another real English compound word, schoolbook, the Chinese translation equivalents of the two constituents—校 (school) and 书 (book)—were activated and recomposed into 校书 in Chinese. Since 校书 is not a real compound word in Chinese, the contradiction of the lexical status in the two languages was more likely to confuse the child and result in a mistaken judgment (see Figure 7.3).

The bilingual lexicon has frequently been investigated through cross-language priming experiments in adults. In a cross-language priming experiment, the target words in one language are preceded by the translation equivalents or semantically related words in the other language. These translation equivalents or semantically related words are

\[ \text{tooth} \rightarrow \text{牙} \]
\[ \text{toothbrush} \rightarrow \text{牙刷} \]
\[ \text{brush} \rightarrow \text{刷} \]
\[ \text{school} \rightarrow \text{校} \]
\[ \text{schoolbook} \rightarrow \text{校书} \]
\[ \text{book} \rightarrow \text{书} \]

Figure 7.3 Compound processing in Chinese bilinguals
called primes. For example, 牙刷 is the translation equivalent of toothbrush in Chinese. When 牙刷 is presented as the prime and toothbrush is the target word, we can measure the response time and accuracy of lexical judgment or naming of the target (i.e., the related prime-target pair), and then compare it to the unrelated prime-target pair, such as 鞋子 (shoes) and toothbrush. The cross-language activation can be revealed if there is a significant difference between the two.

Kim, Wang, and Ko (2011) reported findings from a set of cross-language priming experiments with Korean-English bilingual adults on their processing of derived words. Results indicated strong evidence for cross-language activation of morphological structures drawn from L1 in processing L2 morphological stimuli. In Experiment 1, when participants were given a real Korean derived word (e.g., 매력적, attractive) and an interpretable derived pseudoword (i.e., illegal combination of a stem and a suffix, e.g., 매력화, attractization) as a prime, the response times for the corresponding English-translated stem (e.g., attract) were significantly faster than when they had received an unrelated word (e.g., 공격수, playground). These results suggest that cross-language activation of morphologically complex words occurs in bilingual reading, and that bilingual readers decompose complex words and are sensitive to morphological structure, not lexicality. In Experiment 2, in order to test the role of morphological structure further, words with non-morphological endings (i.e., an illegal combination of a stem and an orthographic ending, e.g., 매력래, attract-em) were included; this did not show a priming effect. Finally, in Experiment 3, non-interpretable derived pseudowords also yielded a significant priming effect just as the interpretable ones did. These results together suggest that cross-language activation of morphologically complex words occurs independently of lexicality and interpretability. Figure 7.4 illustrates how the priming effect occurs in the real derived word condition in Experiment 1.

Kim and Wang (2014) conducted a follow-up study to further examine the time course of the cross-language activation of constituent morphemes in Korean-English bilingual readers, using a similar masked priming experiment with three prime durations (36, 48, and 72ms). Results showed that when derived real words of Korean were used as primes, participants’ response times were significantly faster on the corresponding English L2 translated stems at all prime durations. However, derived Korean pseudoword primes (i.e., an illegal combination of a stem and a suffix) showed a

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**Figure 7.4 Derivational word processing in Korean bilinguals**
significant priming effect on English L2 stems only at longer prime durations (48 and 72 ms). These results suggest that cross-language activation of constituent morphemes may occur very early in bilingual reading. The lexicality factor plays an important role in the time course of decomposing L1 morphologically complex words. While supra-lexical analysis is involved in the early morphological processing in bilingual readers, sub-lexical analysis is involved in later cross-language activation of morphemic information.

The findings of cross-language activation of morphological constituent morphemes have important implications for classroom instruction for second language learners. For example, if second language learners indeed decompose morphological complex words in processing their two languages, teachers need to help the learners understand both the meanings of whole words and the meanings of constituent morphemes. Further, if it is the case that when second language learners process morphological complex words in one language, the translated equivalents in the other language are activated, one pedagogical implication would be the need for teachers to take into account both languages that are spoken by the second language learners.

