INTERNATIONAL JOURNAL OF PSYCHOLOGY, 2005, 40 (6), 407–415

Psychology Press
Taylor & Francis Group

Nonselective access of spelling–sound knowledge for Korean-English bilinguals

Chang H. Lee

Pusan National University, South Korea

Kichun Nam

Korea University, Seoul, South Korea

Leonard Katz

University of Connecticut, Storrs, CT, USA

An intense debate in monolingual research concerns the presence of phonological recoding in word recognition. Research supporting the phonological recoding hypothesis in monolingual research suggests the possibility of phonological recoding even in L2 recognition. There has been some experimental evidence showing phonological priming between L1 and L2 for alphabetic bilinguals (e.g., French-Dutch). In the present study, lexical decision experiments used either L1 or L2 primes with targets from the other language at SOAs of 140 ms and 250 ms for Korean-English bilinguals. It was found that phonological information activated by either an L1 or L2 prime can interact with phonological information in the other language. That is, L2 shares phonological information with L1, and its spelling–sound knowledge is activated, apparently automatically, at an SOA of 140 ms. The consistent pattern of phonological priming of both L1 and L2 targets at the 140 ms SOA indicates that the spelling–sound knowledge of bilingual lexicons is activated when any linguistic form is presented. Importantly, this indiscriminate activation of spelling–sound knowledge in the Korean-English bilingual system occurs in the absence of any common orthographic cues because the two languages have totally different writing systems.

Un débat intense en recherche monolingue concerne la présence de recodage phonologique dans la reconnaissance des mots. Les appuis empiriques de l'hypothèse du recodage phonologique dans la recherche monolingue suggèrent la possibilité d'un recodage même dans la reconnaissance d'une langue secondaire (L2). Il existe plusieurs soutiens expérimentaux qui ont montré un amorçage phonologique entre la langue première (L1) et L2 chez des individus bilingues alphabétiques (par ex., français-allemand). Dans la présente étude, des expériences de décisions lexicales ont été menées auprès de bilingues coréens-anglais en utilisant soit une amorce L1 ou L2 avec des cibles de l'autre langue, avec des asynchronies d'apparition du stimulus (AAS) de 140 ms et de 250 ms. Les résultats ont montré que l'information phonologique activée par une amorce soit L1 ou L2 peut interagir avec l'information phonologique de l'autre langue. Ainsi, L2 partage de l'information phonologique avec L1 et sa connaissance prononciation-son est activée, apparemment, automatiquement lors d'une AAS de 140 ms. Le patron constant d'amorçage phonologique des cibles L1 et L2 lors d'une AAS de 140 ms indique que la connaissance prononciation-son des lexiques bilingues est activée quand n'importe quelle des formes linguistiques est présentée. Il est important de noter que cette activation distribuée au hasard de la connaissance prononciation-son dans le système bilingue coréen-anglais se produit en l'absence d'indices orthographiques communs parce que les deux langues ont des systèmes orthographiques totalement différents.

Un debate intenso en la investigación sobre el bilingüismo se refiere a la presencia de recodificación fonológica en el reconocimiento de las palabras. La investigación que apoya la hipótesis de la recodificación fonológica en la investigación monolingüe sugiere la posibilidad de recodificación fonológica aún

Correspondence should be sent to Chang H. Lee, Department of Psychology, Pusan National Univeristy, 30 Changjeon-Dong, Keumjeong-Ku, Pusan, 609-735, South Korea (E-mail: chleehoan@pusan.ac.kr), or Kichun Nam, Department of Psychology, Korea University, 5 Anam-Dong, Sungbuk-Gu, Seoul, South Korea (E-mail: kichun@korea.ac.kr).

