

Cross-language Priming of Lexical Decision in Bilinguals: The Role of Word Concreteness

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Korean-English bilinguals were shown a prime word in one language for 150 msec, followed by a word or nonword in the other language which required a lexical decision. Target words which were translations of the preceding word showed a substantial (96 msec) priming effect compared to unrelated target words; targets semantically associated to the translation also showed a significant though smaller priming (56 msec). For both types of targets and for both target languages, the priming effect was greater for concrete word pairs than for abstract word pairs. In contrast, a second experiment with monolinguals found equivalent priming for concrete and abstract pairs. The results support the hypothesis of Saegert and Young (1975) and Paivio and Desrochers (1980) that the two lexicons of the bilinguals are most closely integrated via a common, nonverbal representation.

The ability of bilinguals to coordinate two often radically different language systems suggests a variety of basic questions about the relationship of form and meaning. Given the distinction between the surface form of a word and the concept it represents or "symbolizes", a fundamental question concerns the extent to which corresponding words in two languages refer to the same conceptual representation.

Most research concerning the conceptual representation of different language forms has focused on two competing hypotheses, commonly posed in their extreme form. The *independence hypothesis* states that the bilingual person has two separate conceptual memory stores or systems: knowledge of the word is

represented in one language system and is available to the other system only through an intentional translation process (Kolers, 1963). The *interdependence hypothesis* is that all conceptual information is represented in a single system or store (e.g., McCormack, 1977).

Early work on the issue of degree of independence is reviewed by McCormack (1977). A variety of paradigms have been applied to the question, ranging from a comparison of associative responses to translates (Kolers, 1963), cross-language transfer and confusions in verbal learning and recall tasks (e.g., Lopez & Young, 1974), and the "language switch" studies, which compare the relative ease or

difficulty of processing mixed-language vs. same-language materials (e.g., Dalrymple-Alford, 1985). Much of this literature is difficult to interpret, since in many cases evidence for interdependence has come from tasks in which covert translation was possible and helpful in task performance; conversely, evidence for independence has often come from subjects' ability to remember language of input, which could be mediated by memory for surface information stored along with a language-independent conceptual representation.

Cross-language Priming of Word Recognition

Recently, a number of experiments have made use of tasks which produce priming effects within a language system, and compared this to conditions where the priming stimulus and target stimulus are in different languages. If cross-language priming is obtained when active translation is unlikely, it is taken as evidence for interdependence on the stimulus dimension being primed (see Anderson & Ross, 1980, for an equivalent argument regarding semantic and episodic memory).

Three studies have made use of the fragment-completion task, where the ability to find a word given only some of its letters in the correct position (e.g., H-U-) is facilitated by presentation of the target word in a prior phase of the experiment as a prime. The within-language priming effect is robust, long-lasting, and often independent of overt recognition that the word was presented earlier (Tulving, Schacter, & Stark, 1982).

In each of the bilingual fragment-completion priming studies, the degree to which a word in one language primed completion of its translate was compared to within-language priming. In their Experiment 1, Watkins and Permircioglu (1983) found a small but a significant cross-language effect but were able to eliminate it completely in Experiment 2

when more thorough precautions were taken to avoid intentional translation of prime words in the first phase. Durgunoglu and Roediger (1986) also failed to find a cross-language priming effect on fragment completion. Smith (1985) did observe significant cross-language priming when the word was embedded in a meaningful sentence during the first phase, but this may also have been due to a tendency to translate during the priming phase. Consistent with this was the lack of difference between cross- and within-language priming, and equivalent priming for words actually presented and those that could be inferred from the study sentences (cf. Roediger & Blaxton, 1987).

