Transfer of Phonological and Morphological Awareness to Reading in English and Logographic Hanja among Korean Children*

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This study examined differential contributions of Korean phonological and morphological processing skills to reading and spelling across Korean Hangul, logographic Hanja, and English among 107 sixth graders in Korea. In regression equations, after controlling for vocabulary and phonological awareness, both number naming speed and morpheme judgment accounted for unique variance in Hangul word reading and spelling. Korean phoneme awareness explained unique variance in reading and spelling skills in English, but not in Hanja. In addition, Korean morphological awareness was found to predict reading in both Hanja and English. It is thus suggested that phonological and morphological awareness, which are both language-general abilities, transfer to reading skills across languages and writing systems.

Key words: morphological transfer, phonological transfer, Korean Hangul and Hanja, English

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This study examined how different Korean phonological and morphological processing skills contribute to reading and spelling abilities in Korean Hangul and Hanja (Chinese characters), as well as in English as a second language among Korean 6th graders. A growing number of studies on biliteracy and second-language acquisition has demonstrated that phonological awareness skills in a first language (L1) are predictive of reading skills in a second language (L2) (e.g., Cisero & Royer, 1995; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Durgunoglu, Nagy, & Hancin-Bhatt, 1993; see Durgunoglu, 2002 for a review). These studies have focused on learning to read English as L2 although diverse languages were used as L1, including alphabetic languages such as Spanish, Italian, and Korean (e.g., Comeau, et al., 1999; Cisero & Royer, 1995; Durgunoglu et al., 1993; Wang, Park, & Lee, 2006), as well as logographic Chinese (Chow, McBride-Chang, Burgess, 2005; Gottardo, Yan, Siegel, & Wade-Woolley, 2001; Wang, Perfetti, & Liu, 2005). However, few studies have been done to test phonological transfer from alphabetic L1 to reading of nonalphabetic scripts. These studies will shed light on an ongoing debate on whether or not phonological awareness skills transfer across languages with different phonological structures.

In addition, transfer of morphological knowledge has been examined in the literature using European languages which share, more or less, grammatical and morphological principles (e.g., Galambos & Goldin-Meadow, 1990; Geva, 1995). However, few studies have examined morphological transfer across languages that have considerably different morphologies, such as Korean and English. Koreans learn to read and write two scripts of Hangul and Hanja. Hangul, a major script in Korea, is alphabetic just as is English; in both, graphemes represent phonemes. In contrast, Hanja consists of logographic Chinese characters adopted for the Korean language (Taylor & Taylor, 1995). Indeed, the Korean language shares common features with Chinese in syllable structure and morphology. Therefore, data from Korean children learning to read Hangul, Hanja, and English can provide good empirical evidence on how phonological as well as morphological awareness in L1 contribute differently to reading and writing across second languages and writing systems, namely alphabetic English and logographic Hanja. In addition, we examined to what extent phonological awareness, speeded naming, and morphological awareness were associated with read-
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ing and spelling Hangul words among older children.

**Hangul and Hanja**

Korean uses two scripts of Hangul and Hanja (see, Cho, 2009; Taylor & Taylor, 1995, for reviews). Hangul is an alphabet with 14 basic consonants and 10 basic vowels. In Hangul, grapheme-phoneme connections are relatively consistent. For example, consonants ㄷ and ㅁ make the sounds /d/ and /m/, respectively, and a vowel, ㅣ, makes the /i/ sound. Although it is an alphabet, two or three letters are clustered in a syllable block as a syllabary (e.g., 손 /son/ meaning a hand). Letters are arranged in order from top to bottom and from left to right within a syllable block. Most Korean syllables are of CVC or CV structure and there are no initial consonant clusters in the syllables.

Koreans used logographic Hanja, Chinese characters, for more than 10 centuries before the Hangul alphabet was invented in the 15th century. Hanja characters represent syllables and morphemes, which are basic units in meaning. In general, Hanja characters have the same shape as the original Chinese characters and have similar meanings and sounds. Although Hanja is relatively limited in its use nowadays, it is still important in understanding of the Korean language. For example, children learn 1800 Hanja characters as a required class subject in secondary school.

