EFFECTS OF L1 PROCESSING EXPERIENCE ON L2 MORPHOLOGICAL AWARENESS

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Introduction

To be an efficient and effective reader of a second language, one must develop cumulative insight into the internal structure of words, as well as acquire the necessary skills for using such insight in facilitating lexical processing and enhancing reading comprehension. In recent time, the growing recognition of the significance of these capabilities has led to a rapidly expanding body of research on intraword awareness, particularly among psychologists and reading specialists. Inasmuch as the resulting data base has clearly demonstrated that intraword awareness develops primarily through print processing experience (e.g., Yopp, 1988; Bowey, & Francis, 1991; Vellutino & Scanlon, 1987; Bertelson, Morais, Alegria, & Content, 1985; Morais, Cary, Alegria, & Bertelson, 1979; Perfetti, Beck, Bell & Hughes, 1987), we can expect that the nature of such awareness differs considerably from language to language, at least to the extent that their lexical structures vary. We also know that linguistic knowledge

and processing skills transfer across languages among second language learners (e.g., Kilborn & Ito, 1989; Sasaki, 1992; Koda, 1993). Accordingly, we can both anticipate and infer that L2 lexical processing will be heavily constrained by L1 intraword structural knowledge.

Consequently, the present study investigated the way in which, as well as the extent to which, L1 intraword processing experience influences the formation of L2 intraword awareness among adult learners of English as a second language with contrasting L1 backgrounds. In the sections that follow, first current research on intraword awareness is summarized, then an in-depth cross-linguistic analysis on intraword structural variations is presented, and finally a resulting investigative framework is postulated.

Intraword Awareness and Alphabetic Literacy

Because of the morphophonemic nature of English orthography, recent empirical research has concentrated on the development of two key aspects of intraword awareness — phonological and morphological awareness — and their specific contributions to lexical processing and acquisition. Liberman and her colleagues were among the first to empirically examine the early stages of phonological awareness and contend how difficult it was to acquire such meta-linguistic knowledge (e.g., Liberman et al., 1974, 1977, 1989). An abundance of evidence presented by Liberman et al., as well as others (e.g., Stanovitch, Cunningham and Cramer, 1984; Lundberg, Frost and Peterson, 1988; Juel, 1988), demonstrates that sensitivity to the segmental structure of spoken sounds is directly related to children's ability to read and spell English words, thus providing strong empirical support for the role that intraword phonological awareness plays in early literacy development. Longitudinal studies also show that (1) phonological awareness is a powerful predictor of reading success both in early and middle grades (e.g., Juel, Griffith and Gough, 1986; Bryant, MacLean and Bradley, 1990); and (2) word reading skills are significantly enhanced by phonemic

awareness training (e.g., Bradley and Bryant, 1991; Ball and Blackman, 1991).

With respect to the somewhat parallel increase in research on phonological and morphological awareness, it is worth noting that the two develop concomitantly as children gain better understanding of the distribution of letter patterns. A recent longitudinal study (Carlisle, 1995), as a case in point, shows that while phonological awareness accounts for word recognition efficiency differences, morphological awareness is the best predictor of reading comprehension among second-grade children. Experimental studies also demonstrate that (1) skilled readers are sensitive to a word's morphological structure (e.g., Feldman, Frost and Pnini, 1995), and adept at morphological analysis during lexical processing (Taft, 1986, 1991; Chilant and Carmazza, 1995); (2) less skilled readers make considerably more errors in expressing inflectional and derivational morphemes in writing (Rubin, 1991; Duques, 1989); and (3) the ability to use morphological information during sentence processing differentiates good from poor readers (Tyler and Nagy, 1989). Viewed collectively, these findings make it plain that morphological awareness plays a critical role, independent of phonological awareness, in the development of reading and writing skills in English.

Morphological Processing in English

The basic unit of word formation and the principles governing their combination vary widely across languages. In concatenative languages, such as English, morphological formation generally entails the addition of affixes either before or after a base morpheme. Three types of morphemes are commonly used in English: (a) inflectional affixes: signaling grammatical relationships (e.g., past tense, progressive, and plurality marking); (b) class-changing derivational affixes: forming new words by changing the grammatical class (*happy —> happiness*); and (c) class-maintaining derivational affixes: forming new words without changing the grammatical class (e.g., *happy —>*

unhappy). It is argued that such affixes, regardless of type, have independent status in lexical memory (e.g., Taft, 1979, 1995), which, in turn, suggests that affix information can be obtained through procedures similar to those used for lexical access – once their representation is established in the lexicon.

While such a view assumes readers' consistent engagement in both morphological composition and decomposition during lexical processing, it should be noted that there is considerable variation in the systematicity with which intraword morphemes are combined. For example, morpheme concatenation is far more systematic in inflectional formation – where a distinct grammatical function is assigned to a specific affix – than derivational formation — where mapping on one-to-many function-to-form correspondence (e.g., *-tion*, *-ness*, *-ty*, *-al* are all used to form nouns) is required. In fact, it has been suggested that derivational processes necessitate sophisticated knowledge of the constraints on intraword morpheme concatenation (e.g., Tyler & Nagy, 1990).

