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Trilingual Word Recognition: Phonological Priming Effects in Trilingual with Different-script Languages*

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ABSTRACT

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Research on bilingual lexical processing has been extensive, yet studies focusing on trilingual lexical processing, particularly involving different-script languages, remain scarce. This gap in the literature highlights the need for further investigation into whether phonological representations are shared across languages in trilingual individuals. The present study addresses this need by exploring phonological priming effects in unbalanced trilingual speakers of Chinese (L1), English (L2), and Korean (L3). Using a masked-priming lexical decision task, this study investigates phonological priming effects in unbalanced trilingual speakers of Chinese(L1)-English(L2)-Korean(L3), focusing on the cross-linguistic influence of L3 on L2 word recognition. Responses from 38 participants were analyzed using a linear mixed-effects model to examine the influence of phonological information in L3 on the activation of L2 in trilinguals. The results showed a marginally significant phonological priming effect, indicating that Chinese speakers were influenced by Korean phonological information during English word recognition. Interactions between prime types and proficiency were also observed, albeit marginally significant, suggesting that higher proficiency in each language increases the influence of the primes. These findings provide tentative support for non-selective lexical access models, highlighting the complexity of multilingual lexical processing. The results are discussed in relation to several models concerning bilingual and trilingual lexical processing.

KEYWORDS

cross-linguistic influence, non-selective lexical access, trilinguals, different-script languages, masked-priming lexical decision task, phonological priming, multilingual lexical processing

1. Introduction

There is a growing trend of individuals becoming bilingual or multilingual in today's globalized world. A substantial body of research on bilingualism has been established over the past decades. Various models and extensive behavioral research with bilinguals and unbalanced second language speakers have significantly broadened our understanding of bilingual language acquisition, sentence processing/production, and lexical processing, although many aspects remain unsolved. For the past few decades, various theoretical models involving bilinguals or unbalanced speakers of two languages have been put forward to explain how a bilingual's mental lexicon is organized, how a lexical item is retrieved and accessed from two languages, and whether the representations of two languages are shared. Among the models, there are two most extensively explored by many studies – the revised hierarchical model (RHM) (Kroll and Stewart 1994) and the bilingual interactive activation plus model (BIA+) (Dijkstra and van Heuven 2002) in the literature of bilingual mental lexicon. Although each model's fundamentals and central claims differ in several ways, both models agree that two languages in bilinguals' minds are integrated to some extent depending on individual differences, such as language proficiency, the age of second language acquisition, and their environment.

Compared to the field of bilingualism, it is only recently (over the last two decades) that the multilingual phenomenon has gained attention as an area of systematic research in language and linguistic studies (Franceschini 2009, p. 9). Since multilingualism is fundamentally based on foreign language acquisition, it is logical to base its study on the established research in bilingualism, but with even more intense debate, as the addition of another language increases the complexity of the language system in individuals and introduces more variables and considerations in research methodologies as well. Based on the models originating from studies with bilinguals, researchers have begun to show interest in how the existing findings and theoretical explanations can be expanded to multilingual individuals (Lemhöfer et al. 2004, Mulik and Carrasco-Ortiz 2021). Also, some theoretical models of multilingual lexical access have been proposed to provide further discussion on the similarities and differences between bilingualism and multilingualism, as well as the unique characteristics of multilingual language acquisition and processing (de Bot and Jaensch 2015, Ecke 2015, Hall 2002).