The Korean language has common features with Chinese in morphology. Indeed, up to 60% of Korean words were borrowed from Chinese (Lim, 2002). Each Syllable in Chinese-loan words represents a morpheme. Chinese-loan words generally name abstract concepts and technical terms, whereas many Korean native words are frequently used common words. Chinese-loan words can be written in both Hanja and Hangul, whereas Korean native words and grammatical morphemes can only be written in Hangul. Thus, Korean sentences can be written exclusively in Hangul but not in Hanja. Hanja characters are often used to specify meanings of Chinese-loan words because many Chinese-loan words are homophones and each meaning of a homophone will map onto a different Hanja character.

Korean children begin learning to read Hangul in kindergarten or at home at about the age of 4. At age 6, when they enter primary school, most chil-
children have learned letter-sound correspondences of the Korean alphabet. Children also learn some phonological changes of the Korean language caused by resyllabification, assimilation, and palatalization phenomena in primary school. They learn complex and abstract vocabulary in the upper elementary years. In addition, in many primary schools, Korean students learn to read and write Hanja as an elective subject. Korean children also learn English as a second language from the 3rd grade. English education mainly focuses on improving oral language skills, introducing greetings, phrases, and short sentences in the 3rd grade. The English alphabet and written English are introduced from the 4th grade. This study thus examined Korean sixth graders who had learned English from the 3rd grade and Hanja from the 5th grade to investigate whether or not Korean phonological and morphological processing skills would have differential associations with their reading and spelling abilities across Hangul, Hanja, and English.

**Phonological processing skills**

Phonological processing skills are generally defined as the ability to make use of the phonological structure of language (Wagner & Torgesen, 1987). A large body of phonologically-related research has focused on phonological awareness, which is the ability to discriminate and manipulate the sound units of spoken words ranging from syllables to phonemes (see McBride-Chang, 2004, for a review). Phonological awareness abilities have been considered a critical predictor of early literacy development for alphabetic orthographies (Adams, 1990; Brady & Scankweiler, 1991; Wagner et al., 1997) and also important for the logographic Chinese orthography (Ho & Bryant, 1997; Hu & Catts, 1998; McBride-Chang & Ho, 2000). Phonological awareness is also influential for early reading acquisition of Korean Hangul (Cho & McBride-Chang, 2005a; Cho, McBride-Chang, & Park, 2008). Cho and McBride-Chang (2005a), for example, demonstrated that both syllable and phoneme awareness uniquely accounted for variability in concurrent Hangul word recognition among Korean kindergartners and second graders after controlling for vocabulary and naming speed. Indeed, recent work has demonstrated that different levels of phonological awareness were associated with word recognition in different writing systems (Cho & McBride-
Chang, 2005b; Chow, McBride-Chang, & Burgess, 2005). For example, phoneme-level awareness contributes primarily to reading in alphabetic languages where the phoneme is a basic speech sound unit, whereas syllable awareness is more important in reading Chinese because each character, the basic unit of the Chinese writing system, is represented at the syllable level. Given evidence for the different levels of phonological awareness depending on orthographies, this study aimed to include both syllable and phoneme awareness tasks in Korean to examine their associations with reading and spelling across Hangul, Hanja, and English.

Another area of research has focused on speeded serial naming of familiar materials such as numbers, letters, or pictures. Speeded naming appears to tap many of the skills including phonological access in lexical memory (Wagner & Torgesen, 1987) and nonphonological factors such as visual sequencing and symbol processing (Manis, Seidenberg, & Doi, 1999; Wolf & Bowers, 1999). The relation between speeded naming and reading skills varies across orthographies. Although the role of speeded naming tends to diminish in English when phonological awareness skills are taken into account, speeded naming is correlated more strongly than phonological awareness in some regular orthographies such as German and Dutch and in the deep orthography of Chinese (de Jong & van der Leij, 1999; Ho & Bryant, 1997; Wimmer, Mayringer, & Landerl, 2000). Although Korean is a relatively regular orthography, the role of naming speed was found to be equivocal in early Hangul reading acquisition (Cho & McBride-Chang, 2005a, b), but the role was significant in a more recent study (Cho et al., 2008). The lack of consistency in previous findings requires further investigation.