Morphological Processing in Chinese

Morphological formation in non-concatenative Chinese involves a non-linear integration of lexical components (radicals). According to Taylor and Taylor (1983), two methods — ideographic and semantic-phonetic compounding — are predominantly used for character formation. Ideographic compounding involves an integration of two or more characters whose semantic information is related to the whole character meaning. For example, the character for "bright" consists of two lexical radicals, implying something bright — i.e., one character represents the "sun" and the other the "moon". The character for "forest" provides another illustration of ideographic compounding. The character contains three identical components (the character for "tree") arranged in a pyramid shape (two "tree" characters at the bottom and one on top). Similarly, many multiple-character words — where two or more characters form a single lexical entry such as "society" or "world"

— are also products of ideographic compounding. As examples demonstrate, ideographic compounding is achieved through character-specific, or idiosyncratic, formation procedures, and therefore, the meaning of the whole word cannot be easily inferred by simply combining the meaning of component characters.

The second method, semantic-phonetic compounding, also requires the integration of two or more characters, but, unlike ideographic compounding, a distinct function — i.e., providing either phonetic or semantic information — is assigned to each component character. Phonetic radicals are lexical characters, retaining both phonological and semantic representations, but their recognition necessitates retrieval of phonological information — while suppressing semantic activation. Many semantic radicals, on the other hand, are sub-lexical morphemes (like English affixes), signaling the semantic category of the entire character. As an illustration, the meaning of characters containing the "water" radical relates to water in one way or another, as evident in Table 1. Characters sharing the "water" radical include "lake", "pond", "ocean", "flood", "swim", and so on. Semantic radicals are thus useful in providing information which facilitates lexical retrieval and inference (e.g., Hsu, Anderson, & Zhang, 1995; Hsu & Anderson, 1997). However, given that other intraword components (i.e., phonetic radicals) yield no semantic information, it is highly unlikely that recognition of the whole character can be achieved through the semantic radicals alone.

Table 1. Character formation in Chinese characters/Japanese Kanji: Examples

Single-character words

1. Ideographic compounds —> combining semantic information of two or more characters

日＋月ー＞明　　木＋木＋木ー＞森

sun moon bright　　tree tree tree forest

2. Semantic-phonetic compounds —> combining two or more functionally distinct (phonetic and semantic) characters

言＋吾ー＞語　　説　講　話　誤

say /go/ language　　explain lecture speak mistake

氵＋巷ー＞港　　湖　海　洋　池

water /kou/ port　　lake sea ocean pond

Multiple-character words (forming a single lexical entry)

1. Unique ideographic compounds (non-distributional)

勉強　　関係　　地図

study　　relation　　map

2. Distributional ideographic compounds

会話　　談話　　電話　　世話

conversation　　discourse　　telephone　　care

Finally, morphological construction in Chinese involves three basic spatial arrangements: (a) left-right structure, wherein component radicals line up horizontally (side by side); (b) upper-lower structure, wherein intraword morphological elements are vertically arranged; and (c) inside-and-outside structure, wherein one of the component radicals forms an outer enclosure surrounding the other component morphemes. Recent Chinese studies repeatedly show that radical location also plays a significant impact on character recognition (e.g., Zhang et al., 1994). To summarize, the analysis indicates that (1) Chinese intraword morphemes provide limited grammatical information, and as a consequence, morphological processing is far less systematic than English; (2) the semantic relationship between component radicals and the whole character is not always transparent; and (3) since character formation involves a non-linear integration of multiple radicals, radical location plays a role during lexical processing. In short, Chinese intraword morphemes provide useful but insufficient information, and therefore, whole character recognition can rarely be achieved by analyzing intraword components. Thus, Chinese word recognition necessitates simultaneous retrievals of both whole character and intraword component meanings. Recent Chinese studies do, in fact, provide empirical evidence supporting such parallel processing: (1) semantic transparency enhances character recognition (e.g., Zhang, Zhang, & Peng, 1990); (2) skilled readers are more competent in deriving the meaning of unfamiliar words based on radical information (Shu, 1994); (3) the ability to integrate contextual and radical information greatly facilitates reading comprehension (Shu, Anderson, & Zhang, 1995); (4) lexical decision performance is facilitated more by word-frequency than morpheme-frequency (e.g., Zhou & Marslen-Wilson, 1994); (5) word naming is faster for first-position characters than second-position characters in two-character compound words (e.g., Zhu & Taft, 1994; Yu and Cao, 1994) and (6) school-aged Japanese children often fail to provide a reading (phonological code) of component characters in multiple-character words (National Institute of Language, 1964). A summary of the cross-linguistic analysis is presented in Table 2.