This study was made possible by the grant from Korea Science and Engineering Foundation (R08-2003-000-10052-0). L. Katz was supported by NICHD grant HD-01994 to Haskins Laboratories, New Haven, USA.

http://www.tandf.co.uk/journals/pp/00207594.html DOI: 10.1080/00207590500188157

en el reconocimiento de una segunda lengua (L2). Existen datos experimentales que muestran una señal fonológica entre la primera (L1) y la segunda lengua para bilingües alfabéticos (por ejemplo, Francés-Holandés). En el presente estudio bilingües coreano-inglés participaron en los experimentos sobre decisiones léxicas que usaron, ya sea, señales de L1 ó L2 con blancos de la otra lengua, con asincronías del inicio del estímulo (AIE) de 140 y 250 milisegundos. Se encontró que la información fonológica activada, ya sea por una señal L1 ó L2, puede interactuar con la información fonológica en la otra lengua. Es decir, L2 comparte información fonológica con L1, y se activa su conocimiento de la pronunciación-sonido, aparentemente, en forma automática a una asincronía del inicio del estímulo de 140 milisegundos. La pauta constante de señales fonológicas tanto de blancos de L1 como L2 a una AIE de 140 milisegundos indica que el conocimiento de la pronunciación-sonido de los léxicos bilingües se activa cuando se presenta cualquier forma lingüística. Es importante resaltar que la activación indiscriminada del conocimiento de la pronunciación-sonido en el sistema bilingüe coreano-inglés ocurre en la ausencia de cualquier indicio ortográfico porque estas lenguas tienen sistemas de escritura totalmente diferentes.

Traditional bilingual research has assumed that each of the bilingual's lexicons is accessed independently when a printed word is presented. However, this assumption has since been challenged by many studies showing that lexical knowledge of both languages is activated when a reader's task involves only one language. When we look at these studies more closely, the two languages generally differ in degree of activation, depending on whether a reader processes L1 (the dominant language), or L2 (the nondominant language). In other words, previous research tells us that it is more likely that the knowledge of L1 is activated when a reader processes L2 than vice versa (Dijkstra & Van Heuven, 1998).

Previous research has made use of words that are shared between the two languages. For example, Gerard and Scarborough (1989) and Dijkstra, Grainger, and Van Heuven (1999) used "cognates," the interlingual homographs that not only share orthographic form but also meaning. For example, the word "LIP" has same meaning for English and Dutch. Studying the performance of interlingual cognates or homographs can provide information on how the bilingual lexicon is organized and accessed. The logic of the design is that if lexical access is selective, then performance of a cognate like "LIP" by people for whom Dutch is their L1 and English is their L2 in an English lexical decision task should be approximately the same as that of a noncognate word or a control word. In contrast, if lexical access is nonselective, then the cognate should be processed faster than any other word because two lexicons are activated for the cognate, but not for the other words.

A series of studies showed that lexical knowledge of L1 was automatically activated if the experimental task was to process a word of L2. These studies showed that the cognate was processed faster than control words, indicating the activation of both lexicons of bilingual languages. Van Heuven, Dijkstra, and Grainger (1998) studied Dutch-English bilinguals. Processing English was affected by the neighbourhood size (i.e., the number of words that can be made by changing just one letter of a word) of Dutch. The required task was to make a lexical decision in English; the dominant language, Dutch, did not appear at all. Thus, subjects had no reason, consciously, to invoke Dutch, suggesting the automatic activation of L1.

In contrast, mixed research results have been obtained on whether the lexical knowledge of L2 is activated when we process a word in the context of L1. De Groot, Delmaar, and Lupker (2000) showed that interlingual homographs (which were not cognates) were processed *slower* than control words for Dutch-English bilinguals in a Dutch lexical decision task. This result indicates that the same orthographic form of the homographs activated the two different meanings in the two languages. In contrast, Scarborough, Gerard, and Cortese (1984) found that Spanish-English bilinguals had no difficulty in rejecting the L2 language (nontarget) in a Spanish lexical decision task (see also Gerard & Scarborough, 1989, using Spanish-English interlingual homographs and cognates). They argued that each lexicon of the bilingual languages was selectively accessed, eliciting no difficulty in rejecting the nontarget language. Grainger (1993), however, noted that the orthographic features of Spanish and English are very different. This might have provided a context in which participants could have used the corresponding orthographic cues in the lexical decision task. If so, these studies are not relevant to the present research question because of the confounding factor.

