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Cross-linguistic Semantic Priming Effect for Korean-English Unbalanced Bilinguals*

Wonil Choi[1] **Chang Lee[2]** **Kichun Nam[3]**

[1]Department of Psychology, University of North Carolina at Chapel Hill
[2]Department of Psychology, Sogang University
[3]Department of Psychology, Korea University

An experiment was conducted to examine the conceptual systems for Korean-English unbalanced bilinguals. The main focus was to examine whether the conceptual systems of Korean and English words are shared or independent. A primed lexical decision task was used and two types of semantic priming were compared: within-language and cross-language. The pattern of priming was very different, which suggests that Korean and English conceptual systems are not the same for Korean-English unbalanced bilinguals. Instead, it seems that they are connected but independent systems.

Key words : Word Recognition, Bilinguals, Semantic Priming, Korean-English

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† 교신저자 : Kichun Nam, Dept. of Psychology, Korea University, Anam-Dong, Sungbuk-Gu, Seoul, Korea
E-mail: kichun@korea.ac.kr

The population of bilingual speakers has increased dramatically as many countries globalize. Bilingualism is common and is the rule rather than the exception in most places (Harris & Nelson, 1992). It is difficult to define bilingualism clearly. The narrow definition of bilingualism is the ability to speak with the same or very similar proficiency in both first and second languages (hereafter, L1 and L2, respectively). However, an opposing and broader definition of bilingualism regards a bilingual speaker as one who may have limited proficiency in the second language, like Korean-English Bilinguals. In this study, we are interested in the lexical and conceptual structures of the latter population.

Among many topics of study on bilingualism, the manner in which mental lexicon and conceptual structures are organized has been one of the most important research questions. Weinrich (1953) suggested three structures for the bilingual speaker's mental lexicon. First, coordinated (i.e., balanced) bilinguals possess one "signified" for every "signifier". In other words, each word has a connection with each conceptual form. Second, compound bilinguals possess only one concept level representation for the translation-equivalent of two languages. Third, subordinate (i.e., unbalanced) bilinguals have no connection from their second language word level to the concept level; a link only exists from the second language word level to the first. That is, their second language system is subordinated to their mother language system. Potter, So, Von Eckhardt, and Feldman (1984) examined the developmental stage of the bilingual mental lexicon by using the translation and picture naming tasks. They suggested two models of the bilinguist's memory: the word association model and the concept mediation model. The word association model is similar to the subordinative structure in Weinrich's (1953) terminology, while the concept mediation model is similar to the compound structure. If the response time of a word translation task is shorter than that of a picture naming task, then the word association model would be supported. However, if the response time of the two tasks has no significant difference, then the concept mediation model would be supported. The study by Potter, et al. (1984) found that the result showed no different pattern between a novice bilingual and a fluent bilingual in the two tasks, supporting the concept mediation model. This result, however, has been refuted by Kroll and Curley (1988). They used subject groups with a larger discrepancy in proficiency than did Potter et al. (1984). In this study, there was a significant response time difference between the translation task and the picture naming task in the novice bilingual, but not in the fluent bilingual. This indicates that, as second language

proficiency increases, the mental lexicon changes from word association to concept mediation. Similar results were reported in studies using the bilingual Stroop task (Chen & Ho, 1986; Tzelgov, Henik, & Leiser, 1990). In their studies, the fluent bilinguals experienced constant interference both in between-language and within-language conditions, but the novice bilinguals had more interference in the within-language condition than the between-language condition. (see also La Heij, De Bruyn, Elens, Hartsuiker, Helaha & Van Schelven, 1990 for a similar finding).

Kroll and Stewart (1994) proposed the revised hierarchical model (RHM) to explain the previous findings (see figure 1).

According to this model, the words in each language (L1 and L2) are interconnected at the lexical entry representation of L1 and L2 and the lexical entry of each language is connected with the shared conceptual representation as shown in figure 1. Moreover, the connection