Table 2. Intraword morphological structure: Crosslinguistic analysis

ENGLISH Morphologically Complex (Derivational) Words				
	Functions		Formation	Information
Formation	Description	Information	systematicity	distribution
prefix+ lexical base (insane, unhappy)	semantic modification	semantic	yes	yes
prefix+ lexical base (endanger, delimit)	syntactic-class change	syntactic	yes	yes
prefix+ sublexical base (involve, revive)	semantic guide	semantic	yes	yes
lexical base+ suffix (childhood, kinship)	semantic guide	semantic	yes	yes
lexical base+ suffix (categorize, categorization)	syntactic-class change	syntactic	yes	yes
lexical base+ suffix (believable, actor)	semantic guide syntactic-class change	semantic/ syntactic	yes	yes

Table 2. Continued

CHINESE Morphologically Complex Characters				
	Functions		Formation	Information
Formation	Description	Information	systematicity	distribution
Single-character words				
ideographic compound	semantic contribution	semantic	no	no
semantic-phonetic compound	semantic guide phonetic indicator	semantic/ phonetic	no	yes
Multiple-character words (forming a single lexical entry)				
unique ideographic compound	semantic contribution	semantic/ phonetic	no	no
distributional ideographic compound	semantic contribution	semantic/ phonetic	no	yes
distributional sub-lexical compound	semantic modification	semantic	yes	yes

Intraword Awareness in L2 Reading: An Investigative Framework

Cross-linguistic analysis demonstrates that morphological processing in English and Chinese differs in several important ways: (1) grammar plays a major role in English morphological processing, but not in Chinese; (2) English morphological formation necessitates complex, but systematic, one-to-many function-to-form mappings, whereas character formation in Chinese involves a non-linear

integration of component morphemes; and (3) while recognition of morphologically complex English words can be achieved through the systematic integration of intraword morphemes, Chinese character recognition is heavily dependent upon simultaneous retrievals of both whole-word and component-character meanings. Thus, in short, a critical difference in English and Chinese morphological processing lies in the way in which intraword morphological analysis is conducted and the extent to which lexical processing relies on such structural analysis.

The logical question, then, is precisely in what ways, and to what extent, does L1 morphological processing experience influence L2 intraword morphological awareness when L1 and L2 are typologically different. Based on the analysis, it was predicted that (1) Chinese ESL learners would be less sensitive to the internal morphological structure of English words; and as a result, (2) they would be less perceptive to the constraints on the intraword morphological concatenation than those whose L1 requires processing procedures similar to those in English. These predictions were empirically tested in the study by comparing various aspects of morphological awareness among adult ESL learners with typologically different L1 backgrounds. In this context, two typological dimensions were considered — i.e., orthographic (alphabet vs. logography) and morphological (concatenating vs. non-concatenating).

It is often argued that a full understanding of English derivational morphemes involves at least three distinct aspects of awareness: relational, syntactic, and distributional (Tyler & Nagy, 1989). First, relational awareness refers to a general understanding that words have complex internal structures and that two or more words may share a common base morpheme. Syntactic awareness, on the other hand, has to do with tacit knowledge that suffixation alters syntactic categorization. The competent user of English, for instance, knows that *generalize* is a verb by virtue of being suffixed with *-ize* and *generalization* is a noun by virtue of being suffixed with *-tion*. Finally, distributional awareness

concerns learners' sensitivity to the constraints on base-affix concatenation. Accordingly, the specific awareness aspects examined in the study include (a) relational awareness (i.e., knowledge that words sharing the same base are morphologically related); (b) morphological production (i.e., ability to produce morphologically related words); (c) syntactic awareness (i.e., knowledge of syntactic properties of English derivational morphemes); and (d) distributional awareness (i.e., sensitivity to the constraints on intraword morpheme concatenation).

Methods

Participants

Two groups of ESL learners were recruited on two American university campuses. The groups were native speakers of Korean (N=20; 11 males and 9 females) and Chinese (N=24; 14 males and 10 females). Korean ESL learners were included as a control group to be contrasted with Chinese because their L1 employs unrelated, yet typologically similar, orthographic (alphabetic-syllabary Hangul) and morphological (concatenating) systems to those used in the target language, English.

The two groups were matched on L2 proficiency using T0EFL vocabulary and reading comprehension sub-test scores. The proficiency test scores are listed in Table 3. The vocabulary scores of the Chinese participants ranged from 7 to 25, and those of the Koreans from 9 to 28. Similarly, Chinese reading comprehension scores ranged from 8 to 28, and Koreans from 7 to 30.

All participants reported that they started taking courses in English as a foreign language in high school in their home countries, wherein traditional teaching methods emphasizing reading and grammar were used. At the time of the study, all participants had been in the United States less than six months with a mean length of 4.7 months. None had prior living experience in any English-speaking countrie. Thus, the two groups were comparable in terms of (a) educational background

in their home countries; (b) length of stay in the US; (c) type and amount of formal English instruction in their home countries (the number of years they had received English instruction in schools); and (d) amount of English instruction in the US (the number of English classes they had taken at the intensive English program they in which were enrolled).