One aspect of lexical knowledge that has been intensely investigated is lexical phonological

information. In particular, an important theoretical question is raised by monolingual research in which word recognition is sometimes argued to be mediated by spelling–sound decoding (i.e., mediated by phonology). Many studies that employed the priming task showed robust phonological priming (e.g., TOWED → toad). In the case of bilingual language performance, Brysbaert, Van Dyck, and Van de Poel (1999) used the phonological priming task to address the issue of whether or not phonological mediation precedes lexical access. Their results showed that a briefly presented prime of L1 (Dutch) facilitated the processing of the target of L2 (French). Gollan, Forster, and Frost (1997) also found that priming occurred for Hebrew-English cognates[1] when bilinguals processed L2 (English), but not when they processed L1 (Hebrew). Because Hebrew and English have very different orthographies, the effect was necessarily phonological. These results suggest that phonological information from L1 is automatically activated when a reader processes L2 as the target and that the phonological information in L1 and L2 is connected at some point. For the absence of phonological priming when an L2 cognate preceded an L1 target, they argued that the phonological information of L2 may not have been automatically activated or the L1 target was not processed phonologically. Other studies, using techniques other than the priming task, have also provided evidence of simultaneous phonological activation in bilingual reading. They provide experimental evidence that the interlingual homophone is processed more slowly (Dijkstra et al., 1999; Doctor & Klein, 1992), and that word-body neighbours in the nontarget language have a significant influence on recognition (Jared & Kroll, 2001).

Wijnendaele and Brysbaert (2002) showed, using French-Dutch bilinguals, that the phonological priming from an L2 prime to an L1 target is as significant as the phonological priming from L1 prime to L2 target. (But see Brysbaert et al., 1999, and Gollan et. al., 1997, for contrasting results.) This indicates that phonological lexical knowledge in both languages can be nonselectively activated when reading one language.

The present study has been designed to investigate phonological priming from L2 to L1 as well as from L1 to L2 for Korean-English bilinguals. In addition to testing both kinds of phonological priming in a single study, another motive for the present study was to take advantage of the orthographic differences between Korean and English. The orthographic structures and features of Korean and English are so dissimilar that they cannot provide orthographic cues in priming and, in fact, may be mutually inhibitory to a bilingual reader. Note that, in the research reported above, all the participating languages have writing systems that are alphabetic orthographies. Written Korean is more accurately described as a syllabary, in contrast to English, which is alphabetic. In this sense two writing systems represent phonological information at different hierachial levels in information processing. Further, a substantial proportion of Korean printed words (about 30% in common use) are not syllabic representations at all, having been carried over, historically, as whole-word Korean pronunciations of Chinese ideograms. Thus, this study also assesses the question of whether activating the orthographic cues of very different writing systems will fail to activate bilingual information automatically.

Experiment 1 (1a and 1b) addresses the question of phonological priming from an L1 prime (Korean nonword) to an L2 target (English word) across short and long SOAs (stimulus onset asynchrony). In contrast, Experiment 2 (2a and 2b) investigated phonological priming from L2 (English nonword) to L1 (Korean word) across short and long SOAs. The purpose in varying SOA was to allow little time (short SOA) or longer time (long SOA) for the prime to have its effect. The long SOA was within the range typically considered to allow subjects to be aware of the prime and to consciously adjust their response to the target. The short SOA was within the range typically considered too short to allow subjects to adjust their response to the target.

As a first step in investigating the pattern of accessing bilingual phonological lexicons, Experiments 1a and 1b employed a Korean nonword (L1) as a prime, and an English word (L2) as a target. The duration of the prime was 140 ms in Experiment 1a, too brief to involve awareness of the prime (Neely, 1991). In contrast, the duration of the prime in Experiment 1b was 250 ms, a duration that is long enough to allow conscious processing. We hypothesized that if the phonological information of L1 was activated in the early stage of processing of the letter-string, this activated phonological form would be available in processing the L2 target, as much monolingual research showed (e.g., Lukatela, Eaton, Lee, Carello, & Turvey, 2002). The amount

[1]For Hebrew-English bilingual language, the cognates are words that are similar in meaning and phonological form across the two languages.

of evidence in support of the phonological recoding in processing the mother tongue suggests that the second language would be more likely to be processed phonologically as reading skills of the second language increase (Fletcher-Flinn & Thompson, 2004).