The time interval between prime and test events in the above studies is typically in the range of 15 min. to one hour. Very similar results have been obtained from studies of the priming of lexical decisions over similarly long intervals. These experiments made use of the repetition priming effect on lexical decisions (Forbach, Stanners, & Hochhaus, 1974). The faster responses to repeated lexical items are, in contrast to fragment completion, relatively insensitive to changes in physical attributes of the words (Scarborough, Cortese, & Scarborough, 1977) and so may be more appropriate for isolating cross-language lexical priming effects.

Nonetheless, a series of studies has failed to show any cross-language priming of lexical decision. Kirsner, Brown, Abrol, Chadha, and Sharma (1980) found no evidence for priming across presentations of English and Hindi translates. In a more extensive series, Kirsner, Smith, Lockhart, King, and Jain (1984) investigated the repetition effect across blocks of trials for English-French translates. No cross-language priming of lexical decision was found in Experiment 1. In the first phase of Kirsner, et al.'s Experiment 3, subjects were given a word and asked to generate a sentence containing that word. In the test phase, they were instructed to decide whether

the word named was an "animate" or "inanimate" object. The results showed that sentence generation facilitated the semantic categorization of the word in the same language, but there was no indication of interlingual facilitation. Essentially the same outcome was observed by Scarborough, Gerard, and Cortese (1984), and Fischler, Boaz, McGovern, and Ransdell (1986).

In Experiment 2 of Kirsner, et al. (1984), when subjects were required to produce the initial letter and the number of letters of the translation of each word in the first block list, they did not obtain subsequent cross-language facilitation of lexical decision time as well as within-language facilitation. These results are quite consistent with those for the fragment-completion task reviewed above, and suggest that at least for widely spaced repetitions, priming is restricted to intralingual conditions.

Several studies of within-language priming effect suggest that the time interval between presentation of a prime and a test may be critical for demonstrating interlingual priming. For associates within a language, priming effects on lexical decision are often limited to a period of seconds, and are eliminated by the presence of even one intervening item or decision (Gough, Alford, & Holley-Wilcox, 1982). The relation between a word and its translates may be better modelled by close associates or synonyms within a language, where the semantic relation is close but the surface forms are quite different than by repetitions of the identical lexical item (see Kolers & Gonzalez, 1980).

Support for the presence of a short lived cross-language activation has been obtained in several different paradigms. In her classic study, Treisman (1964) found that French-English bilinguals would notice the translated equivalence of a shadowed and a "rejected" message in dichotic listening if the rejected message led the shadowed one by two seconds or less. In a free recall test, Glanzer and

Duarte (1971) found that the superiority of recall of interlingually repeated items was most marked when there was no intervening item but this advantage disappeared as the number of intervening items increases. In Experiment 2, Kolers (1975) had French-English bilingual subjects read sentences either in normal orientation or in inverted orientation. Reading time for different orientation conditions was measured and it was found that a facilitation effect in reading time for repeated sentences across language was obtained at shorter lags (i.e., the ordinal offset of a sentence and its repetition), but the facilitation in reading time disappeared at longer lags. Finally, Dalrymple-Alford (1985) reported faster naming latency for words preceded by their translates in lists of words read aloud but failed to find any cross-language priming when translates occurred across blocks of trials.

In Experiment 4 of the Kirsner, et al. (1984) study, associative facilitation was found for both intralingual and interlingual conditions using paired presentations, where a word and its associate were shown simultaneously and subject judged if both were words. But it is possible that this paired presentation created a longer effective SOA and encouraged active translation. The equivalent cross-language and within-language facilitation in this experiment supports this interpretation.

In Experiment 5 of Kirsner, et al. (1984), subjects made a lexical decision to each of a series of words. Some words served as primes for subsequent words, which were associates of primes or of their translates, with lags of 0, 2, or 13 intervening items. Only when the lag was 0, was any priming found. Here again, subjects had time to anticipate, based on the prime word, what the next one might be.