**Morphological awareness**

Recently, morphological awareness has been found to facilitate children’s reading and writing skills in English and Chinese studies (Feldman, 1995; McBride-Chang, 2004). Morphological awareness refers to the ability to manipulate and recognize morphemes. English studies have demonstrated the important roles of derivational and inflectional morphology in learning to read and write (Bryant & Nunes, 2004; Carlisle, 2000; Nagy, Berninger,
& Abbott, 2006; Singson, Mahony, & Mann, 2000; Verhoeven & Perfetti, 2003). On the other hand, compound morphology is particularly important in the Chinese language in part because Chinese morphemes are relatively transparent in their meanings and most Chinese words consist of two or more morphemes (McBride-Chang, 2004; McBride, Shu, Zhu, Wat, & Wagner, 2003; Shu, McBride-Chang, Wu & Liu, 2006). The Korean language has common features with Chinese in the prevalence of lexical compounding and homophones (Taylor & Taylor, 1995). In Korean vocabulary, Chinese-loan words and even many Korean native words consist of multi-morphemes. For example, the words fish, beef, and pork in English are literally translated as water meat (물고기 /mul.ko.ki/), cattle meat (소고기 /so.ko.ki/), and pig meat (돼지고기 /dae.dzi.ko.ki/) in Korean. Indeed, the ability to infer the meaning of multi-morphemic words was found to be important in reading both Korean and Chinese. For example, in a cross-cultural study testing 2nd graders from the different cultures of Korea, China, and the United States, McBride-Chang et al. (2005) found that morphological structure awareness, that is, flexibility in combining morphemes together to create new concepts, contributed unique variance to early reading skills in Korean Hangul as well as in Chinese but not in English. In the present study, we adapted and included two morphological tasks, morpheme production and morpheme judgment, originally developed by Shu et al. (2006), to measure Korean children’s knowledge of lexical compounding and homophones.

Cross-language transfer

Studies on biliteracy and second-language acquisition have provided growing evidence that phonological awareness skills in an L1 are related to and predictive of reading skills in an L2 (Chiappe & Siegel, 1999; Chiappe, Siegel, & Gottardo, 2002; Cisero & Royer, 1995; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Geva, Wade-Woolley, & Shany, 1993, 1997). Linsey, Manis, and Bailey (2003), for example, demonstrated that phonological awareness in L1 Spanish transferred to English and was predictive of Spanish and English word recognition after 1 year among Spanish kindergartners. Most of the bilingual
studies examined associations of phonological awareness skills across two alphabetic languages that more or less share the same alphabet, such as English as an L2 and Spanish, or Italian as an L1 (e.g., Comeau, et al., 1999; Cisero & Royer, 1995; Durgonoglu et al., 1993; Lindsey et al., 2003).

Recently, phonological transfer was demonstrated across two different writing systems, namely, Chinese and English (Chow et al., 2005; Gottardo, Yan, Siegel, & Wade-Woolley, 2001; Wang, Perfetti, & Liu, 2005) and Korean and English (Wang, Park, & Lee, 2006). In Chinese bilingual studies, rhyme detection (Gottardo et al., 2001) or syllable deletion (Chow et al., 2005) was predictive of L2 English reading skills. Testing Korean-English bilingual children, Wang et al. (2006) found that onset-rhyme detection and phoneme deletion skills in L1 Korean were strongly correlated with phonological awareness in L2 English and explained unique variance in English reading. Similarly, Cho and McBride-Chang (2005b) demonstrated that Korean phoneme awareness in 2nd grade was predictive of subsequent word recognition in English as an L2 after 1 year, whereas syllable awareness contributed to subsequent Hangul word recognition. These Chinese and Korean studies tend to indicate that phonological transfer is not restricted to languages with similar structures. We, in the present study, aim to further validate the previous findings by examining whether Korean phonological awareness transfers to reading logographic Hanja. In addition, the current study also investigated whether Korean speeded naming contributed to learning to read English and Hanja (e.g., Chow et al., 2005; Lindsey, Manis, & Bailey, 2003).

Empirical evidence on morphological transfer across languages is sparse although its possibility has been suggested in several studies (Carlisle, 2000; Nunes & Hitano, 2004). Because many of the uses of morphological knowledge in literacy are more or less conscious and explicit, that is, metalinguistic, it is hypothesized that morphological skills transfer across languages (e.g., Nagy & Berninger, 2003; Nunes & Hitano, 2004). Indeed, several studies have demonstrated the transfer of grammatical knowledge across languages such as English and Spanish (Galambos & Goldin-Meadow, 1990) and English and Hebrew (Geva, 1995), where one language more or less shares with another language grammatical and morphological principles. However, few studies have tested this issue across languages
with considerably different morphologies, namely Korean and English.