Thus, if L2 shares a common phonological stage with the L1 word access system and it is processed phonologically, the L2 target would be processed faster in the phonological condition than in the control condition. In a reversal of Experiment 1, Experiment 2 employed a Korean nonword (L1) as a prime, and an English word (L2) as a target.

EXPERIMENT 1

In this experiment, using a nonword in the priming position instead of a word has a theoretical importance. Because a nonword does not have a corresponding lexical entry, the production of its phonological information must be accomplished by using the spelling-to-sound correspondence. This assembly of phonological information by the rule is more compatible with the assumption of the phonological recoding hypothesis rather than the competing dual-route hypothesis in the monolingual research (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001). This is because the dual-route hypothesis assumes that phonological information should be addressed by accessing the lexicon in a fast timescale. The assembly of phonological information by the grapheme–phoneme correspondence (GPC) rule can be accomplished only in a slower timescale. In contrast, the phonological recoding hypothesis argues the opposite way. Phonological priming by L2 in a fast timescale would support the idea of automatic phonological assembly even for a nondominant language, and the application of the hypotheses in the monolingual research to the bilingual research would be proven viable.

Korean-English bilinguals are unbalanced to English in the sense that they begin to learn English only in school and not from early childhood. However, they have almost perfect English reading ability, especially in word recognition, due to an intense reading education programme. They were taught English reading for about 6 hours per week in middle school and high school. Thus it was likely that participants in this study, the college students, would have no difficulty in reading words from a high school textbook and would do so fluently. The experimental task was the naming task, a popular task that can reveal the online reading process.

Experiments 1a and 1b

In Experiments 1a and 1b, a Korean prime preceded an English target. In Experiment 1a, the prime-target SOA was 140 ms and in Experiment 1b, it was 250 ms.

Participants. Forty-three college students who were Korean-English bilinguals participated in Experiments 1a and 1b. No one was trilingual. Twenty-nine students were female, with an average age of 19, and 14 students were male, with an average age of 20. They were enrolled in the Introductory Psychology class at Pusan National University in Korea and participated in the experiment as a course requirement. Participants had normal or corrected-to-normal vision. They were taught English as the second language in middle and high school, giving them 6 years of English study. All students were brought up in the south-eastern part of Korea, which includes the city of Pusan.

Materials and procedures. Twenty-eight English target words were selected from the CELEX database (Baayen, Piepenbrock, & Van Rijn, 1993). Their average frequency was 10658; the CELEX is based on over 17 million words. Next, two types of Korean nonword primes were made, a phonological prime and a control prime. Korean and English do not overlap orthographically at all but a phonological prime was made by an appropriate combination of consonants and vowels such that the Korean nonword resembled the pronunciation of the English target. (Stimuli are presented in Appendix A.) The control prime was made to be phonologically different from the English target in that there were no phonemes in common between the prime and the target. Two counterbalanced stimulus lists were made by assigning a phonological prime and a control prime to the same target. Each list had an equal number of phonological and control primes with no repetition of the same target. An additional 16 practice trials took place with an equal number of phonological and the control primes.