Table 3: English proficiency test scores

Tests	Maximum	Chinese		Korean	
	Score	M	SD	M	SD
Vocabulary	28	19.52	3.82	20.47	3.41
Reading Comprehension	26	21.96	4.79	21.47	3.41

Test Batteries

A series of paper-and-pencil tests were administered to measure the three major aspects of morphological awareness (i.e., relational, syntactic, and distributional). The sections that follow describe the tasks utilized to measure each of the three aspects.

1. Relational Awareness

Two tests were used to assess the relational aspect of derivational knowledge. The first, a recognition test, involved a multiple-choice analogy task, wherein the participants were required to complete an analogy by choosing an appropriate word from a pool of four morphologically related words. For example:

Danger is to dangerous as delight is to _____:
a. delightful b. delightfully
c. delighting d. delight

Two sets of fifteen target words (high and low-frequency items) were selected from Kucera and Francis (1967) word-frequency lists. The mean frequency-count of the high-frequency words was 154, while that of the low-frequency was 5.4. Four types of derivational transformation were included in the test: (a) deriving nouns from adjectives, (b) adjectives from nouns, (c) adverbs from adjectives, and (d) nouns from verbs. A total of 30 sentences were randomly ordered and presented to the participants. The second measure was a straightforward production test, wherein the participants were asked to write as many morphologically related words as they could for each of five high-frequency English words. Given that neither task required intraword structural manipulation, notable between-group, or L1-based, differences were not expected in either relational task.

2. Syntactic Awareness

The syntactic aspect of English derivational knowledge was assessed using a form correction task. This test consisted of thirty sentences, each containing a syntactically inappropriate word which was marked with underlining. The task was to derive an appropriate form of the word in the given syntactic context. For example:

We have to take act before it is too late._____

Thus, the task requirements included (a) identifying a syntactic category of the target word, and (b) deriving a morphologically correct form of the word. Given that no intraword componential analysis was required, here again little group difference was expected.

3. Distributional Awareness

The distributional aspect of English derivational knowledge was measured using a base-affix combinability judgment task. According to Tyler and Nagy (1989), of the three aspects of derivational knowledge, distributional sensitivity is the last to be acquired, because affixes are

constrained by the syntactic category of the base morphemes they attach to, thus requiring learners to have some idea about syntactic contribution of individual affixes before they could learn precisely how their distribution is restricted.

To measure ESL participants' distributional awareness, a base-suffix combination acceptability test was used. The test involved the following three conditions: (a) suffixed real words (e.g., *useless*), (b) legally combined pseudo-words (e.g., verb + *-tion*, such as *drop+tion—>droption*), (c) illegally combined pseudo-words (e.g., noun + *-able*, such as *noon+able—>noonable*). The test consisted of fifty well-formed (25 real and 25 legal-pseudo) and fifty ill-formed (illegal-pseudo) derivatives. A total of one hundred stimulus words were randomly ordered and presented to the participants. The task was to circle all the words which they thought were real or possible English words. Since the task necessitated substantial knowledge of the constraints on intraword morpheme concatenation in English, a notable Korean superiority was expected in this task.

Results and Discussion

Relational Awareness

The relational aspect of English morphological awareness was measured first through a multiple-choice sentence-analogy task. As shown in Figure 1, little difference existed between the groups in either the high- or low-frequency target-word condition. A subsequent two-way repeated measures ANOVA, conducted with language Group as the between-subject variable and target-word Frequency (high vs. low) as the within-subject variable, revealed that the main effect of Frequency was significant [$F(1, 40) = 5.25$, $p<.05$], but the main effect of Group and that of Group x Frequency interaction were not. Clearly, the groups are similar in the ability to identify categorical relationships among morphologically related words.