Although there have been several studies on trilingual or multilingual thus far, these existing studies primarily focused on the comparison between languages that share the same alphabetic system, such as Dutch-English-French or Dutch-English-German (Lemhöfer et al. 2004, Mulik and Carrasco-Ortiz 2021, Szubko-Sitarek, 2015, van Hell and Dijkstra 2002). Therefore, in this study, we aim to observe lexical processing of unbalanced trilingual whose first language is Chinese, a second language(L2) is English, and a third language(L3) is Korean. With these different-script languages, we seek to examine whether the phonological and lexical knowledge of the L3 can influence word recognition in L2. Below, we present a brief overview of studies focusing on bilingual lexical processing and two models of bilingual lexicon. Then, we focus on the studies of lexical processing by trilingual and review some of the models in the context of multilingual mental lexicon. The experiment involving unbalanced trilinguals with L1-Chinese, L2-English, and L3-Korean in a masked-priming lexical decision task adds interesting data to the discussion of the lexical representations and processing of multilingual with different combinations of languages.

2. Theoretical Background

Over the past decades, a substantial body of research has been conducted to determine whether bilinguals

activate only the relevant language or both languages simultaneously during language recognition in bilingual lexical processing. Accordingly, many theoretical models have been proposed to account for the results. To be more specific, the question of whether bilinguals have separate lexicons for each language (language-selective) or if there are some overlaps between the two (language-nonselective) has been probed. Until now, it appears that most existing studies agree on the idea that lexical candidates from both languages are linked to some extent, supporting the language nonselective view of bilingual lexical representation (de Groot et al. 2000, Dijkstra et al. 1999, Duyck 2005, Duyck et al. 2004, Pu et al. 2019). One line of evidence supporting the language nonselective view comes from research using the cross-language masked phonological priming paradigm, investigating whether phonological representations in the two languages are integrated. Many studies have initially focused on languages that share alphabetic systems (Brysbaert et al. 1999, Duyck 2005, Duyck et al. 2004, Haigh and Jared 2007, Jared and Szucs 2002). More recently, research has also included languages with different orthographies (Dimitropoulou et al. 2011, Kim and Davis 2003, Lim and Christianson 2023, Lupker et al. 2015, Nakayama et al. 2012, Zhou et al. 2010).

One of the models that received the most attention early in the literature on bilingual mental lexicon is the Revised Hierarchical Model (RHM) by Kroll and Stewart (1994). It was initially proposed to explain the asymmetries observed in bilingual lexical production, i.e., translation tasks, particularly for late bilinguals. In this model, L2 words are mediated by L1 translation equivalents at the beginning of learning an L2, such that the link from L2 to L1 is more vital than the other direction at the lexical level of representation. As L2 proficiency develops, the conceptual level that has shared concepts for both languages gets stronger since L2 words begin to establish their direct conceptual links. These accounts explain well the findings that late bilinguals showed faster and more accurate backward translation (L2 to L1) than forward translation (L1 to L2), especially for less proficient bilinguals, and the asymmetrical translation is reduced as they develop L2 proficiency. La Heij et al. (1996) had bilingual participants translate words presented with nonverbal contexts from both forward and backward directions, exploring the concept of mediation in bilingual memory representation. The results showed more robust effects of nonverbal context in forward translation, indicating more reliance on conceptual mediation. In contrast, backward translation exhibited weaker effects of nonverbal contexts, suggesting more reliance on direct lexical links. These findings highlighted the asymmetric nature of bilingual memory representation proposed by the RHM.

The RHM (Kroll and Stewart 1994) has been supported by many other studies for the last few decades (Dufour and Kroll 1995, Jiang 1999, Kroll and Tocowicz 2005, Kroll et al. 2010, La Heij et al. 1996). The model fundamentally supports the idea that bilinguals exhibit non-selective to both languages during word recognition, with activation spreading from L2 words to their L1 translation equivalents and shared concepts. It has been very influential in shaping our understanding of bilingual lexical organization and processing until it has faced some criticism and revisions (for more details of criticism and revisions, see Kroll et al. 2010)