In summary, the three major lines of research on learning a second language have addressed how the two languages facilitate or interfere with each other. The line of cross-language transfer research has focused on children’s learning of the two languages simultaneously. The main research methodology used is correlational. There is a great deal of evidence for the universal cross language transfer of phonological and morphological awareness.

Cross-language orthographic transfer may be language-specific depending on whether the two languages use a similar script. When adults learn to read a second language, obviously there are some cognitive consequences when the languages are across different writing systems. This line of research has used various experimental tasks tapping into phonological and orthographic processing skills in the target language, which is normally English. It appears that when second language learners come from a logographic first language writing system such as Chinese, they tend to rely on less phonemic-based phonological information in processing English words.

The bilingual mental lexicon models have attempted to address the question of how the two languages in mostly adult second language learners are connected to each other. Lexical form level (i.e., phonological and orthographic information) and semantic form level activation across the two languages are the focus of these studies. Clearly, language proficiency in the second language determines which level of mental lexicon information is accessed and retrieved. With low second language proficiency, the two lexicons are linked at the lexical form level. Presumably, most second language learners pass through this level of learning. With high second language proficiency, the activation of semantic information becomes stronger and more immediate.

**FUTURE DIRECTIONS**

**Causal Relation between Phonology, Orthography, Morphology and Second Language Reading**

In the line of research addressing the cross-language transfer issue in learning a second language, most current studies have reported correlational data where the language- and reading-related tasks were administered simultaneously (e.g., D’Angiulli, Siegel, &
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Serra, 2001; Deacon, Wade-Woolley & Kirby, 2009; Geva & Siegel, 2000; Tong & McBride-Chang, 2010; Wang et al., 2005, 2006). Therefore, we cannot make any suggestions concerning the directionality of the relation between phonological, orthographic, or morphological skills and second language literacy acquisition. To better understand this relation, future research needs to address the issue of bidirectional relations; that is, whether the better reading skills are the outcome of the better phonological, orthographic, or morphological skills, or the better phonological, orthographic, or morphological skills are the outcome of the better reading skills. In line with monolingual research on the reading processes and reading acquisition, future studies should examine the predictive power of phonological, orthographic, and morphological awareness in second language reading acquisition over time. It would be especially interesting to test the relation between phonological, orthographic, or morphological processes in one language at early time points and reading skills in another language at later time points, as well as to explore the reciprocal developmental relation between reading skills and the three related processes (i.e., phonology, orthography, and morphology).

Further, future research also should consider phonological, orthographic, and morphological training studies on bilingual children to see if phonological-, orthographic-, or morphological-awareness training in one language would produce substantive gains in students’ word reading and reading comprehension in another language. Combining longitudinal studies and training studies will allow researchers to establish the causal relation between reading processes and reading skills in second language reading acquisition.

Control for General Abilities and Language Proficiency

In the line of research addressing the issue of the cognitive consequences of cross-language orthographic depth in learning a second language, it is necessary to control for general cognitive abilities such as intelligence level and overall language proficiency in the second language when comparing second language learners with monolingual English speakers or when comparing second language learners with different first language backgrounds.

Inclusion of Varieties of First Language Backgrounds

Future research is also needed to include second language learners with various first languages. Not only can second language learners with a logographic first language (e.g., Chinese) background be compared with those with an alphabetic first language background, second language learners with alphabetic first languages of varying orthographic depths can also be compared among each other. For example, native French speakers learning to read English as second language can be compared to native Italian speakers learning to read English as second language. French and Italian are different in their transparency in mapping between letters and sounds. The effect of cross-language orthographic depth can thus be tested even within the alphabetic orthographies. Another future research direction is to identify the specific linguistic elements that may lead to different performance between the different first language groups. For example, Lin, Wang and Isardi (2014) suggested that while both English and Chinese have contrastive stress at the word level, Korean does not. Consequently, native-Chinese speakers may have an advantage over native-Korean speakers in English stress
processing, even when matched for their general English proficiency. Their results showed that Chinese ESL college students indeed performed better than their Korean ESL counterparts in encoding stress in short-term memory and lexical judgment.