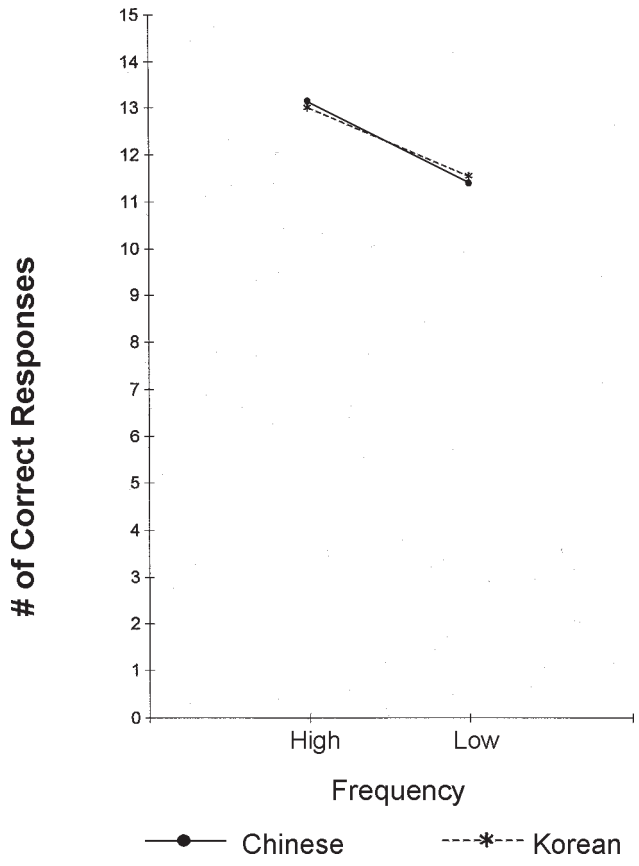

Figure 1. Analogy test scores

The second task was a morphological production test, in which the participants were presented with five high-frequency English words and asked to write as many morphologically related words as they could. In analyzing the written responses, the following coding categories were used: (a) correct, (b) correct derivation with spelling errors, (c) derivationally incorrect, and (d) irrelevant. In scoring, one point was awarded to both correct and derivationally correct responses, and no point was given to any other responses. Figure 2 shows

morphological production performance between the groups. As evident, virtually no difference existed in overall production, thus again indicating that the groups are similar in morphological production ability. In short, the two tests, analogy and production, consistently demonstrate that relational awareness among ESL learners is essentially unaffected by variations in their L1 morphological processing experience.

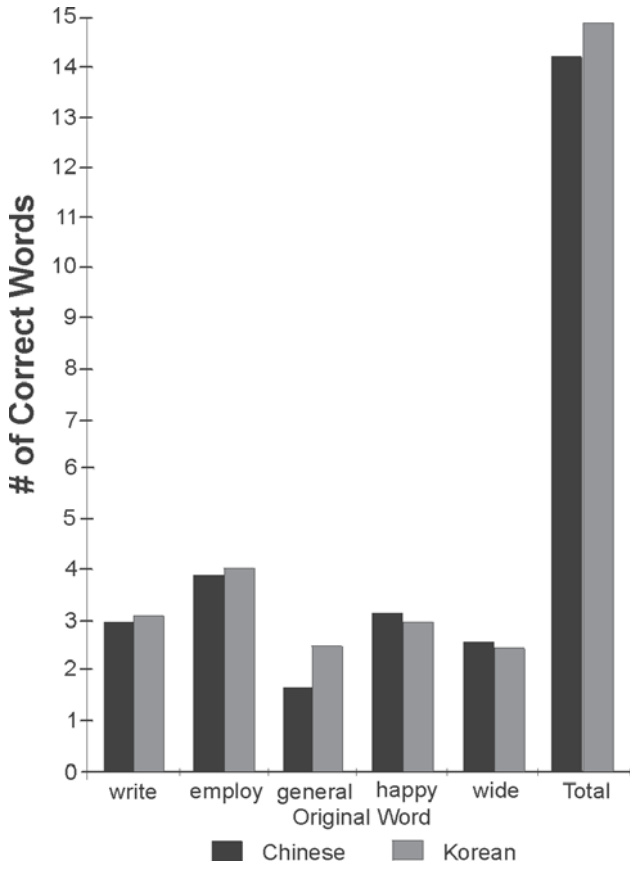

Figure 2. Morphological production test performance

Syntactic Awareness

The syntactic aspect of English derivational knowledge was compared using a form correction test. In the task, the participants were asked to read a sentence containing a syntactically inappropriate target word, and instructed to change the word into a morphologically appropriate form. In analyzing the written responses, the following categories were used: (a) correct derivation, (b) spelling, (c) incorrect syntactic categorization (e.g., *active* in the sentence, "We have to take act before it is too late."), (d) correct syntactic categorization/ incorrect suffixation (e.g., *moveness* in the sentence, "The cat noticed a sudden move in the bushes."), and (e) irrelevant and/or no response. In scoring, one point was awarded to correctly derived words, and no point was given to any other responses. A subsequent *t*-test indicated a significant group-mean difference in the form-correction test scores ($t = 39.0$, $p < .005$: Chinese: $M = 16.83$, $SD = 3.52$; Korean: $M = 20.59$, $SD = 3.84$). An additional analysis was carried out, therefore, to determine the source of the significant performance difference among Chinese and Korean participants. Figure 3 shows response variations in the three error categories between the groups. As evident, a notable difference occurred in the correct syntactic categorization/incorrect suffixation category. Chinese responses in this category significantly outnumbered those among Koreans ($t = 39.9$, $p < .0001$). Clearly, then, it is not the ability to identify the syntactic category of individual morphemes that separates Korean from Chinese in their overall performance. Seemingly, it is the sensitivity to the lexical restrictions on English suffixation. Hence, the findings suggest that syntactic awareness is another aspect of English derivational knowledge, which develops relatively free from L1 processing influence.