Recently, the Bilingual Interactive Activation plus (BIA+) model with more dynamic and connectionist approaches to bilingual memory has been suggested by Dijkstra and van Heuven (2002) to explain the evidence of non-selective access in bilingual word recognition. The model proposes that the bilingual's two languages are integrated at all linguistic levels of orthographic, phonological, and semantic and that bilingual word recognition is influenced by similarities and overlaps at all three levels. Numerous studies have empirically supported the model until now, employing various types of translation equivalents such as cognate, noncognate, and homophone words in different types of linguistics tasks and diverse language populations. For instance, using three types of response tasks (lexical decision, naming, semantic categorization), Kim and Davis (2003) examined Korean-English unbalanced bilinguals, focusing on how different prime-target relationships and response tasks would

influence cross-language priming effects. The participants in the study showed cross-language cognate and phonological effects, but the degrees of priming effects were dependent on the tasks and prime-target relationships. While lexical decision tasks were more sensitive to semantic processing, naming tasks were more responsive to phonological priming. Although the response tasks influenced priming effects, the study showed the nonselective activation of phonology between Korean and English.

A more recent study by Lim and Christianson (2023), replicating and partly addressing a gap in Kim and Davis's (2003) study, provided further evidence that the lexical and phonological representations are shared between Korean and English, manipulating the amount of phonological overlap and L2 proficiency. Lim and Christianson (2023) replicated the lack of phonological priming effect in the L1 to L2 direction, just as in Kim and Davis (2003), but found a reliable effect in the L2 to L1 direction using a masked-priming lexical decision task. The authors interpreted their results in that the direction of the prime-target, L2 proficiency, and the degree of phonological overlap played significant roles in cross-language activation, and lexical and phonological representations are shared to some extent supporting the BIA+ model. Another study by Zhou et al. (2010) investigated whether phonological representations are integrated for Chinese speakers learning English, testing the hypothesis of non-selective access. Through four experiments of cross-language naming tasks and masked-priming lexical decision paradigms, the study found robust phonological priming effects in both the naming and lexical decision tasks, regardless of the levels of L2 proficiency and the language direction. This study was meaningful because it extended evidence for the nonselective access hypothesis to language pairs with very different writing systems (Chinese and English).

Building on findings from studies on bilingualism, some researchers have questioned whether the non-selective access hypothesis can hold for trilingual and multilingual. Lemhöfer et al. (2004) extended the exploration of non-selective lexical access from bilinguals to trilingual by examining Dutch (L1)-English (L2)-German (L3) trilingual. They used a lexical decision task in which participants determined the validity of German (L3) words. The study utilized three types of word stimuli – German control words (G), double cognates (DG), where words are similar in L1 and L3 but not in L2, and triple cognates (DEG), where words are similar in all three languages. Results showed that participants responded faster to the group of DG cognates than the control condition (G), and they were even faster to the DEG cognates group, suggesting additional facilitative influence from English (L2) and cumulative cognate effects. The study provided strong evidence for non-selective lexical access in trilingual, extending the bilingual findings, showing that all language knowledge is simultaneously activated during L3 word recognition. Although the authors advised further research to fully understand the trilingual processing system, this study's findings on the simultaneous activation of multiple languages support the generalization of non-selective access models to trilingual or multilingual contexts. Another recent study by Mulík and Carrasco-Ortiz (2021) utilized an event-related potentials (ERPs) paradigm to examine the influence of L1(Spanish) and L2(English) phonological representations on L3(Slovak) lexical learning using internal homophone words. The L1-dominant Spanish-English bilinguals participated in a three-day learning period where they listened to three groups of Slovak words; some phonologically overlapped with L1 Spanish or L2 English, and control words with little or no overlap with L1 or L2. While the pre-training session yielded no significant homophones in ERPs, some significant effects were observed in post-training session as follows: (a) an N100 effect was found for English (L2) interlingual homophones, suggesting early sensory processing differences, (b) opposite N400 effects were found for L1 and L2- a reduced N400 effect for Spanish (L1) interlingual homophones, meaning easier lexical processing, and an increased N400 effect for English(L2) interlingual homophones, suggesting competition and difficulty in processing due to the non-dominant status of L2. By obtaining both facilitation from L1 phonology and inhibitory processes from L2 phonology, the study provides evidence that L1 and L2 phonological representations influence

L3 lexical learning differently. It also contributes to understanding how multiple languages interact in the bilingual brain, supporting the notion of non-selective lexical access, and implies the complexity of multilingual lexical processing.