**Purpose of this study**

This study investigated how differently Korean phonological awareness, speeded naming, and morphological awareness were associated with reading and spelling skills in Korean Hangul and Hanja, and English as an L2 among Korean 6th graders. Some studies demonstrated that both phonological and morphological awareness were strongly associated with early Hangul reading (e.g., Cho, McBride-Chang, 2005a; Cho et al., 2008); however, it was not certain whether similar relations would be obtained in upper elementary students as in kindergartners. In addition, Korean phoneme awareness was expected to be strongly associated with reading and spelling in English, but Korean syllable awareness was related with reading skills in logographic Hanja. This is due to the fact that the basic phonological unit in English is the phoneme, whereas Hanja characters are represented at the syllable level. Finally, we expected that morphological awareness in Korean would be more strongly associated with reading and spelling skills in Hanja than in English. However, its contribution to English word recognition was not clear. The transfer of morphological awareness to English word recognition would suggest that it is a language-general ability.

**Method**

**Participants**

Participants were 107 6th graders (63 girls and 44 boys) of one public primary school in Masan, Korea. The mean age of students, all of whom were native Korean speakers, was 12.62 years. They were tested in February 2004. The students learned English, as a required subject, for more than 3 hours a week from the 3rd grade, whereas they learned Hanja for one hour a week from the 5th grade as an elective class. Reading skills in English and Hanja vary considerably among Korean children because many of them often learn English and Hanja at home or at private institutions.
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Procedure

Students participated in two testing sessions of individual and group testing, each lasting approximately 40 minutes. All individual testing of children took place in a quiet room at school by trained psychology majors. The group session took place in the classrooms of students. The measures administered were as follows.

Korean Hangul word reading. Children were presented a list of 30 words of two and three syllables in an individual setting. In order to increase the difficulty level of the words, all words in the list required the application of Korean phonological changes such as resyllabification, consonantal assimilation, and palatalization. The words were presented in a graded list. Children were asked to read from the beginning of the test. Testing was stopped when 5 consecutive items were failed. There was no time limit for the testing. One point was awarded for every item correctly read aloud based on phonological rules in Korean. Thus, the maximum score on this task was 30.

Korean Hangul word spelling. This task was done in a group setting. Children were orally presented 30 multi-syllable words and were asked to write the words on a paper. One point was allotted for every item correctly spelled. The maximum score on this task was 30.

English word reading. We administered a task of English word reading in an individual setting. This test consisted of 30 English words that were selected from English textbooks used in Korean primary schools. The words were presented from easiest to most difficult. Children were asked to read aloud, and testing was stopped when 5 consecutive items were failed. Every correct word was allotted one point. There was no time limit for the testing. All items were real words in this task.

English word spelling. This task was done in a group setting. Children were orally presented 30 words and were asked to write the words on a paper. One point was given for every item if correctly spelled. Thus, the maximum score on this task was 30.

Hanja character reading. This task was done in a group setting. It consisted of 30 Chinese characters that were selected from Hanja textbooks found in Korean primary schools. The 30 characters were written in a page
with a blank next to each character. The children were asked to write down the sound of each character in Hangul in the blank, and every correct item was allotted one point.

*Hanja character spelling.* Children were orally presented 30 Hanja characters each with a meaning in a group setting. They were asked to write the Hanja characters on a paper. One point was awarded for every item if correctly spelled. Thus, the maximum score on this task was 30.

*Syllable Deletion.* This task was administered individually. Children were orally presented with stimuli from which they were asked to delete a syllable. Each item consisted of four 3-syllable and eight 4-syllable nonwords. Thus, twelve items were included in this task. All three-syllable items required taking away the middle syllable. Of the four-syllable items, four items required taking away the second syllable and four involved deleting the third syllable from the nonword. For example, *son jang mil* (손장밀) without *jang* (장) would be *son mil* (손밀).

*Phoneme Deletion.* Phoneme deletion was also given in an individual session. Children were orally presented with 12 one-syllable nonwords with a CVC construction. Then they were asked to delete an initial phoneme from each syllable. An example is saying *tum* (텀) without the initial sound, to get *um* (엄). All items focused on phoneme onset deletion only.