Distributional Awareness

Distributional awareness was measured with a base-suffix combination acceptability task. In the test, the participants were visually

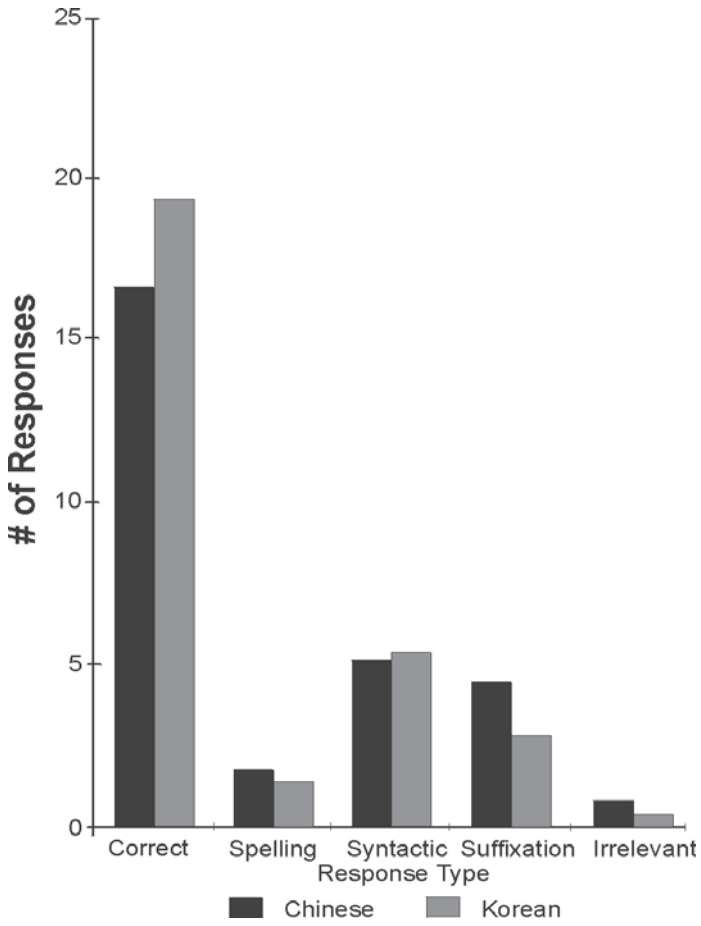

Figure 3 - Syntactic test responses

presented with three types of morphologically complex stimuli (i.e.,real words, legal pseudo-words, illegal pseudo-words), and asked to circle only the words which they thought were real, or possible, words in English. Since judging pseudo-derivatives necessitates substantial

knowledge of the distributional constraints on morpheme concatenation, it was predicted that the Korean learners would outperform the Chinese. Figure 4 presents response variations between the groups in the three stimulus conditions. As evident, the groups were similar under the real-word condition, but their performance varied considerably in the two pseudo-word (legal and illegal) conditions: i.e., while little difference was found between legal and illegal strings among the Korean participants, the Chinese accepted substantially more illegal than legal strings - and rejected more legal than illegal strings - as possible English words.

Subsequently, a two-way repeated measures ANOVA was conducted with language Group (Chinese vs. Korean) as the between-subject variable and stimulus Condition (real, legal-pseudo vs. illegal-pseudo) as the within-subject variable. The analysis showed significant main effect of Condition [$F(2, 40) = 113.22$, $p < .0001$] and Condition x Group interaction effect [$F(1, 40) = 3.76$, $p < .05$], and non-significant Group effect. Post hoc pairwise comparisons revealed that (1) both groups reported significantly more real-word stimuli as "possible" than either type of pseudo-word stimuli (Chinese real-legal, $t = 11.13$, $p<.0001$; Chinese real-illegal, $t = 6.82$, $p<.0001$; Korean real-legal, $t = 8.82$, $p<.0001$; Korean real-illegal, $t = 9.17$, $p<.0001$); (2) the number of "possible" responses did not significantly differ between the two pseudo-word conditions among Korean learners; (3) Chinese participants made significantly more "possible" responses in the illegal, rather than legal, condition ($t = 4.31$, $p<.0001$); and (4) Korean learners reported significantly more legal pseudo-words as "possible" than did Chinese ($t = 2.70$, $p<.005$).