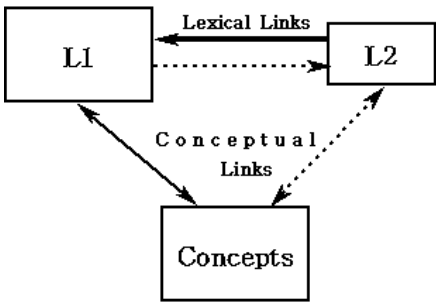

Figure 1. Revised Hierarchical Model(Kroll & Stewart, 1994)

strength between two languages is asymmetrical; the lexical links from L2 to L1 are much stronger than those from L1 to L2. Kroll and her colleagues (1994) proposed that this asymmetry of the lexical link strength comes from the second language learning method. Second language learners try to associate L1 and L2 vocabularies from L2 to L1 rather than from L1 to L2. The revised hierarchical model explains that the novice bilingual is more dependent on the lexical link in the backward translation task than on the lexico-semantic link. According to previous models, the links between L2 words and concepts are newly made as the bilingual's proficiency increases, and the L1-L2 connection at the lexical entry representation level disappears (Potter et al., 1984; Weinrich, 1953). However, according to the revised hierarchical model, after a new link between an L2 word and concept is made, the link between L1 and L2 at the lexical entry representation level still remains. This model proposes that the lexical level links are stronger from L2 to L1 than from L1 to L2, but that the conceptual links are stronger for L1 than for L2.

Although the RHM describes bilinguals ' language processing, it does not explain the bilingual's semantic structure. Studies examining the bilingual's semantic structure have produced some controversial results. One possibility is the shared store model (Glanzer & Duarte, 1971;

Kolers, 1966) and another is the separate store model (Goggin & Wickens, 1971). In the recall task, the rate of recall for the between-language repetition condition (translation-equivalent) is the same as or better than that for the within-language repetition condition (Glanzer & Duarte, 1971; Kolers, 1966). This result supports the shared store model. In contrast to this result, evidence for the separate store model (Goggin & Wickens, 1971) also exists. When Goggin and Wickens (1971) manipulated the language condition: same language versus different language, the pattern of proactive interference altered the recall task. If the lexical and semantic knowledge of L1 and L2 is shared, then changing the language of the memory items should not influence the memory performance in the recall task. However, when the language of the items was changed, the proactive interference disappeared in the recall task, i.e., the two languages were processed separately. It is difficult to determine whether the conceptual systems of L1 and L2 are shared or independent because the results of the memory experiments of L1 and L2 remain controversial and the memory task reflects other cognitive functions, not just lexical processing. In order to determine the structural characteristics of the conceptual representation of L1 and L2, it is necessary to use a more direct task reflecting lexical and semantic processing, such as the semantic priming technique.

De Groot (1992a, 1992b) proposed the conceptual feature model to explain the conceptual structure of the bilingual's lexical memory (see figure 2).

This model insists that the various distributed conceptual features are linked to the lemma of each language. Thus, in this model, concepts are represented by semantic features. According to the conceptual feature model, the conceptual features of concrete words of L1 and L2 are shared, whereas those of abstract words are independent. The main findings supporting this model are that concrete words and cognates are translated faster than abstract words and

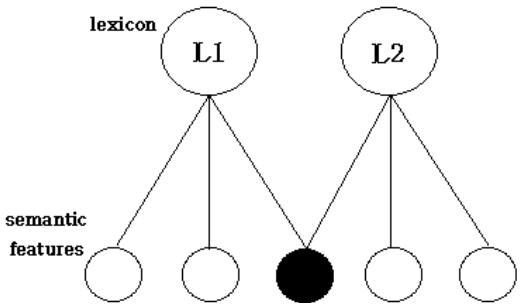

Figure 2. Conceptual Feature Model(De Groot, 1992)

non-cognate words. Because concrete words have similar or identical conceptual feature subsets across languages, the reaction time (RT) for concrete words is faster than that for abstract words. In contrast, the conceptual features of abstract words are different depending on the context of the language use or on the language culture, so they have fewer shared conceptual features across languages than concrete words. This leads to slower RTs in recognizing abstract words than concrete words.

Dong, Gui, and Macwhinney (2005) examined Chinese-English bilinguals' conceptual system using an improved semantic priming paradigm and semantic closeness rankings. They argued that bilinguals have shared and separate conceptual systems simultaneously across the meaning characteristics (De Groot, 1992a, 1992b). They showed identical priming patterns between the within-language condition and the cross-language condition. This result supports the position that bilinguals have shared semantic structures. However, this argument should be restricted to balanced bilinguals as subjects who participated in this experiment were fluent and balanced bilinguals. It is an established claim that the L2 proficiency of bilinguals is one of the most important variables in bilingual language processing (Elston-Gü ttler, Paulmann & Kotz, 2005; Kotz & Elston-Gü ttler, 2004; Kroll & Curley, 1988). Accordingly, It is needed to investigate the semantic structure of unbalanced bilinguals who have less L2 proficiency level.