*Speeded Naming.* We individually administered two tasks of speeded naming, number naming and picture naming. The task of number naming included the same five digits arranged in different orders across five rows. Picture naming consisted of three rows of the same five pictures with two-syllable Korean names, arranging different orders across three rows. For each task, children were asked to name all items as quickly as possible. Two trials were administered in each task, and the average speed on each task was used for analysis.

*Morpheme Production.* Morpheme production was administered in a group session. Children were orally presented with a two-syllable Korean word, where each syllable was a morpheme, and a target morpheme was identified. Children were then asked to produce and write two words in Hangul including the target morpheme. One of the morphemes was supposed to have the same meaning as the target morpheme, whereas the other morpheme was to have a meaning different from its original meaning.
However, both morphemes were the same in sound and spelling in Hangul. For example, when the experimenter orally presented the word 군밤 /kun. bam/ (meaning roast chestnut), children were then asked to produce and write a new word with the morpheme 밤 /bam/ having the same meaning as in 군밤 /kun.bam/. An answer could be 밤나무 /bam.na.mu/ (meaning chestnut tree). Children were also asked to produce and write a word that included the morpheme 밤 /bam/ in which its meaning was different from that in 군밤 /kun.bam/. An answer would be 밤낮 /bam.nat/ (meaning night and day). There were 30 items. The maximum possible score was 60 because each item had two answers.

*Morpheme judgment.* This task was administered in a group. Children were orally presented with two Korean words consisting of two morphemes. Each of the two words included a syllable that had the same sound and spelling in Hangul. For example, 남 /nam/ is a shared syllable in 남녀 /nam.jə/ (meaning male and female) and 남북 /nam.buk/ (meaning south and north). Although the target syllable was identical in sound and spelling in Hangul, its meanings were the same in half of the items and they were different in the other half. Children were asked to judge whether the target syllable common for each pair of words had a similar or different meaning. There were 30 items in total.

*Vocabulary.* This task was administered in a group session. Twenty items were generated from the experimenters to measure reading vocabulary through written multiple-choice items. In the first 10 items of the task, students were asked to choose a word that meant the same or about the same as a given item from among 4 alternatives; and in the last 10 items, students were given a description of a word to find among 4 alternatives.

**Results**

Means, standard deviations, and reliability estimates are shown in Table 1. In general, tasks showed adequate reliabilities and did not show any obvious ceiling or floor effects. Two exceptions were Hangul reading and syllable deletion, where children demonstrated relatively high performance, with the mean values of 93% and 88%, respectively.

Table 2 shows correlations among all variables included in the pres-
ent study. Reading and spelling of English words and Hanja characters were moderately correlated with Hangul word reading (.33 < rs < .40) and strongly with Hangul word spelling (.55 < r < .63). Correlations between reading and spelling within each script were strong, ranging from .65 to .88. Vocabulary was also strongly associated with reading and spelling (.45 < rs <.69) and with phonological and morphological skills (.32 < rs < .52) in the three scripts. It is interesting to find that phonological awareness, speeded naming and morphological awareness tasks showed somewhat different patterns of associations with reading and spelling across Hangul, English, and Hanja. Speeded number naming was strongly associated with reading and spelling in Hangul (r = -.64, -.56, respectively), but moderately in English and Hanja (rs ranging from -.30 to -.41). Phoneme deletion appeared to be strongly associated with reading and spelling in English (r = .54, .48, respectively), but relatively weakly with those of Hanja characters (both rs = .30). However, the associations of morphological production were stronger with reading and spelling in Hanja (r = .51, .54, respectively), compared to those in English.

<table>
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<th>Variable</th>
<th>Reliability</th>
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Note. N = 107. Total scores are in parentheses.

*aInternal consistency reliability.

*bTest-retest reliability.
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<td>9. Rapid number naming</td>
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<td>10. Rapid picture naming</td>
<td>-.24*</td>
<td>-.36***</td>
<td>-.34***</td>
<td>-.34***</td>
<td>-.34***</td>
<td>-.21*</td>
<td>-.34***</td>
<td>-.34***</td>
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<td>-.34***</td>
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<td>-.34***</td>
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<tr>
<td>11. Morpheme production</td>
<td>.32**</td>
<td>.47***</td>
<td>.43***</td>
<td>.43***</td>
<td>.51***</td>
<td>.34***</td>
<td>.14</td>
<td>.42***</td>
<td>.24*</td>
<td>.24*</td>
<td>.24*</td>
<td>.24*</td>
<td>.04</td>
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<tr>
<td>12. Morpheme judgment</td>
<td>.01</td>
<td>.10</td>
<td>.13</td>
<td>.17</td>
<td>.10</td>
<td>.11</td>
<td>.05</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
</tr>
<tr>
<td>13. Vocabulary</td>
<td>.53**</td>
<td>.53***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
<td>.53***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
<td>.56***</td>
</tr>
</tbody>
</table>

