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Cognate Facilitation Effects in Cross-Script Languages: Evidence from Unbalanced Korean-English Bilinguals*

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Lim, Jung Hyun, Cui, Mao and Ahn, Hee-Don. 2020. Cognate Facilitation Effects in Cross-Script Languages: Evidence from Unbalanced Korean-English Bilinguals. *Korean Journal of Linguistics*. 45-1, 167-180. The purpose of this paper is to examine the questions of how the amount of phonological information manipulates the cognate facilitation effect and to what extent the L2 proficiency modulates the priming effect. A lexical decision task in L2 to L1 direction was performed with Korean-English unbalanced bilinguals, whose languages have no overlaps in orthography. The experiment yielded the results that the participants were influenced by short or long pronounced words (i.e., the amount of phonological information) and that there was a cognate facilitation effect even with different-script languages in backward translation direction. The results also reported a role of L2 proficiency on the priming effect. These results are discussed within several models of lexical bilingual organization. (Konkuk University)

Key words: cognate translation priming effect, phonological information, L2 proficiency, cross-language activation

1. Introduction

How we access to a word is one of the important questions in lexical

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processing research. A substantial body of research in bilingual lexical processing literature has examined how two languages are organized and represented in bilingual memory for decades (Kroll & Curley, 1988; Kroll & Stewart, 1994; Potter, So, Von Eckardt, & Feldman, 1984). The existing studies thus far tend to suggest the language nonselective view, which assumes that the first language (L1) is accessed even when people read an L2 or vice versa (Costa, Caramazza, & Sebastian-Galles, 2000; Dijkstra & Van Heuven, 2002; Jared & Kroll, 2001; Schwartz, Kroll, & Diaz, 2007).

One of the strong evidence for language nonselective view comes from the studies that found cognate facilitation effect across languages (Davis, Sanchez-Casas, Garcia-Albea, Guasch, Molero, & Ferre, 2010; Dunabeitia, Perea, & Carreiras, 2010; Gollan, Forster, & Frost, 1997; Kim & Davis, 2003; Nakayama, Sears, Hino, & Lupker, 2013). Cognates are the words that share similar (or near identical) form, meaning, and sound between languages, just as “winter” in Dutch and English. It has been found that cognate words generally have advantages over non-cognates when recognizing and accessing in a lexical decision task, the commonly used experimental paradigm in lexical processing research. The cognate facilitation effect has been usually observed between languages which share high levels of orthographic, phonological, and conceptual similarities, such as Dutch and English, Spanish and English, and it suggests that the lexicons are integrated across languages in the mind of bilinguals and even unbalanced L2 learners. In recent years, as researchers have broaden interests into East Asian languages, such as Japanese, Chinese, and Korean, which mostly do not share orthographic similarities at all with English, the question of whether the cognate priming advantage would also be observed with different scripts, has been put forth and vigorously investigated (Kim & Davis, 2003; Lee & Choi, 2018; Nakayama, Sears, Hino, & Lupker, 2012; Nakayama, Ida, & Lupker, 2016; Nakayama, Verdonschot, Sears, & Lupker, 2014; Zhou, Li, Liu, Fang, & Shu, 2011). The previous studies have reported that bilinguals or L2 learners with cross-script languages (e.g., Japanese-English, or Chinese-English) process cognate words much easier and faster than unrelated words just like those with the same-script languages, suggesting integrated phonological representations for different-script bilinguals (Nakayama et al., 2012, 2014; Zhou, Chen, Yang, & Dunlap, 2010).

Although existing studies have found some evidence that bilingual lexicon with different-script languages are phonologically and

conceptually shared to some extents, there are many things to be remained inconclusive. In addition, there are not many studies to look at Korean-English language pairs, focusing on cognate priming advantage (*cf.* Kim & Davis, 2003; Lee & Choi, 2018). Thus, the present study attempted to capture the gap in the literature, investigating the questions of whether different amounts of phonological information would have an influence on cognate facilitation effects in Korean learners of English, and whether L2 proficiency can affect the priming effect, if any occurs.

2. Theoretical Background

Various models and hypotheses have been put forth to account for bilingual lexical interaction such as the Revised Hierarchical Model (Kroll & De Groot, 1997), the episodic L2 hypothesis (Jiang & Forster, 2001), the Bilingual Interactive Activation plus (BIA+) model (Dijkstra & Van Heuven, 2002), or phonological account (Voga & Grainger, 2007). Previous studies have started with typologically similar languages in which they share the common alphabetic scripts (e.g., Dutch and English, French and English, or Spanish and English). It is only recent that researchers have conducted studies with L2 speakers or bilinguals with orthographically two different languages to discuss the findings in terms of the theoretical models. Interestingly enough, similar to those same-script languages, the cross-script languages have also been found integrated to some extents, providing valuable information to understand the nature of bilingual lexicon in different script languages (Dimitropoulou, Dunabeitia, & Carreiras, 2011; Jiang, 1999; Jiang & Forster, 2001; Kim & Davis, 2003; Nakayama et al., 2012, 2014).