To minimize both the time between presentation of prime and test words, and the likelihood of prime translation, the present experiments used a very short SOA, with subjects making no overt response to the

prime stimulus. Recently, Schwanenflugel and Rey (1986a) reported significant cross-language priming of lexical decision with a 100-msec and 30-msec prime-test SOA, where the prime was a category name and the test word exemplars of high, medium or low typicality (e.g., BODY-HAND). This confirmed that such priming could be produced under conditions making intentional translation within each trial unlikely.

Concreteness and Cross-language Priming

The major concern of this study is the role of word concreteness in cross-language priming. Paivio and Desrochers (1980), enlarging on some earlier findings of Saegert and Young (1975), suggested that the bilingual has two discrete language-dependent memory systems that are partially connected to a third, nonlingual store, the "imagery system." While there are connections between these qualitatively different systems, translating one code into another must involve more complex processing than that needed within a system.

In this bilingual version of the dual-coding hypothesis, Paivio and Desrochers (1980) suggest that a common image code, available to both language systems, is responsible for much of the results supporting the interdependence view. The essential idea is that concrete words will have their meaning closely tied to a common, imaginable referent and show more evidence for interdependent processing so that there will be more interlingual transfer. Abstract words, in contrast, are more likely to be defined in terms of other verbal information within the specific language system, and therefore will show more independent processing, hence less interlingual transfer.

Words that have concrete referents that allow links between the two languages may not require direct verbal translation to produce cross-language activation. As we have seen, there is evidence that transla-

tion is not automatic (Kolers & Gonzalez, 1980; Kirsner et al., 1984). A concrete word in one language may therefore elicit an image which could facilitate the comprehension of the word in the other language. With abstract words, however, if the only connection between the words in two languages is verbal translation, which is not automatic, these pairs should not show facilitation.

Support for this hypothesis was reported by Saegert and Young (1975), who found a greater tendency for cross-language substitutions in mixed-language paired associate responses when responses were concrete than when they were abstract words. The opposite results was found, however, by Winograd, Cohen, and Barresi (1976), whose subjects were better able to report the language of input for concrete than for abstract words. As we have noted, however, studies looking at cross-language confusion in recall are complicated by subject's strategies during acquisition.

The present experiment compared the extent of cross-language priming for concrete and abstract word pairs. The Paivio and Desrochers (1980) hypothesis predicts reduced or absent priming for abstract word pairs.

Priming for Translates vs. Associates

Interestingly, while all the across-block priming studies used translations versus within-language repetitions, all the short-SOA studies were restricted to pairs of associates rather than direct translates and repetitions. One purpose of the present study was to directly compare these two different kinds of priming: interlingual repetition (translation) and interlingual association. Associative facilitation is usually, at least in part, explained in terms of activation spreading automatically from the prime word's representation in the mental lexicon to the test's representation, thus temporarily lowering the recognition threshold

of associatively related words. So the "closer" the test word is to the prime in the mental lexicon, or the more accessible the link between prime and test word, the greater the effectiveness of the prime.

The most straight forward prediction, then, would be that translates would show greater priming than would cross-language associates. On the other hand, it may be that while speaking fluently in one language, a bilingual must actively inhibit corresponding words in the other language to avoid interlingual interference. If there is such an item-specific inhibitory mechanism for translates, then priming might be less for translates than for associative or unrelated prime words.

EXPERIMENT 1

Method

Subjects

Twenty-four native Korean graduate students at the University of Florida participated in this study. All subjects had at least seven years of formal education of English and were initially exposed to English before adolescence. The mean length of residence in an English-speaking country was 3.8 years, with a range of 2 to 8 years. During that period, they conducted a major part of their lives in English.

Design

The experiment used a 2 x 3 factorial design with repeated measures. Prime condition (translate, associate or unrelated) and Test language (Korean or English) were varied within subjects. Concreteness of prime test word pairs was included as a factor for the analyses by items (see below). The dependent variable was lexical decision latency, in msec. The interval between the onset of prime word and the onset of the test word-stimulus onset asynchrony

(SOA) was held constant at 150 msec. for all subjects.