Note: * p < .05, ** p < .01, *** p < .001.
Table 3. Standardized Beta Weights for Regression Equation with Reading and Spelling in Korean Hangul, Hanja, and English as the Dependent Measures

<table>
<thead>
<tr>
<th></th>
<th>Hangul</th>
<th>Hanja</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading</td>
<td>Spelling</td>
<td>Reading</td>
</tr>
<tr>
<td>Syllable deletion</td>
<td>-.07</td>
<td>-.93</td>
<td>-.06</td>
</tr>
<tr>
<td>Phoneme deletion</td>
<td>.11</td>
<td>1.35</td>
<td>.29</td>
</tr>
<tr>
<td>Number naming</td>
<td>-.53</td>
<td>-6.46***</td>
<td>-.28</td>
</tr>
<tr>
<td>Object naming</td>
<td>.12</td>
<td>1.46</td>
<td>.02</td>
</tr>
<tr>
<td>Morpheme production</td>
<td>.01</td>
<td>.06</td>
<td>.15</td>
</tr>
<tr>
<td>Morpheme judgment</td>
<td>.22</td>
<td>3.15**</td>
<td>.02</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>.27</td>
<td>2.92**</td>
<td>.36</td>
</tr>
</tbody>
</table>

Note. * p < .05. ** p < .01. *** p < .001. Hangul reading: $R^2 = .56$; Hangul spelling: $R^2 = .64$; Hanja reading: $R^2 = .36$; Hanja spelling: $R^2 = .38$; English reading: $R^2 = .43$; English spelling: $R^2 = .43$. 
Finally, to investigate the unique contribution of each of processing skills to reading and spelling in Hangul, English and Hanja, we included all tasks in separate linear regression equations predicting of reading and spelling of each script. Vocabulary, which has been shown to be important for reading abilities, was also entered into the equations to control for the variance in explaining reading and spelling. Final beta weights for all variables are displayed in Table 3. Number naming and morpheme judgment appeared to contribute unique variance to Hangul word recognition, and phoneme deletion, number naming and morpheme production contributed to Hangul word spelling. Phoneme deletion and morpheme production accounted for unique variance in English reading, and only phoneme deletion accounted for English spelling. On the other hand, number naming and morpheme production explained significant variance in Hanja reading, and only morpheme production accounted for Hanja spelling. Across all regression equations, neither syllable deletion nor speeded object naming tasks uniquely explained any reading and spelling tasks.

**Discussion**

Our results clearly highlighted the importance of phoneme awareness for reading and spelling in English, and morphological awareness for those in logographic Hanja. In addition, speeded naming and morphological awareness appeared to be strongly associated with Hangul reading and spelling among Korean older children. It is noteworthy that morpheme production contributed unique variance to English word recognition, even after controlling for the effects of Korean vocabulary, phonological awareness and speeded naming. These findings are discussed further below.

In contrast to previous research on early Hangul acquisition (e.g., Cho & McBride-Chang, 2005a; Cho et al., 2008), syllable and phoneme deletion did not contribute significant variance to Hangul reading in this study once morphological awareness and vocabulary were included in a regression equation. Instead, speeded number naming and morphological awareness explained unique variance in Hangul reading and spelling. Thus, the role of phonological awareness in Hangul word recognition seemed to diminish, but the naming speed remained pervasive when mastery of reading Hangul
was achieved during the upper elementary grades. These are similar to the findings on reading in languages with a more regular orthography, such as German and Dutch (Wimmer, 1995). In this study, however, phoneme deletion was found to be important for spelling Hangul words.