Kim and Davis (2003) was one of the influential studies to look into bilingual lexical interaction with different script languages. The study utilized L1 to L2 experiments with cognates, noncognates, and homophones in three different kinds of priming task, a lexical decision task, a naming task, and a semantic verification task in Korean-English unbalanced bilinguals. Manipulating the types of prime and target relationship and the type of tasks, the authors attempted to investigate whether cross-script priming would occur regardless of task types. In the masked prime lexical decision task, a significant priming effect for cognates and noncognates was found, but not for homophones, whereas in the word naming task, cognates and homophones yielded a significant

effect, but not noncognates. In the semantic categorization task, participants were influenced by noncognates, but not by homophones. With the results that priming effect for prime-target relationships was differentially modulated by the response task, the study suggested that bilingual's languages are connected at a different locus depending on the status of prime-target and the given lexical task.

Another series of studies by Nakayama and colleagues have reported the integrated phonological representation between cross-script languages for Japanese-English bilinguals. Nakayama et al. (2012) examined the effects of processing fluency of L2 targets on phonological priming, manipulating the frequency of the targets and individual difference (i.e., L2 proficiency). They used cognate translation equivalent primes (loan words), phonologically similar but conceptually unrelated prime (homophone) in an L1 to L2 lexical decision task. The cognate translation priming effect was found larger for the lower-proficient group as being consistent with Gollan et al. (1997), but the magnitude of phonological priming effect did not significantly differ across the two different proficiency groups. The study suggested that phonological representations of bilinguals with even completely different scripts are still integrated.

Nakayama and the colleagues (2014) further investigated whether phonological similarity would affect the magnitude of the cognate priming effect, testing the phonological account proposed by Voga and Grainger (2007). The phonological account (2007) assumes that the cognate priming effect consists of both phonological and conceptual facilitation, such that cognates and noncognates differ only in the aspect of the phonological similarities. According to the account, therefore, Nakayama et al. (2014) predicted that the cognate priming effect size would be related to the phonological similarity of cognates, and the results of the L1 to L2 lexical decision task showed that high level of phonological similar prime-target pairs yielded larger cognate priming effect. The study pointed out the important role of phonological information even when two languages have no overlap between phonology and orthography, supporting well for the phonological account.

Although the existing studies on different-script languages have provided us useful information on bilingual lexicon organization, there still seem to be many open questions. The present study therefore asks several questions that have not been investigated that much: (a) whether

the cognate facilitation effect would occur in different-script languages, Korean and English, in L2 to L1 direction, (b) whether the amount of phonological information would affect the magnitude of the cognate priming effect, and (c) whether L2 proficiency would modulate the cognate translation advantage. A weak priming effect in L2 to L1 direction compared to the L1 to L2 direction has been often reported (Gollan et al., 1997; Jiang, 1999). Therefore, if we found any priming effects in L2 to L1 direction in the current study, it would be the strong argument for the language nonselective access to phonological and conceptual representation. Also, there are no studies at present to manipulate the amount of phonological information– that is, short and long-pronounced words, the results gained from the current study would provide useful empirical data to the field of bilingual lexical processing.

3. The Present Study

3.1. Participants

Thirty-eight college students and graduates from two large universities located in Seoul participated in this experiment. The age of the participants ranged from 21 to 32 years. The participants' native language was Korean and all had started learning English at schools at least after 8-years-old as a second language in Korea, not in other English-speaking countries. They were given 15,000 won (KRW) in compensation for their participation.

3.2. Materials

The total of 144 pairs were used in this experiment, consisting of 48 English-Korean cognate prime-target pairs and 96 filler pairs. Cognate words utilized in this study are usually the words that entered Korean from English (e.g., *computer*), such that the two words are similarly pronounced and have almost the same meaning. Half of the 48 English primes included one-syllable words (i.e., short words) which were adapted from the materials used in the study of Kim and Davis (2003) (e.g., the English prime /pen/ and the Korean target 펜 /pen/), and they were on average 3.2 letters in length and had a mean SUBTLEX word frequencies of 1.8 (Brysbaert, New, & Keuleers, 2012).