In the Translate condition, the prime word was followed by its direct translation; in the Association condition, by a semantically related test word in the other language; and in the Unrelated condition, by a semantically unrelated test word. For each subject, half the trials were English-Korean and the other half were Korean-English in each of those conditions.

Stimuli

Fifty-six of the seventy-two English word pairs to be used in the Associate condition were selected from the association norms of Postman and Keppel (1970). The remaining 16 test pairs were compiled by the experimenter by giving association tests to 80 undergraduate students at the University of Florida. All were chosen with the constraints (1) that the associate was the primary normative response for its stimulus, and (2) that the word in either language would be unambiguously translated into a single word in the other language. Associative strength for Korean versions of the stimulus words was not obtained (see Schwanenflugel & Rey, 1986b).

Given these constraints, an attempt was made to sample test words from as wide a range of rated concreteness as possible. The resulting set of 72 test words ranged from 2.29 to 6.68 on a 7 point scale (Toglia & Battig, 1978). Another 72 words were chosen as unrelated primes, which were matched to those 72 prime words in the Associate condition for word concreteness and familiarity.

An additional 28 words were employed as primes for nonword trials. Half the nonword trials were English-Korean and the other half were Korean-English. Nonword targets were constructed by changing one letter in English or in Korean with the constraint that the words should be orthographically and phonologically legal. Each subject saw each test word once, with one of the three possible primes.

Across each set of three subjects, a given test word appeared following each prime once.

English strings were typewritten in lower case, black on white, Korean strings were handprinted so that the average height, length, and line thickness were comparable to the English strings.

Apparatus

A 4-field Iconix tachistoscope and exposure box were used to present the stimuli and record response latency. The stimuli were shown on the center of the visual field, subtending approximately 0.5 degree vertically and 1.0 degree horizontally. Two telegraph keys were arranged in front of the subjects. For half the subjects, the left key was for "word" and the right key for "nonword". For the other half, this was reversed so that the hand of response was counterbalanced.

Procedure

Subjects were tested individually in one 50-min session. The session consisted of 72 word trials and 28 nonword trials, randomly ordered. Written instructions were given in English. At the start, subjects were informed that they would be shown two character strings in succession and would have to decide, as quickly as possible, whether the second was a legitimate word. No mention was made of the relationship of prime and test words on some trials, and it was stressed that although we were interested in how the presence of the first word influenced the decision, they were to ignore the first word as best they could.

The language of the test item was randomized rather than blocked in this experiment. Previous literature is controversial on whether bilinguals can "filter" the other language if the imperative stimuli and responses are consistently in one language (cf. Scarborough, et al., 1984; Soares & Grossjean, 1984). In any event, any strategy to use the prime word to

predict the test word on one hand or alternatively to filter one language code altogether, should be minimized by randomizing the presentation.

On each trial, the following events occurred: (a) The experimenter said "ready" to alert the subject to the start of the trial. (b) A fixation field was then shown for 750 msec., in which an * indicated the location of the prime stimulus. (c) The fixation field was replaced by the prime word, which remained in view for 150 msec. (d) The test string was presented in the same location as the prime, and remained in view until a keypress response was made. Lexical decision latency and accuracy were recorded by the experimenter.

There was a series of 13 practice trials at the beginning of the session, in which Translates, Associates, Unrelated, and Nonword trials appear as in the same proportion as in the subsequent session. Intertrial interval was about 10 seconds. Accuracy and speed were emphasized equally in the instructions.

Results

Analyses by subjects

Mean latency for correct responses within each of six prime conditions was calculated for each subject and served as a single score in the analyses to follow. Table 1 presents the mean latency and accuracy for each prime type and test language condition across subjects. The error rates for the various conditions are also presented. In general, more errors were made in the slower conditions. The only suggestion of speed-accuracy trade off was between the Associate and Unrelated condition for English. But for the most part, error rates in Table 1 mirror the difference in latency scores. No further analysis was done on errors.