These results indicate that although the groups dealt with real English words similarly, they differed markedly in their handling of both legal and illegal pseudo-words. Since Korean participants were more adept than Chinese in identifying permissible base-suffix combinations, one could conclude that Koreans are more sensitive than Chinese to intraword distributional constraints, which, in turn, suggests

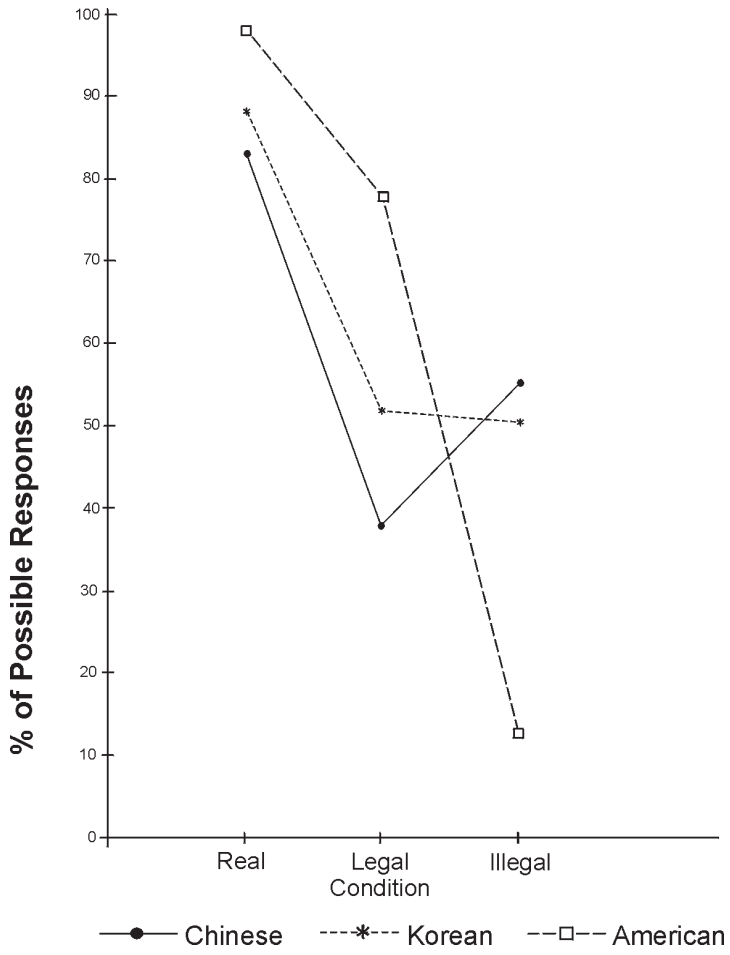

Figure 4. Distributional test responses

that extensive L1 intraword analysis experience may provide a common (i.e., non language-specific) basis for learning the distributional constraints on morpheme concatenation in a new unrelated language. Nonetheless, the absence of response variation between legal and illegal pseudo-word stimuli by the Korean participants indicates that even with some facilitation derived from their compatible L1 processing

experience, their distributional awareness — although better than the Chinese — remained incomplete in that it provided only partial information on the specific ways English base and suffix morphemes were combined. Further, the non-significant group-mean difference in the illegal condition demonstrates that such L1-based facilitation alone does not provide a satisfactory explanation of the performance variations among L2 learners. Subsequently, data from a small group of native English speakers (N=8) were analyzed and compared with those of the non-native (ESL) participants. As shown in Figure 4, the most notable difference occurred in the illegal pseudo-word condition. While native speakers accepted very few illegal derivatives as "possible", non-native speakers regarded roughly half the illegally combined pseudo-derivatives as conceivable English words. Clearly, then, the definite factor in the response variation between native and non-native participants is the ability to detect constraint violations in morpheme concatenation. Thus once again, severely restricted distributional awareness sophistication is commonplace among ESL learners.

To summarize, then, the data demonstrated that distributional sensitivity develops slowly among L2 learners. Since the acquisition of this aspect of morphological awareness presupposes substantial understanding of both relational and syntactic properties of English derivational morphemes, this finding is hardly surprising. What is critical here, however, is that the predicted performance variations between the groups under the pseudo-word conditions were somewhat evident. However unstable their distributional awareness, Korean learners performed slightly above the chance level in both legal and illegal pseudo-word conditions, whereas Chinese performance fell considerably below this level, because they accepted significantly more illegal than legal derivatives while rejecting more legal strings. Hence, distributional sensitivity among Korean learners seemingly progresses towards native-like sophistication, whereas Chinese learners, at least in this study, showed no such developmental patterns. Based on these

and other findings, it is reasonable to conclude that all aspects of morphological awareness do not develop at the same rate and in the same manner among L2 learners with diverse L1 processing experience.

L2 Proficiency and Intraword Awareness

To explore possible interconnections among L2 proficiency, morphological awareness, and L1 processing experience, correlational analyses were performed with the following five variables: (a) vocabulary knowledge (TOEFL vocabulary scores); (b) reading comprehension (TOEFL reading comprehension scores); (c) relational awareness (analogy test scores); (d) morphological production; (e) syntactic awareness (form-correction test scores); and (f) distributional awareness (base-affix combination acceptability test scores). Table 4 lists correlation coefficients between L2 proficiency and morphological awareness components.