The other half primes were more than two-syllable words, (e.g., the English prime /leadership/ and the Korean target 리더십 /leadership/). The long words are supposed to provide much phonological information than the one-syllable words, the short words. The long words had on average 7.6 letters in length and had a mean SUBTLEX word frequencies of 1.9. In addition to the experimental primes, 48 unrelated English prime words were selected to pair with Korean targets, in order to serve as a control condition. Just as English related primes had two types, half of the unrelated primes were matched to the short-words primes with an average length of 3.4 and a mean frequency of 1.7, and to the long-words primes with an average length of 7.9 and a mean frequency of 2.0.

In addition to the 48 English prime words, 96 English filler primes and 96 Korean nonword targets were constructed to make participants answer “No” in a lexical decision task. All of the filler primes and nonword targets were designed to mirror to the experimental prime-target pairs, relating to length and frequency. Korean nonword targets followed the limitations on sequences of Korean segments. Two counterbalanced lists were created, such that each target appeared with an experimental prime and control prime and no participant would see the same target in their trials. In order for participant to get used to the experiment, a practice session with six extra prime-target pairs were constructed, and half of the targets were nonwords, just as the experimental cycle.

3.3. Apparatus and Procedure

The experiment was individually conducted in a quiet laboratory. Participants were instructed about the experiment both in the written and verbal forms. They were first asked to perform a masked prime lexical decision task on a computer. Each trial was presented with the following sequences: first, the forward mask (#####) was presented for 500 ms, and this mask was replaced by the English prime for 50 ms, and then the prime was followed by the Korean target until the participant’s response. All the masks, primes, and targets were presented in the center of the screen. Stimulus presentation and response data collection was yielded with E-prime 3.0 software. After participants finished the lexical decision task, they were verbally asked if they noticed any flashing during the task, and none of them noticed the flashing. After the main task, participant completed a language background survey, providing self-rated

English proficiency in five areas (listening, speaking, reading, writing, and grammar), and their official English test scores (i.e., TOEIC) and filled out an English cloze test. The cloze test was adapted from the one which had been used in the lab of Dr. Paula Dussias at Pennsylvania University (cf. Lim & Christianson, 2015). In the text, participants were asked to read a narrative story (adapted from American Kernel Lessons: Advanced Students' Book, 1981), which included every 10th word replaced by a blank, total up to 40 blanks. They filled out the blanks with any part of the speech. A total time for the whole experimental session was approximately 30 to 35 minutes.

3.4. Results

As with the standards of data treatments in the previous studies (Kim & Davis, 2003; Lee et al, 2018; Nakayama et al, 2014), response times more than two standard deviation from the mean were excluded from the data analysis, yielding 2% of data loss. Reaction times were analyzed using a mixed-effects linear model in R program (Baayen, Davidson, & Bates, 2008). Using a stepwise selection procedure, the factors of prime types (related vs. unrelated), condition (short vs. long) and cloze scores were included as fixed effects in the final model. Participants and items were included as random intercepts. Likelihood ratio tests were conducted to fit the model for the random effects structure. Only the significant fixed and random effects are presented in the result section. Table 1 shows mean response latencies and error rates in each of the four conditions.

Table 1. Mean response latencies and error rates

Condition	Short		Long	
Prime_type	RT (ms)	Errors (%)	RT	Errors (%)
Related	681.44	2.8	590.30	0.2
Unrelated	729.69	2.5	620.06	0.0

*For the nonword filler items, the mean response latency was 1,021 ms and the error rate was 14 %.

The response time seemed to tell us that there is a significant difference between short and long words, showing participants needed more time to decide on short words rather than long words. Table 2

presents the significant ($p < .05$) and marginally significant effects ($p < .10$) in the results of a mixed-effect linear model in R.

Table 2. Fixed effects in the linear mixed-effect model of response latency

	Estimate	SE	<i>t</i> -value	<i>p</i> -value
(intercept)	663.800	18.186	36.500	<.00001***
condition	-52.517	5.264	-9.979	<.00001***
prime_type	21.073	5.254	4.003	<.01*
prime_type:proficiency	4.219	2.145	1.967	.054.
condition:prime_type:proficiency	-3.812	2.013	-1.893	.066†

The factors of condition and prime type yielded a significant main effect, meaning that participants took longer to decide on the short words than the long words and that they also were slower to respond to targets with the unrelated primes than targets with the related primes. Though not significant at .05 level, the interaction between prime types and proficiency was marginally significant ($p = .05$), indicating response latency was influenced by functions of prime type and proficiency. In addition, the three factors were all interacted with a marginal significance ($p = .06$), leading to post-hoc analyses for the further investigation.