As hypothesized, Korean phoneme deletion explained significant variance in reading and spelling English as an L2, supporting previous studies on biliteracy and L2 acquisition among Korean young children (Cho & McBride-Chang 2005b; Wang et al., 2006) as well as among Western children (Comeau, et al., 1999; Cisero & Royer, 1995; Durgonoglu et al., 1993; Lindsey et al., 2003). However, neither phoneme nor syllable deletion contributed to Hanja reading and spelling in this study, although phonological awareness, for example, syllable or rime awareness, was found to be important in reading Chinese as an L1 in recent Chinese studies (e.g., Chow et al., 2005; Ho & Bryant, 1997). The lack of associations of syllable awareness with Hanja reading and spelling in this study might be due to the fact that the syllable deletion task was at ceiling. The 6th graders participating in this study seemed to be too old and too sophisticated to show much variability in the syllable deletion task. On the other hand, the insignificant role of phoneme awareness in Hanja reading and spelling makes sense because Hanja characters are read at a syllable level. Our results indicate that Korean phoneme awareness transfers to learning how to read and write English words. Presumably, learning to read a given script depends on awareness of the speech sound units necessary for that script (e.g., Cho & McBride-Chang, 2005b). Moreover, Korean speeded number naming was demonstrated to be important only for Hanja character reading, which supports previous findings on Chinese as an L1 (Ho & Lai, 1999; McBride-Chang & Ho, 2000). The role of speeded naming may be partly due to arbitrary symbol processing with a less regular grapheme – phoneme relationship in logographic Hanja (e.g., Chow et al., 2005; Manis et al., 1999).

It was not surprising to find the significant role of Korean morphological awareness in Hanja reading and spelling because each Hanja character is a morpheme and Hanja words (e.g., Chinese-loan words) consist of multimorphemes. More important, Korean morphological awareness explained unique variance in reading English words after vocabulary, speeded naming and phonological awareness were controlled, although morphology
between Korean and English is considerably different in their specifics as well as in principles. These results suggest that morphological transfer is not limited to languages with similar structures. In other words, morphological awareness may be a language-general rather than a language-specific ability (e.g., Nunes & Hitano, 2004). Morphological transfer across scripts may be explained by current models on word recognition indicating that morphemes are represented in memory and play a role in word recognition (e.g., Verhoeven & Perfetti, 2003). In the model of Taft and Zhu (1995), for example, interactive processing of concept, word, and morpheme levels occurs if a reader has mental representations of the constituent morphemes. On the other hand, cross-language morphological transfer may be related to the conceptual memory common to both languages in the architecture of bilingual child’s memory, as proposed by Kroll and Stewart (1994).

There were several limitations of the present study that could be improved in future work. First, the 6th graders as a whole could perform correctly in most items of the syllable deletion task presented to them. The depressed variability in syllable deletion was likely to decrease the magnitudes of its association with other dependent measures, Hanja reading and spelling in particular. In future study, younger Korean children, for example, 3rd or 4th graders learning to read both Hanja and English, may be tested their reading skills in Hanja as well as in English to explore different patterns of phonological transfer. Second, our tasks of morphological awareness captured only lexical compounding but not other important features of Korean morphology, such as inflections and derivations. Future research may need to develop various morphological awareness tasks including inflections, derivations, as well as compounding of Korean to further validate which morphological skills transfer to reading skills across languages with different structures. Third, we administered reading vocabulary, which was found to be strongly associated with other reading measures, particularly in Hangul and English. It would be worthwhile in future work to include other types of expressive or receptive vocabulary to study the cross-language and writing system transfer. Finally, this study was not longitudinal. Further research needs to demonstrate developmental associations between morphological and phonological awareness skills and reading abilities across scripts employing longitudinal research designs. In particular, it would be interest-
ing to see whether morphological awareness has bidirectional associations with Hanja reading achievement.

In summary, speeded naming and morphological awareness appeared to be particularly important predictors of Hangul word reading in the upper primary students, whereas the influence of phonological awareness seemed to diminish. Phoneme awareness in Korean contributed to reading and spelling skills only in English but not in Hanja. This indicates that phonological transfer likely depends on awareness of the basic phonological units necessary for the scripts to be read. Moreover, Korean morphological awareness was found to contribute unique variance to reading both English and logographic Hanja. It is thus suggested that phonological and morphological awareness, which are both language-general rather than language-specific abilities, transfer to reading skills across languages and writing systems with different structures. Our results provide some practical implications that Korean morphological and phonological awareness skills could be trained for Korean upper elementary students to improve reading and spelling skills in Korean Hangul and Hanja, as well as English as a second language.

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