Participants sat approximately 60 cm away from the computer screen, and the experimenter sat beside the participant to monitor the experiment. Participants were instructed to read the target out loud as quickly as possible but to do so accurately. The prime and the target were presented by Superlab experimental software with three-field priming technique (i.e., mask-prime-target sequence). Each trial consisted of: (1) a row of four hash marks for 500 ms; (2) the Korean

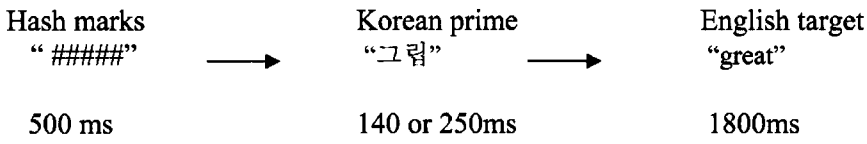

Figure 1. Stimulus presentation order of the priming task.

nonword prime for 140 ms in Experiment 1a, and 250 ms for Experiment 1b; (3) the English word target for 1800 ms. The intertrial interval was 1000 ms. The refresh rate of the Pentium monitor was 78Hz, making the refresh rate (one tick) equal to 12.9 ms. Stimuli were presented in a random manner. All letters were presented as white on a dark background. Stimulus presentation order is shown in Figure 1.

In order to ensure that subjects had an adequate ability to read English, 24 pictures of common objects (e.g., bus, tree) were shown to the participants (Jared & Kroll, 2001), and only those who could pronounce the names of all the objects in English were included in the experiment. Participants were assigned randomly to either of two counterbalanced lists.

Results and discussion

Response latencies less than 100 ms and more than 2000 ms were discarded as outliers; these were less than 0.5% of all responses (Ulrich & Miller, 1994). The mean RT and its standard error for each condition are summarized in Table 1.

Both RT and error responses for words were analysed by ANOVA. Each ANOVA was a 2×2 mixed-factor design, with a within-subject variable of prime type (i.e., phonological, control), and a between-subject variable of SOA (i.e., 140 ms, 250 ms). ANOVAs were conducted for subjects (F1) and items (F2), respectively.

For RT, there was a significant main effect for prime type, $F1(1, 84) = 74.3$, $p < .001$, $F2(1, 54) = 85.5$, $p < .001$. All other effects, including the interaction, were not statistically significant, $Fs < 1$. For the error ANOVA, a significant main effect for prime type was also found, $F1(1, 84) = 15.02$, $p < .001$, and $F2\ (1, 54) = 16.1$, $p < .001$. The interaction between prime type and SOA was statistically nonsignificant, $Fs < 1$, for SOA, and $F1(1, 54) = 2.73$, $p > .05$, $F2 < 1$.

The main results of Experiment 1 were that phonological priming from an L1 prime to an L2 target was significant across both SOAs. Target RT and error rates in both follow the same pattern, with faster time and fewer errors in the phonological condition. This suggests that the spelling–sound information in L1 is automatically invoked in the early stage and is still available in the later stage. Because the phonological effect is not larger for the longer SOA, it appears that no additional use is made of the prime's phonological information in the 250 ms SOA beyond the effects that occur in the first 140 ms.

Although we interpret effects of the 140 ms SOA to be automatic because subjects, if queried about the contents of the prime, could not report them, we did not specifically test for automaticity in a more subtle way. However, one recent paper has introduced this test (see Kouider & Dupoux, 2001, for just such a procedure). Thus, the present research is somewhat equivocal on the automaticity issue and future research should test specifically for the absence of awareness.

TABLE 1
Lexical decision latencies (ms) and error rates (%, in parentheses) across the two SOA conditions in Experiment 1

	Prime condition			
	Phonological	*Control*	*Difference*	*Mar. mean*
SOA (ms)				
140	721 (4.9)	768 (8.2)	47	744
250	723 (6.6)	766 (5.7)	43	744
Mar. mean	722	767		

EXPERIMENT 2

Experiments 2a and 2b

In Experiments 2a and 2b, an English prime preceded a Korean target. In Experiment 2a, the prime-target SOA was 140 ms and in Experiment 2b, it was 250 ms.

Participants. Participants were same as in Experiments 1a and 1b.