In order to observe the interactions, separate analyses by proficiency group were conducted. Higher and lower group were formed by the median score 26 (out of 40) of participants' cloze test scores ($t = 2.51$, $p = .02$). Besides the cloze test scores, participants' self-rated scores of each skills were also compared to verify that the lower and higher proficiency group significantly differed in their language proficiency levels ($\bar{p}s < .01$ for reading and grammar, $\bar{p}s < .05$ for writing, speaking and listening). Table 3 shows the results of mixed-effects linear models for each proficiency group.

Table 3. Fixed effects in the linear mixed-effect model of response latency by proficiency

	Estimate	SE	<i>t</i> -value	<i>p</i> -value
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Low-proficiency (N=20)				
(intercept)	652.333	23.489	27.771	<.00001* **
condition	-55.862	7.253	-7.701	<.00001* **
High-proficiency (N=18)	Estimate	SE	<i>t</i> -value	<i>p</i> -value
(intercept)	644.587	29.372	21.946	<.00001* **
condition	-37.952	9.591	-3.957	.001*
prime_type	25.631	9.598	2.670	.016*

The separate analyses explained the marginal significant interactions among factors, showing the different patterns of priming effects. While the higher-proficiency group showed both the main effects of condition and prime type, the lower-proficiency group only showed the main effect of condition, suggesting the certain role of proficiency level on the priming effect.

4. Discussion

The goals of the present study were to test whether the amount of phonological information affects the process of access to the target words in unbalanced bilinguals of two different script languages (Korean and English), and also to investigate whether lexical organization of two languages was modulated by L2 proficiency. To these aims, a lexical decision task on short and long cognate words was conducted with Korean-English unbalanced bilinguals. The present study focused on L2 to L1 (backward) direction because previous studies showed a relatively weak cognate facilitation effect in the direction and none of the studies have looked at this direction with a manipulation of phonological information.

The masked-prime lexical decision task in a backward direction performed by Korean-English unbalanced speakers yielded the results to show that the amount of phonological information indeed played a significant role in making a decision on the task; in other words, when

English primes were longer, the latency to L1 targets were much shorter. The longer the prime words, participants were more easily able to recognize and process the target words. It is quite a noteworthy finding that people were influenced by the syllable length of the words, since the previous studies did not consider this factor such that one-syllable words and multi-syllable words were used altogether in one experiment (*cf.* Kim & Davis, 2003; Nakayama et al, 2012; 2014). If the amount of phonological input was not a crucial factor, the condition effect (short or long) would not have occurred in the present experiment.

This finding suggests that the amount of phonological information is important in facilitating the target words even when two languages do not have phonological and orthographic overlap. The condition effect found in this study is also in line with the results of Nakayama et al. (2014) that phonological similarity affected the magnitude of the cognate priming effect. As reviewed earlier, Nakayama et al. found that the high-phonological similar cognates were significantly faster in the lexical decision task than the low-phonological targets, supporting for Voga and Grainger's (2007) phonological account. Our results can also be said to provide empirical evidence to the phonological account.

Another major finding in this study was the role of L2 proficiency in cognate translation priming effect. The current study provides another piece of evidence that cognate facilitation effect in cross-script languages is affected by L2 proficiency to the language processing literature. While the higher-proficiency group was influenced by both condition (short vs. long) and prime type (related vs. unrelated), the lower-proficiency group only showed the effect of condition. It means that the cognate translation advantage did not appear for the lower-proficiency L2 learners, suggesting a certain level of proficiency is needed for cross-language activation.

In addition, the different pattern depending on L2 proficiency can be explained by the Revised Hierarchical Model (RHM, Kroll & Stewart, 1994). The model assumes that lexical and conceptual links are connected to the L1 and the L2 with different strength, and that increasing L2 proficiency develops direct conceptual links for the L2 words. Although there is a debate whether the RHM should be replaced by the BIA+ (the discussion is out of scope in this paper, see Brysbaert & Duyck (2010) for more reviews), the current result on the L2 proficiency effect is well accounted for under the RHM. For the lower-proficient participants, the

conceptual link to the L2 words did not seem to be well developed yet, such that they did not get any primed by the L2 words even if the words were cognates.

5. Conclusion

The manipulation of the amount of phonological information certainly lead to the different effects of cognate translation advantage, showing that phonological information plays a crucial role and that phonological and conceptual representation are shared across cross-script languages. This study offers a useful and important guideline for future research in terms of an experimental design. In addition, by finding an interaction between cognate priming effect and L2 proficiency in L2 to L1 direction, the study add the experimental data on the role of L2 proficiency to the literature of bilingual lexical organization.

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