A 2 (test language) x 3 (prime type) analysis of variance was performed on the latency scores treat-

Table 1. Mean lexical decision latency (msec) and error rate (percent) as a function of test language and prime type.

Test Language	Prime Type			
	Translate	Associated	Unrelated	Nonword
English	656 (3.1)	715 (4.0)	806 (5.9)	868 (11.0)
SE	15.8*	17.5	20.3	14.6
Korean	622 (2.4)	643 (3.8)	658 (3.8)	828 (8.0)
SE	12.1	12.7	15.4	16.2

* Standard error (SE) of the mean across subjects

ing subjects as the only random effect. The main effect of test language was significant, $F(1,23) = 33.42$, $p < .01$, with Korean test words being responded to more quickly than English. There was also a significant main effect of prime type, $F(2,23) = 47.35$, $p < .01$. For both test languages, lexical decisions were slowest following the Unrelated primes, faster following Associates, and fastest following the Translates. The interaction of test language and prime type was significant, $F(2,46) = 16.65$, $p < .01$, with the size of the priming effect somewhat greater for English test words than Korean test words.

Post-hoc analyses of this interaction were done using Newman-Keuls pairwise comparison tests on the latency scores. A significance criterion of $p < .05$ was adopted for all such tests. For English test words, both the Translate condition and the Associate condition were significantly faster than the Unrelated condition. The difference between the Translate and the Associate condition was also significant. For Korean test words, only the difference between the Translate and the Unrelated condition was signi-

ficant. The net priming effects for the different conditions are shown in Table 2.

Analyses by items

Lexical decision latencies were also analyzed treating items as the only random effect to evaluate the impact of word concreteness on the magnitude of priming and to assess the reliability of the effects of prime type and language over other materials.

The list of seventy-two test words was divided at the median, according to their concreteness ratings. This was used as a between-items factor in the analysis. Prime-test associative strength for the association condition was 33.1 (s.d.=16.9) for concrete words, and 35.7 (s.d.=17.7) for abstract words, which were not significantly different.

Mean latencies for correct responses within each of prime conditions were calculated for each item across subjects and served as a single score in the analysis of variance. Mean lexical decision latency and error rates are presented in Table 3.

A 2 (test language) x 3 (prime type) x 2 (concrete-

Table 2. Summary of net priming effects (msec) for English and Korean test language

Test Language	Prime Type	
	Translate	Associated
English	150*	91
Korean	36	15

Note: a positive score (*) indicates facilitation with respect to the unrelated prime condition.

Table 3. Mean lexical decision latency (msec) and error rate (percent) for concrete vs abstract words over test language and prime type.

Test Language	Concreteness	Prime Type		
		Translate	Associated	Unrelated
English	concrete	650 (5.6)	704 (5.6)	828 (5.6)
	abstract	672 (0.7)	742 (10.4)	792 (6.3)
Korean	concrete	621 (3.5)	635 (4.9)	664 (5.0)
	abstract	627 (1.4)	657 (2.8)	661 (2.8)

ness) analysis of variance was performed on the lexical decision latency scores. As before, the main effect of test language was significant, $F(1,70) = 52.62$, $p < .01$, with English test words being responded to more slowly than Korean test words. The effect of prime type was also significant, $F(2,70) = 51.50$, $p < .01$, as was the test language \times prime type interaction, $F(2,140) = 13.99$, $p < .01$. There was no main effect of concreteness, $F(1,70) < 1.00$. Most importantly, however, the concreteness \times prime type interaction was significant, $F(2,140) = 3.71$, $p < .02$. There were no other significant effects involving concreteness.