Materials and procedures. Forty-eight Korean target words were selected from the Korean Word Frequency database (Lee, Lee, Nam, Chung, Lee, & Choi, 1991). Their average frequency was 573; the Korean Word Frequency is based on over 1 million words. Next, two types of English nonword primes were constructed, the phonological

TABLE 2
Lexical decision latencies (ms) and error rates (%, in parentheses) across the two SOA conditions in Experiment 2

	Prime condition			
	Phonological	*Control*	*Difference*	*Mar. mean*
SOA (ms)				
140	552 (1.9)	571 (1.2)	19	561
250	549 (1.2)	585 (1.5)	36	567
Mar. mean	550	578		

prime and the control prime. The phonological prime was made by the combination of consonants and vowels to resemble the pronunciation of the Korean target (see Appendix A). The control prime was made to be phonologically different from the English target. In order to equate the two conditions of the nonword primes, the average bigram frequency[2] was matched, approximately, across the phonological prime condition (M = 1183) and the control prime condition (M = 1019) based on data in Solso and Juel (1980). All other procedures were same as in Experiment 1.

Results and discussion

Data editing was in the same manner as the Experiment 1. The mean RT and its standard error for each condition are summarized in Table 2.

The ANOVA was a 2 × 2 mixed-factor design, with a within-subject variable of prime type (phonological, control), and a between-subject variable of SOA (140 ms, 250 ms). It was conducted with subjects ($F1$) and items ($F2$) as the error term.

Significant main effects for the prime type were found, $F1(1, 84) = 13.6$, $p < .01$, $F2(1, 54) = 7.2$, $p < .05$. The main effects for the SOA were not statistically significant, $Fs < 1$. All other effects, including the interaction, were not statistically significant, $F1 = 1.7$ and $F2 < 1$. The ANOVA on error rate was not performed because all error rates were less than 2%.

The main result of Experiment 2 demonstrated that phonological priming from an L2 prime to an L1 target was significant at both SOAs. This suggests that the spelling–sound knowledge of L1 is automatically activated in the early stages, and L2 processing takes advantage of this available phonological information. The interpretation of results is similar to that in Experiment 1.

[2]Bigram frequency means how often a pair of letters in a word appears in written texts.

GENERAL DISCUSSION

The most intensely debated topic in monolingual research is the presence of phonological recoding in word recognition. The recent dominance of research supporting the phonological recoding hypothesis in monolingual research suggested the possibility of phonological recoding even for L2 recognition. The strong outcome of the present study is that phonological information activated in either L1 or L2 can interact with phonological information in the other. L2 shares phonological information with L1, and its spelling–sound knowledge is, apparently, activated automatically. The consistent pattern of phonological priming of both L1 and L2 targets indicates that the spelling–sound knowledge of bilingual lexicons is activated when a linguistic form of any word is presented. Importantly, this indiscriminate activation of spelling–sound knowledge in the Korean-English bilingual system occurs in the absence of any common orthographic cues because the two languages have totally different writing systems. In addition, the phonemic inventory of Korean is similar as that of English. All phonemes of consonants and vowels in Korean overlap those in English. The only differences are the composite vowels that are used in Korean, and only a few of them were included in the present stimuli. Lastly, the results of this study are more convincing as compared to Gollan et al.'s (1997) study with respect to the absence of phonological effect when L1 cognates precede the L2 targets. Null effect is less convincing than effects.

The findings of these studies cannot be explained by bilingual models that argue for separate lexicons in bilingual systems (Kroll, 1993; Snodgrass, 1993). These traditional bilingual models allow the possibility that bilingual languages share common semantic knowledge, but sharing of lexical knowledge (like the phonology) is not considered. They argue that acquisition of L1 can be done in a phonological manner, but L2 acquisition begins after visual processing of orthographic form becomes a standard process. Thus, phonological coding should be limited to L1, and any lexical knowledge in the early stage of word recognition should not interact between the two language systems. In contrast, the current results can be explained by a simple phonological recoding mechanism that does not discriminate between language systems. Once the presented stimulus is an orthographic form, spelling–sound knowledge is apparently automatically activated, with both L1 and L2 sharing the early stage of phonological processing.