**Bilingual Lexicon in Children with Varying First and Second Language Proficiency**

In the line of research addressing the bilingual mental lexicon, given the fact that the majority of the work is on adult second language learners, it is important to take into consideration the extension of current models to bilingual children. Bilingual children allow us to test the current bilingual lexicon models via varying not only second language proficiency but also first language proficiency, given the fact that bilingual children normally have an unbalanced growth of first and second language proficiency. The asymmetric link between the first and second language lexical forms is expected to become more balanced, given children’s increasing second language proficiency. It is also possible that if children’s second language proficiency becomes higher than their first language proficiency, the direction of the asymmetric lexical link will be changed. The lexical form link from first to second language will become stronger than that from second to first language.

One way to examine the effects of both first and second language proficiency is to manipulate their proficiency levels orthogonally. Four groups can be formed according to their proficiency in the two languages: Low in first (L1) and second language (L2) (LL1-LL2), High in L1 and Low in L2 (HL1-LL2), Low in L1 and High in L2 (LL1-HL2), and high in both languages (HL1-HL2).

**Multi-Measure Approach in Language Proficiency Assessment**

In order to gain a global picture of children’s language proficiency in their two languages, a multiple-measure approach is helpful. First, an oral receptive vocabulary measure can be administered, similar to the Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997), which has served as the index of English proficiency in previous research (e.g., Nicoladis, 2003, 2006; Wang, Cheng, & Chen, 2006; Wang, Park, & Lee, 2006; Wang et al., 2008; Wang et al., 2009). An expressive vocabulary measure can be included as a second measure of language proficiency (e.g., the Expressive Vocabulary Test—Second Edition, EVT-2, Williams, 2007). A listening comprehension test can be added as a third measure of proficiency (e.g., the Listening Comprehension Cluster of the Woodcock-Johnson III (WJ III) Tests of Achievement, Woodcock, McGrew, & Mather, 2001). A composite standard score is generated to categorize children’s first and second language proficiency levels. Finally, parents and teachers can be asked to fill out a Language Background and Experience Questionnaire to provide subjective ratings of their children’s proficiency in the two languages.

**The Influence of the Second Language on the First Language**

Clearly, there has been a focus in the literature about learning a second language on the influence of the L1 on learning the L2. Very little is known about the influence of the L2 on the L1. Although Cummins’s Linguistic Interdependence Hypothesis has been mostly tested in the direction of the influence of L1 on L2, the hypothesis itself does not exclude the potential effect of L2 on L1. Recent research has provided some evidence for an L2-to-L1 effect. For example, Chen, Xu, Nguyen, Hong & Wang (2010) showed
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that native Chinese-speaking children’s Chinese L1 phonological awareness has been improved after receiving ESL instruction in Mainland China. Likewise, in a longitudinal study, Yeong and Richard Liow (2012) found that Chinese L1 children’s scores on the English phonological awareness task at Time 1 were related to their scores on the Chinese phonological awareness at Time 2 in Singapore. More research is clearly needed to address the bidirectional effects between L1 and L2, especially among children who are acquiring both languages simultaneously. For example, it is unclear if English L1 children’s reading would be improved by learning to read Chinese as an L2. If such an influence does occur, then English L1 children may be able to apply their Chinese L2 skill to their English L1 so that they become more sensitive to visual-orthographic patterns in their L1 and thus help enhance their sight word reading skill in English.

In summary, there is a great deal of work needed to advance research on learning a second language in the future. In particular, we need to examine systematically how children develop their language and reading skills in their first and second languages simultaneously, the roles of language exposure at home and at school, and oral language proficiency. Second language learners from varied first language backgrounds need to be included in a more comprehensive research program to form careful comparisons of the similarities and differences across different second language and bilingual populations.

REFERENCES


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