The nature of the concreteness \times prime type interaction was investigated by collapsing mean latency scores in the six conditions of prime type and concreteness across test language. The resulting mean latencies are presented in Table 4, along with the magnitude of the priming effects relative to the Unrelated prime condition. Again Newman-Keuls

pairwise comparison tests were performed within each level of word concreteness. For concrete words, both the Translate and Associate priming effect were significant. For abstract words, only the Translate effect was significant. Further, the priming effect for both Translate and Associates was significantly greater for concrete than for abstract word pairs.

Discussion

Cross-language priming of lexical decision latency was found for both Associates and Translates of test words with a very short (150 msec.) SOA. This replicates the finding of Schwanenflugel and Rey (1986a) and shows it is not necessary to have repeated semantic categories to produce the priming effects.

The significantly greater cross-language priming effects for concrete than for abstract word pairs supports the hypothesis of Paivio and Desrochers

Table 4. Mean lexical decision latency (msec) for three prime types as a function of word concreteness.

Prime Type	Concreteness	
	Concrete	Abstract
Translate	636 (110)	650 (77)
Associated	670 (76)	699 (28)
Unrelated	746	727

Note: The numbers in parentheses are the priming effect for that condition, relative to the latency for unrelated primes.

(1980) that the two sets of lexical knowledge for a bilingual are more closely integrated for concepts which have concrete referents and are relatively more independent for those having more abstract referents, consistent with the predictions of dual-code theory.

The presence of greater cross-language priming for concrete than for abstract pairs would be more impressive if accompanied by its absence for within-language pairs. Few studies have considered the effects of word concreteness on associative priming within a language. Vanderwart (1984) showed subjects pairs of words that differed in degree of relatedness and in rated imagery for a lexical decision. Latency was significantly faster for the related pairs than for the unrelated pairs, but there was no difference in the latency and percentage errors for abstract vs. concrete targets in five semantic prime-target association categories.

In Experiment 2, we attempted to replicate this equivalent priming for concrete and abstract word pairs using the short-SOA, prime-test word procedure of the first experiment, with monolingual subjects seeing only English words.

EXPERIMENT 2

Method

24 undergraduate students enrolled in introductory

psychology classes at the University of Florida served as subjects in this experiment. The design, stimuli, apparatus and procedure were the same as those for Experiment 1, except for the following: (1) there was no Translate condition, and so each subject received only 76 trials compared to 100 trials in Experiment 1.; (2) all prime and test stimuli were in English.

Results and Discussion

Mean response latencies are presented in Table 5 with the corresponding standard errors. A 2 (concreteness) x 2 (prime type) analysis of variance was done on the latency scores treating subjects as the only random effect. The main effect of prime type condition was significant, $F(1,23) = 88.06$, $p < .01$, with Associates being responded to more quickly than Unrelated words. But there was no overall effect of concreteness, $F(1,23) < 1.00$. Most importantly, the interaction between concreteness and prime type was not significant, in contrast to Experiment 1, $F(1,23) = 1.58$, $p > .20$. If anything, there was a tendency toward a larger priming effect for the abstract word pairs in Experiment 2.

As expected, there was a large intralingual priming effect, with test words following semantically related primes responded to significantly faster than following unrelated primes. The important finding for present purposes was that the priming effect for

Table 5. Mean lexical decision latency (msec) and mean standard error (SE) as a function of concreteness and prime types and prime types.

Prime Type	Concreteness	
	Concrete	Abstract
Associated	523	522
SE	12.2	10.7
Unrelated	581	597
SE	17.3	17.7
Priming effect	58	75

abstract words was as large as that obtained for concrete words. The equivalent priming for concrete and abstract Associates for the within-language pairs of Experiment 2, together with the substantially greater priming of concrete than abstract Associates and Translates in Experiment 1, appears to be strong evidence for the Paivio and Desrochers (1980) hypothesis.

Comparison of Tables 4 and 5 suggests that in contrast to Schwanenflugel and Rey (1986a), within-language priming was substantially greater than between-language priming. The difference could be explained in several ways, including the absence of cross-trial repetition of prime words in both language form or the greater graphemic difference between prime and test for Korean and English than for Spanish and English (but cf. Kirsner, et al., 1980).