Besides these behavioral studies, several models have been developed to explain third language acquisition and multilingual cognitive processes. One of them, called the Parasitic Model by Hall (2002), was originally proposed to understand vocabulary acquisition for new languages other than L1 or L2. One of the key aspects of this model is fundamentally based on the RHM (Kroll and Stewart 1994), suggesting that new lexical entries in L3/Ln do not develop in isolation. Instead, they are parasitic on the existing vocabulary of the learner's native language and other previously acquired languages. This means that new L3/Ln words attach themselves to the mental representations of well-established existing languages, and the parasitic connections gradually weaken as proficiency in the new language increases, resulting in stronger and more independent L3 representations. As an example, Hall and Ecke (2003) showed that learners tended to use already known words from their L1 or L2 as anchors, demonstrating parasitic learning. Another model, the Multilingual Processing model, was proposed by de Bot (2004), focusing on multilingual speech production, which builds on existing bilingual models and integrates insights from psycholinguistics and neurolinguistics to account for the complexities involved in multilingual language processing. This model suggests that all known languages of multilingual individuals are simultaneously activated during language processing, in line with the view of non-selective lexical access and the BIA+ model (Dijkstra and van Heuven 2002). Like the BIA+ model, the multilingual processing model (de Bot 2004) also highlights the interactions between languages at all linguistic levels of representations, i.e., phonological, lexical, and syntactic, allowing for cross-linguistic influence and transfer.

Although several studies and theoretical models have been developed thus far to explain multilingual mental lexicon and cognitive processes, empirical studies involving trilingual whose languages do not share scripts are very scarce until now. As Lemhöfer et al. (2004) pointed out, more research should be carried out to validate the generalization of the view of non-selective access in bilinguals to trilingual or multilingual individuals. To fill a gap in this field of multilingual lexical processing, the present study chose an experimental setup where Chinese(L1) speakers of learning English(L2) and Korean(L3) were involved in a masked-priming lexical decision task. With unbalanced trilinguals of different-script languages, the present study aimed to explore whether phonological representations are shared in trilinguals just as bilinguals and to see if L2 and L3 proficiency levels influence priming effects during lexical processing.

3. Method

As noted above, although there has been a line of research on cross-language phonological representations in bilingual populations for the last few decades, it has rarely been examined whether the phonological representations are shared across foreign languages in the multilingual lexicon, especially with different-script languages. Several studies show that the use of L1 and L2 phonological information has an influence on L3 word learning, suggesting parallel activation of multilingual languages (Mulik and Carrasoco-Ortiz 2021, Mulik et al. 2019). Nevertheless, to our knowledge, the backward influence (L3 to L2), i.e., whether phonological information of L3 may affect word recognition in L2, has not been studied in multilingual contexts. Thus, the present study aims to investigate whether phonological representations are shared across three languages: Chinese(L1), English(L2), and Korean(L3). In addition, individual differences, such as the proficiency of L2 and L3, are also considered factors in examining the role of L3 in processing L2. The research questions are as follows:

(a) Do unbalanced trilinguals use L3 phonological information in processing L2 words?
(b) To what extent does the L3 phonological activation influence L2 lexical processing?
(c) Can the language nonselective access hypothesis be applied to trilingual contexts?

3.1 Participants

Forty-two unbalanced trilinguals with Chinese as their native language(L1) and English and Korean as their second(L2) and third language(L3) were recruited from two prominent universities located in Seoul, Korea. All participants, aged 22 to 27, had learned English as a foreign language in middle school after age 12. They then started learning Korean as L3 before they came to Korea for undergraduate or graduate school. Although they had made earlier contact with English than with Korean, it should be noted that most of the participants (except one) answered that they used Korean more frequently than English in daily life at the time of participation in this study through a brief interview with the experimenter after the main experiment.