The purpose of the current study is to investigate the semantic structure of Korean-English unbalanced bilinguals. As discussed, few experimental studies of the semantic structure of unbalanced bilinguals have been done. Because the semantic structures of balanced bilinguals for L1 and L2 have been shown to be relatively shared or related to each other, the focus of this study is on whether the semantic structure of Korean and English words are shared or independent for unbalanced bilinguals. In the monolingual experiment, having the prime words semantically related to the target words facilitated the recognition of the target words compared to having the prime words semantically unrelated to the target words (Meyer & Schvaneveldt, 1971; Neely, 1977). Because the priming stimuli activated the other semantically related words automatically, the response time to target stimuli (the word related to the priming stimuli) was faster than to the controlled stimuli.

By applying this logic to a bilingual experiment, we hope to determine whether bilinguals have shared or separate semantic structures. If the semantic priming effects occurring in the between-language condition of prime and target words and in the within-language condition are similar, then the

meanings of L1 and L2 words are represented in a shared or common semantic system. However, if the semantic priming pattern occurring in the between-language and the within-language conditions is different, the bilingual's semantic structures for L1 and L2 would exist separately. We are also interested in the effect across short stimulus onset asychrony (SOA) and long SOA. It has been shown that there is facilitation in the short SOA priming as compared to inhibition in the long SOA (e.g., Perfetti & Tan, 1998; Wu & Chen, 2003). We expect, in semantic priming, a general pattern of facilitation in short SOA and inhibition in long SOA.

Methods

Subjects The subjects were 466 undergraduate students of Korea University who did not participate in any other experiments. The participants in this experiment self-evaluated their English proficiency as an intermediate level on a 10-level Likert scale, with an average score of 6.8. None of the participants had been to America and they had all learned English in the formal education system. Subjects had problems in speaking and writing, but they could comprehend written texts well.

Materials and Design Forty-one between-language pairs (e.g. “winter” for the prime word and “눈”, which means “snow” in English, for the target word) and within-language prime-target pairs (e.g. “winter” for the prime word and “snow” for the target word) were selected. In addition, an equal number of non-word pairs were made for each condition (i.e., winter -> 룬). Non-word targets were made by changing one component of a real word target. The word length and frequency of priming stimuli were controlled. For the English words, mean frequencies of occurrence of the related and unrelated conditions were 137 and 147, respectively, according to Kucera and Francis (1967). The average word length of the two conditions was 5.12 and 5.07 letters, respectively. For the Korean words, the mean frequencies of occurrence of the related and unrelated conditions were 5615 and 4625, respectively, according to Seo (1998). The average word length of the two conditions was 1.90 and 2.24 syllables, respectively. To prevent subjects from noticing the relation between prime and target, 41 filler prime-target pairs were used. The use of filler pairs was intended to control the post-lexical meaning integration and strategic process. These words were matched with other prime words in terms of word length and word frequency.

Eight experimental conditions were constructed by two factors: four language conditions (four

Table 1. Example of material set

Language Condition	Prime - Target			
	Related Condition		Unrelated Condition	
	prime	target	prime	target
K-K	겨울	눈	과일	눈
E-E	winter	snow	twenty	snow
K-E	겨울	snow	과일	snow
E-K	winter	눈	twenty	눈

combinations of Korean and English prime and target words) and two semantic relation conditions between prime and target words (related vs. unrelated). An example of the material set is shown in Table 1. They are all between subject variables.

Procedure Display of stimuli and response time data was controlled by Superlab version 1.0 running on a Pentium PC. English stimuli were displayed in lower case letters at the center of the 15 inch monitor. A trial consisted of a fixation point for 1000 msec, and then a forward mask (####) for 500 msec followed by the prime. The prime stimulus was presented for 150 msec or 1000 msec across the SOA condition. Then the target was presented and remained on the screen until the subject's response. The inter-trial interval was 1500 msec. Subjects received a single block of 164 trials, presented in random order. Subjects had to make a lexical decision regarding the target as