General discussion

The main findings of the experiment can be summarized briefly. Lexical decision latency to a word in one language was speeded by the prior presentation of a word in a second language when the two words were translates or semantic associates, relative to an unrelated prime control condition. The size of the priming effect was greater for the Translates than for the Associate primes. Concrete word pairs showed significantly greater priming effects than did abstract word pairs for cross-language priming, but priming was equivalent for concrete and abstract pairs in the within-language condition. Although the magnitude of these effects was somewhat larger for English than Korean test words, the pattern of results was quite similar for the two languages.

Cross-language Priming and Concreteness

The finding that a larger priming effect was obtained with concrete words than abstract words is

consistent with the prediction of the dual-coding hypothesis (Paivio, 1971; Paivio & Desrochers, 1980), which holds that concrete words are represented not only within the verbal system, while abstract words, by definition, are not represented as easily visually as are concrete words. Abstract words tend to be defined more in terms of other words within that verbal system, making them more isolated from the equivalent concepts in the other language.

Although the dual-code theory seems a natural way to interpret the language-specific effects of concreteness observed here, the results here do not depend on interpreting concreteness effects in terms of visual imagery. The greater interdependence for concepts involved in "concrete" words could be realized at a semantic or propositional level with no involvement of visual analog representations. Since dual-code theory has difficulty with explaining cases where the concreteness advantage in memory is eliminated (e.g., Hunt & Marschark, 1986) or the superiority of pictures over words reversed (e.g., Roediger & Weldon, 1987) by manipulations of the degree of "conceptually driven" processing at encoding and retrieval, it may make more sense to think of the present concreteness effect as more conceptually than visually based. In any case, the role of concreteness in interlingual priming shows that the question of degree of interdependence cannot be answered without reference to the specific concepts involved.

Recently, Kroll, and Curley (1986) have argued that more fluent bilinguals are more likely to mediate translation, while less fluent bilinguals are more likely to use direct links between words of the two languages. Subjects in Experiment 1 were all more experienced in English than were Kroll and Curley's "fluent" subjects, and the range of English skill was fairly narrow, both in terms of time at which they were first exposed to English and the number of years of formal education and cultural exposure to

English. To examine if there was any relationship between language skill and size of priming, a post-hoc analysis looked at the correlation between the length of subjects' residency in an English speaking country and priming by Translates. The Pearson product-moment correlation was an insignificant .06, suggesting that within this limited sample, extent of second language experience did not seem to play an important role in priming of lexical decisions. It would be of interest to observe priming for a wider range of second language skill. The findings of Kroll and Curley(1986) suggest that less skilled bilinguals may not show the greater cross-language priming for concrete than abstract words.

Several other aspects of the materials besides concreteness influenced the degree of priming observed in Experiment 1. First, as might be anticipated from current models of conceptual memory, Translates served as better primes than did semantic associates. Priming for Translates was found for both Korean and English test words but associative priming was found only for English test words; and for the latter, the overall priming effect was larger for Translates than for Associates, it could have been argued that there was some sort of inhibitory process preventing priming of Translates at the short SOA. The data certainly provides no evidence of such an inhibitory mechanism. It may be that a longer or shorter SOA would produce such evidence; however, the 150 msec SOA used here is within the 200 msec., which others have suggested is needed to select a context-appropriate meaning of an ambiguous word and any inhibition of the inappropriate meaning would presumably occur within this interval.

Finally, larger priming effects were found for English test words than Korean test words. It is obvious from Table 1 that Korean test words were recognized more quickly than were English test words in the unrelated prime condition. All subjects were native speakers of Korean and therefore recog-

nition of Korean was highly overlearned. English prime words took longer to be processed; and so the effective SOA was likely shorter for English-Korean order than Korean-English order.