3.2 Materials

The experimental stimuli were primarily adapted from previous studies of Kim and Davis (2003) and Lim and Christianson (2023). The stimulus list for the masked-priming lexical decision task consisted of 120 pairs; half were 30 Korean primes (L3) with English targets (L2) of homophone words, and the other half were 30 pairs of baseline words. The other 60 pairs were unrelated Korean primes and English nonword fillers. The group of homophone pairs was words highly related in terms of phonology but not in meaning across two languages of English and Korean, such as "눈/nun/ meaning 'eye' – noon" or "숲 /sup/ meaning 'forest' – soup." The Korean primes were one-length syllable words and had a mean frequency of 17.8 per million, and the unrelated primes were matched on word frequency and length with related ones. Target words in the homophone set had a mean length of 3.5 letters and a mean log SUBTLEX frequency of 1.91. Another group of words, baseline pairs, were selected to serve as a control to compare the reading behavior of homophone pairs. The baseline words consisted of words that are not semantically or phonologically overlapped across two languages, such as "역[yeok]'station' – bed." They were all matched in length and frequency to the homophone pairs. In addition to the experimental items, 60 English nonwords were created for the "no" trials in the lexical decision task, and these were selected from the English Lexicon Project database (Balota et al. 2007), obeying the orthographic and phonotactic constraints of English. The lengths of English nonwords were matched to the English targets. There were two counterbalancing lists for the experimental stimuli, such that Korean homophones primed unrelated Korean primes primed targets in List 1 in List 2 and vice versa. Participants were assigned randomly to one of the two lists, with 21 participants in each list.

3.3 Design and Procedure

Participants were tested individually in a quiet lab. The experiment was programmed with an E-prime 3 software package on the computer. Each trial appeared with the presentation of an asterisk mark (*) as a fixation point in the center of the screen for 300 milliseconds (ms), immediately followed by a forward mask (######) for 500ms. Then, a 50ms presentation of the Korean prime appeared for 50ms, the typical duration for primes in a masked-priming lexical decision task, followed by a lower-case English target. The prime was completely masked during

the target presentation. The English target remained on the screen until the participant made a response to the word. Participants were directed to choose whether the word that appeared on the screen was the real word that had meaning or the nonword in English as quickly and accurately as possible by pressing the "yes" or "no" button labeled on the keyboard. Participants completed ten practice items before the experimental stimuli were shown to familiarize themselves with the task. The instruction was given orally (in Korean and English) and verbally (in English on the screen). After the masked-priming lexical decision task, participants were asked to complete an English cloze test and a Korean mini-version of the Test of Proficiency in Korean (TOPIK). The English cloze test comprises a short narrative story (adapted from American Kernel Lessons: Advanced Students' Book, 1981) with 40 blanks and three choices of words to choose from in every fifth to seventh word. The Korean mini TOPIK was adapted from Jang (2018), which contains questions similar to those of original TOPIKs. The experiment session took approximately 40 to 50 minutes in total.

4. Results

The data from four participants were removed due to a high error rate (more than 20%) on the lexical decision, leaving a total of 38 participants in data analysis. Response latencies less than 300ms and more than two standard deviations from the mean of each condition (homophone and baseline) were excluded from the data analysis. This yielded a 4.0% loss in both homophone and baseline trials. A linear mixed-effects model using R was employed to analyze response latencies data, allowing us to account for both fixed effects of prime type (related, unrelated), English cloze test scores (L2 proficiency), and TOPIK scores (L3 proficiency), and random effects of subjects and items. Table 1 shows each prime condition's mean response times (and standard deviations) and error rates.