It should be noted that this study is inconsistent with several studies using English-Spanish bilinguals, which showed no simultaneous access of a bilingual lexicon. Grainger (1993) argued that distinct orthographic features in Scarborough et al.'s (1984) study might have played the role in selectively accessing lexicons in the lexical decision task; the influence of orthographic features might be different according to the type of the experimental task. This study employed the fast priming task that uses nonwords. Thus, the type of information that each study focused on is different. It might also be possible for participants to strategically inhibit nontarget language based on the orthographic cues in a lexical decision task that has no prime; however, strategic inhibition could not occur in a fast priming paradigm. Inhibition is possible in the nonpriming task but not in the priming task. It is clearly of interest to apply the present priming paradigm to Spanish-English bilinguals in order to further evaluate the discrepant results.

One question remaining to be asked is the relationship between the degrees of experience with L2 and its corresponding degrees of phonological processing. Here more research is necessary to decide between contrasting views. Some studies have argued that inexperienced L2 readers do not process L2 words phonologically (Jared & Kroll, 2001); that less experienced Korean-English bilinguals might have not developed an ability to rapidly decode the primes. In contrast, most theories of alphabetic reading concede that beginning reader do, in fact, read phonologically; it might be argued that even adult "beginning readers" (of L2) will follow the same developmental path by beginning to read via decoding and, only after much experience, relinquish that strategy for visual word recognition. Thus we feel that the issue requires further research in which readers of a wide variety of L2 experience should be studied.

A limitation in making stimulus materials should be pointed out. It was intended that the prime and the target in the phonological condition in every experiment would be similar, and that those in the control condition would be dissimilar. The criterion of selecting the prime and the target was solely based on the feedback of conscious pronunciation. Thus the principles adopted in creating stimuli were not applied consistently, and the degree of resemblance and differences in L1 as opposed to L2 was not controlled properly. Another limitation is related to the control of participants' individual differences in English phonological knowledge. Although various demographic variables and the education period were controlled, checking the pronunciation using common object pictures might not be enough to ensure the consistency of all participants' phonological knowledge.

Manuscript received August 2004
Revised manuscript accepted April 2005

REFERENCE

Baayen, R. H., Piepenbrock, R., & Van Rijn, H. (1993). *The CELEX lexical database* [CD-ROM]. Philadelphia: University of Pennsylvania, Linguistic Data Consortium.

Brysbaert, M., Van Dyck, G., & Van de Poel, M. (1999). Visual word recognition in bilinguals: Evidence from masked phonological priming. *Journal of Experimental Psychology: Human Perception and Performance, 25*, 137–148.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108*, 204–256.

De Groot, A. M. B., Delmaar, P., & Lupker, S. J. (2000). The processing of interlexical homographs in translation recognition and lexical decision: Support for nonselective access to bilingual memory. *Quarterly Journal of Experimental Psychology, 53A*, 297–428.

Dijkstra, T., Grainger, J., & Van Heuven, W. J. B. (1999). Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and Language, 41*, 496–518.

Dijkstra, T., & Van Heuven, W. J. B. (1998). The BIA model and bilingual word recognition. In J. Grainger & A. Jacobs (Eds.), *Localist connectionist approaches to human cognition* (pp. 189–225). Mahwah, NJ: Lawrence Erlbaum Associates Inc.

Doctor, E. A., & Klein, D. (1992). Phonological processing in bilingual word recognition. In R. J. Harris (Ed.), *Cognitive processing in bilinguals* (pp. 237–252). Amsterdam: Elsevier.

Fletcher-Flinn, C. M., & Thompson, G. B. (2004). A mechanism of implicit lexicalized phonological recoding used concurrently with underdeveloped explicit letter–sound skills in both precocious and normal reading development. *Cognition, 90*, 303–305.

Gerard, L. D., & Scarborough, D. L. (1989). Language specific access of homographs by bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15*, 305–315.

Gollan, T., Forster, K. I., & Frost, R. (1997). Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew-English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*, 1122–1139.

Grainger, J. (1993). Visual word recognition in bilinguals. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 11–25). Amsterdam: John Benjamins.