Cross-language Priming and Task Demands

It was suggested at the outset that the encoding and retrieval demand of certain tasks were especially important in whether evidence of cross-language priming could be obtained. This point has been stressed by recent studies of repetition priming and bilingualism. Smith (1986), for example, found she could eliminate the cross-language priming effect she had previously observed (Smith, 1985) by changing the study task from sentence judgement to study of words in isolation. Durgunoglu and Roediger (1986) reported that identical encoding tasks for mixed lists of Spanish and English words failed to show cross-language priming for fragment completion but showed equivalent within and cross-language effects in free recall.

Obtaining cross-language priming in the lexical decision task under the present conditions seems, in light of the above, particularly strong evidence for at least partial interdependence of lexical knowledge in bilinguals. Lexical decision is generally considered to be a relatively "data-driven" task (cf. Roediger & Blaxton, 1987; Smith, 1985), and as such, less likely to produce evidence of interlanguage priming. Bilinguals in Experiment 1 were not required explicitly or implicitly to do any type of task with the prime word. This method, in conjunction with the short SOA, was intended to restrict priming effects to more "automatic" than attentional processing of the prime (Neely, 1977).

Since associative priming effects in lexical decision are very short-lived, it is not surprising that cross-language "repetition" priming has not been observed across blocks of trials (Scarborough et al., 1984; Kirsner et al., 1980; Kirsner et al., 1984). Even

if such an effect could be produced by appropriate changes in the encoding demands of the study task, it would probably be irrelevant to the question of interdependence among language system; Fischler, Boaz, McGovern, and Ransdell (1986) have reported that the difference in event-related brain potentials (ERPs) associated with within-language repetitions versus nonprimed words in a lexical decision task appeared well after those usually observed with "zero-lag" semantic priming (cf. Rugg, Furda, & Lortist, 1988). The ERP effect for within-language repetition thus appeared to due more to decision and response demands of the lexical decision, rather than to speeded lexical access due to residual activation.

One worthwhile extension of the present findings to other tasks would be to see if similar results are obtained when the test word is named. The present study used a lexical decision task to be consistent with the earlier research with which this study was directly concerned. But recent studies have shown that naming and lexical decision, for example, can produce different patterns of results in priming experiments. The gist of the argument is that lexical decision may be particularly sensitive to processes of word recognition and decision that come after lexical access. Since associative priming of lexical decision appears at least in part to involve "preaccess" facilitation and it is not obvious how a post lexical decision bias could explain the differential priming of concrete and abstract words in the present study, we would anticipate that our results could be obtained with a naming task as well.

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단어의 구체성이 이중언어구사자의 어휘결정 촉진에 미치는 효과

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한국어-영어 병용자들에게 한가지 언어에서의 점화단어를 150msec동안 제시한 뒤에, 다른 언어에서의 단어나 비단어를 보여주며 어휘결정을 하도록 요구하였다. 목표단어가 먼저 제시한 단어의 번역어(translate)이었던 경우, 무관련된 목표단어(unrelated)에 비해 분명한 점화효과(96 msec)를 보였다. 또한 번역어와 의미적으로 연합된 목표단어(associated) 역시 비록 적기는 하지만 유의미한 점화효과(53 msec)를 나타냈다. 두가지 유형의 목표와 목표언어 모두에서, 점화효과는 추상적인(abstract) 단어쌍의 경우보다 구체적인(concrete) 단어쌍에서 더 컸다. 이와는 대조적으로, 단일언어 사용자를 대상으로한 두번째 실험은 구체적 단어쌍과 추상적 단어쌍에서 동등한 점화효과를 발견하였다. 이러한 결과는 Saegert 와 Young(1975)과 Paivio 와 Desrochers(1980)의 가설을 지지하는데, 즉 2개국어 사용자의 두 어휘는 공동의, 비언어적 표상을 통해 아주 밀접하게 통합되어 있다는 것이다.