Table 1. Mean Response Latencies (RT) in Milliseconds and Error Rates (%) for L2-English Targets Primed by L3-Korean Homophones and Unrelated Words in the Homophone Condition and for Baseline Words in the Baseline Condition

	Prime_type			
	Homophone	Unrelated	Priming Effect	Baseline
Example	영/yeong/ – young 870.94 (12.5%)	솜/som/ – meet 891.27 (13.9%)	+21 (+1.4%)	물/mul/ – bid 843.99 (12.0%)

As seen in Table 1, it appears to be the trend that participants were more likely to respond to the English homophone word slightly faster when it was preceded by the related Korean homophone than when it was not. However, although the response times showed some differences (21ms) depending on the condition, the priming effect did not reach significance. It was only marginally significant (t = -1.72, p =.08) when analyzing the data using a linear mixed-effects model with factors of prime types, Korean TOPIK score, and English cloze scores. The main effects of Korean and English proficiency were not significant (p = .94 and p=.97, respectively). However, there were all marginally reliable interactions of prime type by Korean and prime type by English proficiency (all ps=. 09). Since there were marginal interactions between factors (although they were not significant), more detailed examinations on the response times depending on each language's proficiency were conducted to explore the respective effects of L2 and L3 proficiency on word recognition.

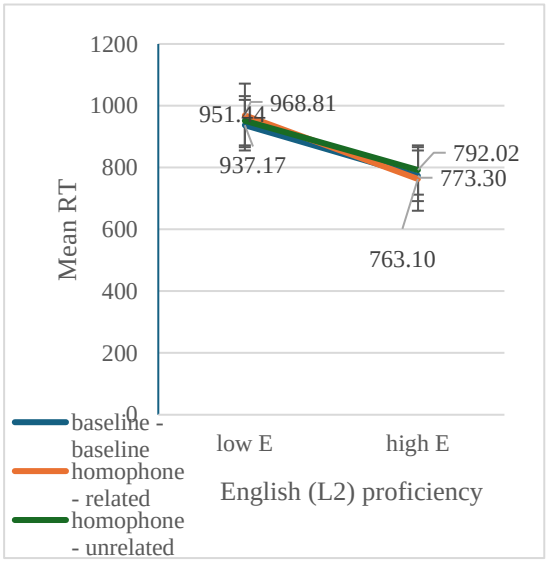

Figure 1. Mean Response Times by English in Homophone and Baseline Condition

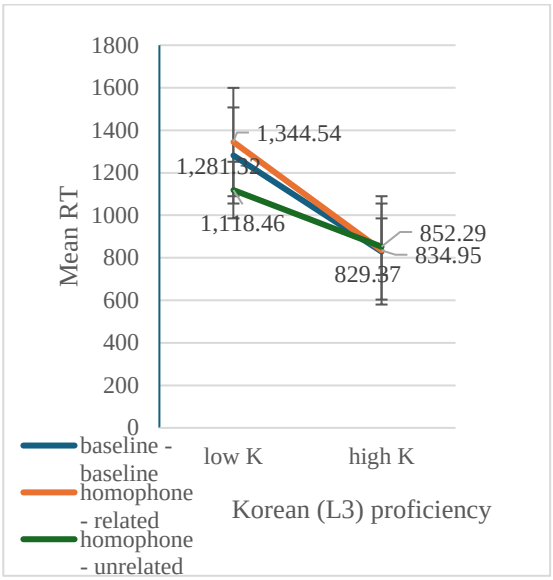

Figure 2. Mean Response Times by Korean Proficiency in Homophone and Baseline Condition