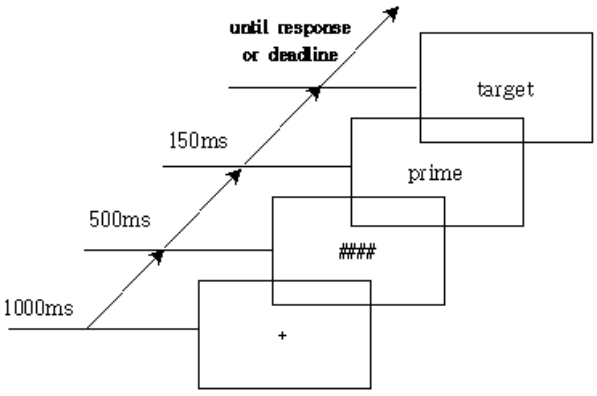

Figure 3. Stimulus presentation order of the priming task in the experiment

quickly and accurately as possible. If the stimulus was a word, subjects had to press the key labeled "Y", and if it was a non-word, they had to press the key labeled "N". This task was the primed-lexical decision task. The response selection of "yes" and "no" and the response hand were counterbalanced across subjects. The stimuli presentation order is described in Figure 3.

Results and Discussion

Only responses to the 41 word targets were analyzed. RTs over or below 2.5 SD were substituted with the 2.5 SD score (3.63%). Erroneous responses were also excluded from the data analysis (4.2%). The errors were mostly evenly distributed across the experimental conditions. Data from nine subjects who gave a lot of incorrect responses (over 50% of all responses) were excluded from the data analysis. Lexical decision time latency for each of the prime conditions is shown in Table 2.

A 4 x 2 (language order x prime type) analysis of variance (ANOVA) was conducted on the correct RTs to word targets with subjects (F1) and items (F2) as the error variance. The two SOA conditions were analyzed independently.

150 msec SOA condition The type of prime and target language was significant: $F1(3,232) = 66.207$, $p<.001$; $F2(3,320) = 230.163$, $p<.001$. The main effect of the prime type was also statistically significant: $F1(1,232) = 10.410$, $p<.001$; $F2(1,320) = 31.669$, $p<.001$. The interaction effect of language order and prime type was marginally significant in subject analysis, $F1(3,232) = 2.340$, $p<.07$; whereas in item analysis it was statistically significant, $F2(3,320) = 12.279$, $p<.001$. Planned comparisons were applied to test whether facilitative or inhibitory priming occurred in the respective conditions.

For the Korean prime and English target set (hereafter, referred to as L1-L2), there were

Table 2. The reaction time(Std) for all conditions in Experiment

	Prime - Target							
	150 msec				1000ms			
	L2-L2	L1-L1	L2-L1	L1-L2	L2-L2	L1-L1	L2-L1	L1-L2
Related	821(78)	642(34)	654(36)	802(72)	798(58)	648(27)	631(34)	855(71)
Unrelated	826(77)	675(39)	663(33)	913(96)	828(76)	663(36)	630(29)	831(66)
Priming	+5	+33	+9	+111	+30	+15	-1	-24

significant facilitative priming effects: F1(1,58) = 6,921, p<.05; F2(1,80) = 34.164, p<.001. For the Korean prime and Korean target set (hereafter, referred to as L1-L1), there were significant facilitative priming effects: F1(1,58) = 5.015, p<.05; F2(1,80) = 16.573, p<.001.

There were no significant effects in the English prime and English target set (hereafter, referred to as L2-L2: F1(1,58) = 0.492, ns; F2(1,80) = 0.069, ns) or in the English prime and Korean target set (hereafter, referred to as L2-L1: F1(1,58) = 0.143, ns; F2(1,80) = 1.397, ns). In summary, facilitative priming was observed in L1-L1 and L1-L2 conditions but not in L2-L2 or L2-L1 conditions in the 150 msec SOA condition. According to the results of the 150 msec SOA condition, facilitative priming occurred only when the prime words were L1 (Korean). That is, whether the facilitative priming occurs or not is determined by the language of the prime words.

1000 msec SOA condition The overall ANOVA test was performed with different results from the 150 msec SOA condition. Language order was significant: F1(3,200) = 70.827, p<.001; F2(3,320) = 332.122, p<.001. The main effect of the prime type was not statistically significant: F1(1,200) = .197, ns; F2(1,320) = .823, ns. The interaction effect of language order and prime type was not significant in subject analysis, F1(3,200) = .876, ns, whereas in item analysis it was statistically significant, F2(3,320) = 3.942, p<.05.