As evident, L2 proficiency correlated differently with varying aspects of morphological awareness. The two TOEFL sub-test scores, as a case in point, x correlated highly with syntactic sensitivity in both groups, but no such strong relationships were found between L2 proficiency and the two types of relational test (i.e., sentence analogy or morphological reduction) scores. Interestingly, L2 proficiency correlated differentially with distributional sensitivity between the groups: i.e., significant correlations between the two variables in the Korean cohort (r=.56 for vocabulary and r=.53 for reading comprehension) as opposed to much weaker relationships in the Chinese data (r=.12 for vocabulary and r=.22 for reading comprehension). Importantly, distributional sensitivity was the precise aspect of morphological awareness where group differences had been predicted because of variations in L1 morphological processing experience. Given the groups' similar print processing experience in the target language, the varying correlations between L2 proficiency and distributional sensitivity among Chinese and Korean learners clearly reflects the dissimilar degrees to which L2 processing experience

facilitates the acquisition of this particular aspect of L2 morphological awareness. This, in turn, would seem to imply that Korean learners may engage in intraword analysis during L2 lexical processing to a far greater extent than their Chinese counterparts. In sum, L2 morphological awareness seemingly evolves through complex cross-linguistic interactions between L1 processing competencies and the cognitive and linguistic requisites specific to the target language.

Table 4: Correlations between L2 proficiency and intraword awareness components

Morphological Awareness Components	Vocabulary		Reading Comprehension	
	Chinese	Korean	Chinese	Korean
Sensitivity to the Constraints on intraword morpheme concatenation (distributional test scores)	.12	.56*	.22	.53*
Relational awareness (analogy sentence completion scores)	.22	.39	.29	.16
Morphological production (total no. of correctly derived words in the production test)	.56*	.54*	.43*	.30
Syntactic sensitivity (syntactic test scores)	62** .	.87***	.65***	.60**

Note. * p. < .05; ** p < 001; *** p<.0001

Summary and Conclusions

The present study investigated the specific ways in which L1 processing experience influences L2 intraword morphological awareness. A cross-linguistic analysis revealed that a critical difference in morphological processing between Chinese and English lies in the ways in which, as well as the extent to which, readers engage in intraword componential analysis during lexical processing. Based on the analysis, it was predicted that Chinese ESL learners would be less sensitive to intraword structural variations, and as a result, less perceptive to the constraints on the morpheme concatenation than those with typologically similar L1 backgrounds.

The study examined various aspects of L2 morphological awareness among ESL learners with similar (Korean: concatenating/alphabetic-syllabary) and dissimilar (Chinese: non-concatenating/logographic) L1 backgrounds. More specifically, the following five aspects were measured and compared between the groups: (a) relational awareness, (b) morphological production, (c) syntactic awareness, and (d) distributional sensitivity. The data demonstrated that (1) the groups differed in neither relational nor syntactic awareness; (2) little difference existed in morphological production; (3) Korean participants showed a higher level of sensitivity to the distributional constraints on English morpheme concatenation than the Chinese; and (4) varying aspects of L2 morphological awareness correlated differentially to L2 proficiency between the two ESL groups.

Viewed collectively, these results seem to suggest that (1) L1 processing experience influences L2 intraword awareness in very specific and highly predictable ways; and (2) some, but not all, aspects of L2 intraword awareness improve with increased L2 proficiency, which, in turn, implies that the specific competencies developed through L1 processing experience may determine, at least in part, both the extent and the forms in which L2 processing experience contributes to the development of L2 morphological awareness. Hence, the present

findings make it plain that L2 learners' prior processing experiences in both L1 and L2 play an important role in the formation of L2 morphological awareness.

These findings yield significant implications for practice. First, the present findings suggest that L2 processing experience contributes differentially to the development of L2 intraword awareness among L2 learners with compatible and incompatible prior processing experience. Given that morphological awareness plays a significant role in lexical processing (e.g., Feldman, 1994; Fowler and Liberman, 1994) and acquisition (e.g., Tylor & Nagy, 1990; Nagy & Anderson, 1984; Miller & Gildea, 1987), explicit instruction would likely benefit L2 learners whose L1 does not require extensive morphological analysis.

Second, the data also demonstrate that L2 learners develop processing competence through repeated, progressively complex, interactions between their previous processing experience and the cognitive and linguistic demands imposed by the target language. These findings clearly suggest that processing competence among learners with diverse L1 backgrounds evolves through definitively different developmental paths. To better understand L2 skill acquisition, therefore, we must recognize that the factors involved in processing variation are exceedingly complex, and - of the greatest importance - that the formation of L2 processing competence can be heavily influenced by previous processing experience. The study findings, thus point to a serious need for new investigative frameworks for exploring qualitatively different processes involved in the development of L2 processing competence among learners with divergent L1 processing experience. Insights from such multi-layered analyses may enable us to fit our instruction to the characteristics of individual learners with much greater precision, and eventually achieve improved instructional efficiency.

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