The data were divided into low- and high-proficiency groups based on the median scores of each language test (median=21 for the English cloze test, median=13.5 for Korean TOPIK). Figures 1 and 2 display the mean response times for low- and high-proficiency groups in English and Korean, respectively. First, a linear mixed-effects model was performed with fixed factors of English proficiency, prime condition, and random effect of subjects and items. The result showed a main effect of English proficiency ($t = -2.4$, $p=.03$). However, there was no interaction between the factors, indicating that the high-proficiency group was faster in homophone word recognition than the low-proficiency group (see Figure 1). Second, another linear mixed-effects model was conducted for Korean TOPIK-based data. It was yielded that a marginal main effect of Korean proficiency ($t = -1.96$, $p=.06$) and a marginal effect of interaction between proficiency and prime condition ($t = 1.75$, $p=.08$), indicating the role of Korean(L3) proficiency on English(L2) word processing as shown in Figure 2.

5. Discussion

The present study examined whether phonological representations are integrated for unbalanced trilingual native speakers of Chinese(L1) learning English(L2) and Korean(L3), which are different-script languages, by adopting a masked translation priming paradigm. Specifically, the investigation of whether and how L3 induces priming effects in L2 word recognition using homophone words allows us to understand whether phonological information is shared and non-selectively activated for different-script trilingual, testing the generalization of the view of the non-selective language access to trilingual contexts. This approach addresses a significant gap in the literature, as studies on L3 lexical processing and a backward influence (L3 to L2) on word recognition are relatively sparse. By examining these interactions, we aimed to contribute to understanding multilingual phonological integration, which has received limited attention in previous research. Another goal of the study was to explore the effects of L2 and L3 proficiency on L2 word recognition, given that much of the existing literature, including the BIA+

model and multilingual processing model, assumes these factors to be critical. However, empirical investigations focusing on the effect of proficiency within trilingual populations are scarce, making this study a valuable addition to multilingual lexicon research. Through a masked-priming lexical decision task, the current results provide novel insights into lexical access by trilingual and the interplay between L2 and L3 on word recognition. However, the statistical significance of the observed priming effects was only marginal.

First, our findings provide tentative yet compelling support for the BIA+ model in the context of the multilingual lexicon, suggesting that phonological representations are indeed integrated across languages (Dijkstra and van Heuven 2002). The present study obtained the marginal phonological priming effect ($p = .08$), indicating that L3 phonological representations might influence L2 homophone recognition, albeit not as strongly as expected. Given that the statistical significance was only marginal, we cautiously suggest that the observed trend in the current data indicates that L3(Korean) homophone primes may activate L2(English) word recognition. If L3 primes had no role, there would have been no differences in response times. The observed priming effect of 21ms suggests that Chinese speakers were influenced by phonological information in L3 when activating L2 lexical meanings, indicating that phonological representations are somewhat shared between L2 and L3 in L1 speakers. This finding is consistent with the BIA+ model's proposal that phonological networks are integrated across languages, allowing for cross-linguistic activation. While these results are promising, additional studies with greater statistical power and larger sample sizes must robustly support our claim.

The weak phonological priming effects observed in this study exhibit some consistencies with previous research (Kim and Davis 2003, Lim and Christianson 2023), which used similar stimuli (monosyllabic Korean words as primes) and reported challenges in eliciting priming effects in a lexical decision task. The difficulty in achieving significant priming effects with Korean monosyllabic words may be attributed to their phonological simplicity and the corresponding challenge in creating sufficiently strong priming effects. This suggests that the phonological characteristics of the stimuli play a crucial role in cross-linguistic priming studies. Indeed, previous studies have demonstrated the influence of the degree of phonological overlap on phonological priming effects in bilingual speakers (Lim and Christianson 2023, Nakayama et al. 2012, Voga and Grainger 2007). Although our results align with previous findings regarding weak or absent priming effects, there is a noteworthy aspect in our current findings. The present study yielded a slightly larger priming effect (21ms) compared to 14.14ms in Lim and Christianson (2023) and 18ms in Kim and Davis (2003). This difference is particularly interesting because the present study involves trilingual participants, unlike the bilingual participants in the previous studies. While further research is necessary to confirm any definitive conclusions, our findings suggest a potential facilitation effect among foreign languages in lexical activation.