Significant facilitative priming occurred in L2-L2 item analysis, but not in subject analysis: F1(1,50) = 1.392, p=.244; F2(1,80) = 4.169, p<.05. The type of priming in the L1-L1 condition was similar to that in the L2-L2 condition, with the facilitative priming effect occurring in item analysis but not in subject analysis: F1(1,50) = .582, ns; F2(1,80) = 4.607, p<.05. The results of the between-language conditions (i.e., L1-L2 and L2-L1) in the 1000 msec SOA condition had null priming effect. In the L1-L2 condition, although the facilitative priming effect appeared in the 150 msec SOA condition, the inhibitory tendency appeared in the 1000 msec SOA condition: F1(1,50) = .744, ns; F2(1,80) = 2.562, ns. In the L2-L1 condition, no priming effect was observed in the 1000 msec SOA condition, the same as in the 150 msec SOA condition. In summary, in the 1000 msec SOA condition, facilitative priming was observed in the within-language condition (i.e., L1-L1 and L2-L2), but the null priming effect occurred in the between-language condition. That is, the priming patterns of the within-language and between-language conditions were qualitatively different in the 1000 msec SOA condition. Therefore, these results uphold that each

semantic system connected to Korean (L1) and English (L2) words exist independently.

The current results are clearly different from those in Dong, Gui, and Macwhinney's (2005) study using balanced Chinese-English bilinguals. They obtained identical priming patterns for within-language conditions and cross-language conditions. This result was interpreted to support the position that bilinguals had shared semantic structures for both languages. Our results of different patterns of priming, especially in the long SOA condition, support different semantic structures for each language in unbalanced bilinguals. It would be necessary to conduct a study using balanced Korean-English bilinguals to obtain converging evidence on this hypothesis in the future.

In the 150 msec SOA condition, there are several possible interpretations for the lack of priming in the L2->L1 condition. The first plausible explanation is that the semantic systems of Korean and English are identical (Francis, 1999; Kroll & Stewart, 1994). However, the semantic connectivity from Korean concepts to Korean and English concepts in the same semantic system is strong enough to activate the semantically related concepts, while the semantic connectivity from English concepts to Korean and English concepts is weak. Therefore, presenting the English prime words does not activate the semantically related Korean and English words. Nevertheless, as shown in the 1000 msec SOA condition, there is a tendency toward inhibitory priming in the between-language condition so this result does not support the first explanation.

The second possible explanation is that recognizing English words was so difficult for Korean bilinguals in such limited time, they could not process the English prime words sufficiently enough to activate the associated meanings. If the second explanation is true, then in the long SOA condition, facilitative priming is expected in the English prime word conditions. However, in the 1000 msec SOA condition, the L2 prime-L1 target pair did not have a facilitative priming effect. Thus, the second possible interpretation fails to explain the results.

The third possibility is that Korean and English semantic knowledge is stored separately and the two semantic systems are linked (Finkbeiner, Foster, Nicol & Nakamura, 2004; Jiang & Foster, 2001; Jiang, 1999). In addition, in each language semantic system, Korean concepts are strongly associated with other semantic features but English concepts are not. The link from Korean semantic knowledge to English semantic kn owledge might be strong but the link from English semantic knowledge to Korean semantic knowledge seems to be weak. The results of this experiment support the third hypothesis. In the long SOA condition, the

following semantic priming by the English prime words occurred: facilitative priming in the within-language condition, but no priming in the between-language condition. Thus, it can be tentatively concluded that Korean-English unbalanced bilinguals are slow at recognizing English words, and the link from English semantic knowledge to Korean semantic knowledge is weak.

Another interesting result that should be discussed is the different pattern of priming for the L1->L2 condition across the two SOA conditions. There was significant facilitation in the short SOA condition as compared to inhibition in the long SOA condition. It could be possible, as proposed, that the semantic link from Korean to English is strong, eliciting facilitation. In contrast, when a word is presented for a longer amount of time, words other than the prime would be inhibited by lexical competition, eliminating any priming effect. No inhibition for the L1->L1 condition even in the long SOA condition, however, makes interpretation complicated because there is usually inhibition in monolingual priming in the long SOA condition (Perfetti & Tan, 1998; Wu & Chen, 2003). The slight trend of reduction in the priming, 33 msec facilitation in the short SOA condition versus 15 msec facilitation in the long SOA condition, could be somewhat matched to the previous findings.