Jared, D., & Kroll, J. F. (2001). Do bilinguals activate phonological representation in one or both of their

languages when naming words? *Journal of Memory and Language, 44*, 2–31.

Kouider, S., & Dupoux, E. (2001). A functional disconnection between spoken and visual word recognition: Evidence from unconscious priming. *Cognition, 82*, B35–B49.

Kroll, J. F. (1993). Accessing conceptual representations for words in a second language. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 53–81). Amsterdam: John Benjamins.

Lee, S. S., Lee, K. D., Nam, K. S., Chung, C. S., Lee, I. K., & Choi, Y. C. (1991). *Development of a corpus of contemporary Korean for compiling a lexicographical database.* Seoul, Korea: Korean Dictionary Compilation Board of Yonsei University.

Lukatela, G., Eaton, T., Lee, C. H., Carello, C., & Turvey, M. (2002). Nonword–nonword pseudohomophonic priming. *Journal of Experimental Psychology: Human Perception and Performance, 28*, 3–21.

Scarborough, D. L., Gerard, L., & Cortese, C. (1984). Independence of lexical access in bilingual word recognition. *Journal of Verbal Learning and Verbal Behavior, 23*, 84–99.

Snodgrass, J. G. (1993). Translating versus picture naming: Similarities and differences. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 83–114). Amsterdam: John Benjamins.

Solso, R. L., & Juel, C. L. (1980). Positional frequency and versatility of bigrams for two through nine-letter English words. *Behavior Research Methods & Instrumentation, 12*, 297–343.

Ulrich, R., & Miller, J. (1994). Effects of truncation on reaction time analysis. *Journal of Experimental Psychology: General, 123*, 34–80.

Van Heuven, W. J. B., Dijkstra, T., & Grainger, J. (1998). Orthographic neighborhood effects in bilingual word recognition. *Journal of Memory and Language, 39*, 458–483.

Wijnendaele, I. V., & Brysbaert, M. (2002). Visual word recognition in bilinguals: Phonological priming from the second to the first language. *Journal of Experimental Psychology: Human Perception and Performance, 28*, 616–627.

APPENDIX A

Stimuli used in Experiment 1 (Korean nonword prime → English word target)

Target	*Pseudohomophone*	*Control*
great	그립	고형
now	나우	타우
know	노우	보푸
dog	도그	오트
read	리듭	가풀
must	머스	사트
May	메입	재집
most	모쓰	수츠
moon	무운	호금
meet	미틀	기틈
back	백크	잭사
boy	보입	고빔
big	비그	차브
sorry	쏘럽	무럼
stop	스트	수흐
city	시팁	기힘
yes	예슬	계츰
over	오브	소브
old	올디	숭티
woman	우면	수덤
your	유어	초거
joke	조큽	보픔
topic	타피	하피
party	파틈	차듣
house	하우	치요
happy	해핍	대압
help	헬피	익이
home	호엄	고임

노	KNOF	JUFF	소	SOH	FUH
댐	THAM	WOLL	시	SIH	ARS
덕	DUC	EXI	식	SIK	RUL
덤	DUMH	DEEH	신	SIIN	PEAC
독	DOGG	GASS	실	SIL	STE
돌	DOL	FOL	씨	SIE	GYI
돔	DOMH	PEEM	악	AK	DI
막	MAR	DES	암	ARN	DUL
먹	MUGG	SKEH	영	YEONG	WATEE
모	MORR	WHEA	자	JA	DU
문	MUN	STA	조	JO	FO
밀	MILV	BOHI	책	CHEC	MORC
밑	MIT	REN	척	CHUC	QUIL
밤	BAMM	CIPP	천	CHUR	DOUN
백	BAC	WEM	추	CHOO	OATE
벗	BUH	NAX	칠	CHIL	OLEE
보	BO	LU	키	KEE	SEH
볼	BOL	HOI	탑	TABB	RUTE
복	BUK	GUK	택	TAEG	WAHN
불	BOOL	COOE	턱	TUK	COH
비	BII	NUP	포	POR	SAV
삽	SAB	ZAB	풀	PUL	DEA