Another interpretation regarding the weak significance of our findings can be seen through the lens of the Parasite Model (Hall 2002, Ecke 2015, Hall and Ecke 2003), which suggests that L3 representations may not yet be robust enough to exert a strong influence on word recognition. Given that the participants are still in the process of acquiring proficiency in Korean, it is plausible that the strength of their L3 phonological representations is insufficient to produce strong priming effects, especially with monosyllabic homophones, which may cause difficulties in triggering not as strong conceptual representations as multisyllabic words in Korean (Oh et al. 2007). This aligns with the Parasite Model's suggestion that integrating L3 representations into the existing linguistic system is gradual and contingent on proficiency levels. Indeed, this is demonstrated by the different response patterns based on the Chinese speakers' proficiency levels in each language. Korean proficiency induces a much larger difference in response times (510ms) independent of the prime condition compared to English proficiency (205ms).

The importance of proficiency in L2 and L3 on word recognition was evident in our data. Although the main

effects of Korean and English proficiency were not significant from the initial analysis, the interactions between prime type and proficiency were marginally reliable in the analyses with proficiency-based data. Further examinations with data by proficiency group revealed that participants with higher English proficiency recognized English homophones faster than those with lower proficiency speakers ($p = .03$), highlighting the role of L2 proficiency in phonological priming effect among unbalanced trilingual. A more interesting result emerged for Korean proficiency. The marginal effect of Korean proficiency ($p = .06$) and the interaction between proficiency and prime condition ($p = .08$) were yielded, indicating that participants with higher proficiency levels in Korean responded to English homophone words faster than the low-proficiency participants. This finding underscores the role of L3 proficiency in L2 lexical access, facilitating and activating L2 English word processing. The interaction shows the different patterns of response times in related and unrelated prime conditions depending on the proficiency group. Specifically, the high-proficiency group responded faster to target decisions when the prime was related than unrelated. Conversely, the low-proficiency group exhibited the opposite pattern, which was not the predicted direction. The present study cannot fully explain the rationale behind this discrepancy. It may be attributed to random data fluctuations or insufficient subjects or items. More research should be done to replicate or validate these findings to better understand the behavior and response patterns of trilingual people with varying proficiency levels.

In general, our data suggests a facilitation effect among foreign languages in lexical activation with higher proficiency in L3 can enhance the processing of L2 words. This particularly supports the view of non-selective lexical access and aligns with the BIA+ model, extending these concepts to trilingual contexts. However, as mentioned several times above, the marginal statistical significance of our results indicates that more robust data is required to confirm these effects. Future research should aim to replicate these findings with larger sample sizes and greater statistical power. Investigating different linguistic tasks, such as a naming task requiring more phonological awareness (Kim and Davis 2003), and including various prime-target relationships could also provide deeper insights into the mechanisms of multilingual lexical processing.

6. Conclusion

The present study explored whether phonological representations are integrated for unbalanced trilingual, specifically, native Chinese speakers learning English(L2) and Korean(L3), by employing a masked translation priming paradigm. While only marginally significant, our findings fill a notable gap in the literature and provide a foundation for future studies. This is the first study to demonstrate the potential integration of phonological representations in unbalanced trilingual with different-script languages, suggesting the extension of the non-selective lexical access view to multilingualism. Our study also advances understanding the interplay between L2 and L3 in lexical processing, indicating that L3 phonological representations may influence L2 word recognition. Although not statistically robust, the observed trends highlight the importance of considering cross-linguistic interactions and proficiency levels in multilingual individuals. Future research should include larger sample sizes and a broader range of linguistic tasks to build on these preliminary findings. Such research will validate and extend our findings and contribute to refining existing theoretical models, such as the BIA+ model, to explain the multilingual lexicon better.

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Examples in: English
Applicable Languages: English
Applicable Level: Tertiary