One of most important limitations in this study is the duration of the prime. There is no agreement about the range of the duration that corresponds to the short SOA and long SOA. Specifically, 150ms SOA might not be short enough to reflect early processes in word recognition as 1000ms SOA might be too long to reflect postlexical processes right after the lexical access. Thus, the interpretations for the results should be limited, and more conditions of manipulating the duration of the prime would be needed in the future studies.

The purpose of this experiment was to determine whether the semantic systems of Korean and English words are shared or separate. If the priming patterns of the within-language and between-language priming tasks are similar, then Korean-English unbalanced bilinguals have a common semantic structure, whereas if the priming patterns in the two priming conditions are different, then the separate semantic structure is supported. According to the results of the 150 and 1000 msec SOA conditions, the priming patterns of the between-lan guage and within-language conditions are different. In the 150 msec SOA condition, there was no priming by the English words, regardless of the language of the target words. The facilitative priming effects were observed only when the prime words were Korean. In the 1000 msec SOA condition, the

priming patterns of the within-language and between-language conditions were qualitatively different: presenting the prime words speeded the target word recognition in the former but slowed recognition in the latter. This result strongly supports the hypothesis of a separate store model of the L1 and L2 concepts. To further investigate bilingual language models, developmental studies across L2 proficiency should be conducted using Korean-English blinguals. (Elston-Gϋttler et al., 2005; Kotz & Elston-Gϋttler, 2004; Altaribba & Mathis, 1997).

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한국어-영어 이중 언어 화자의 의미점화효과

최원일 **이창환** **남기춘**

University of North Carolina 서강대학교 고려대학교

본 연구는 영어가 모국어인 한국어에 비해 능숙하지 않은 이중언어화자(Korean-English unbalanced bilinguals)들의 한국어와 영어의 의미 구조 양상을 조사하기 위해 이루어졌다. 본 연구의 주된 목적은 한국어와 영어 어휘의 의미 구조가 공유되어 있는가 혹은 분리되어 있는가를 알아보는 것이다. 사용된 과제는 점화 어휘 판단 과제였고, 언어 내 의미점화 효과와 언어 간 의미점화 효과의 양상이 조사되었다. 두 종류의 점화효과의 양상은 달랐고, 이는 한국어와 영어의 어휘의 의미 구조가 공유되어 있다기 보다는 분리되어 연결된 형태를 가지고 있다고 볼 수 있다.

주제어 : 단어재인, 이중언어화자, 의미점화, 한국어-영어

Appendix

Korean related prime word	Korean unrelated prime word	Korean target words	English related prime word	English unrelated prime word	English target words
과일	농촌	나무	winter	twenty	snow
색깔	미술	노랑	fruit	ratio	tree
은	조	금	color	moral	yellow
교사	바람	학생	silver	virtue	gold
교회	외부	십자가	teacher	session	student
여우	직선	늑대	church	family	cross
동물	날씨	가축	fox	mix	wolf
겨울	식사	눈	animal	career	cattle
노래	공부	음악	song	plus	music
바다	의원	배	ocean	owner	ship
입	끝	치아	mouth	negro	teeth
사랑	전화	평화	love	full	peace
군대	비리	병사	army	hour	soldier
문제	사회	해결	problem	country	solution
공책	정원	연필	note	lead	pencil
새	달	둥지	bird	maid	nest
높이	범주	깊이	height	lumber	depth
전쟁	기능	적	war	set	enemy
시장	당신	가격	market	growth	price
경찰	저녁	권총	police	answer	gun
꽃	문	장미	flower	victor	rose
변호사	나침반	법정	lawyer	flying	court
역	면	지하철	station	machine	subway
기쁨	무릎	미소	delight	divorce	smile
왕	신	궁전	king	pain	palace
돈	몸	세금	money	today	tax
삼촌	척추	친척	uncle	truck	relative
작가	효과	독자	author	decade	reader
과거	가치	기억	past	name	memory
형제	거울	자매	brother	ability	sister
하늘	과학	별	sky	lie	star
뿌리	수입	줄기	root	flux	stem
공항	마루	비행	airport	servant	flight
책상	걸음	의자	desk	rain	chair
장난감	요리사	인형	toy	nap	doll
감자	내일	옥수수	potato	shower	corn
편지	이웃	우표	mail	poem	stamp
목욕	용도	비누	bath	fist	soap
자전거	젊은이	바퀴	bicycle	vitamin	wheel
시험	기자	점수	test	main	grade
시간	사실	공간	time	will	space