TRANSLATION PROCESSES IN BILINGUALS: ROLE OF INTER-LINGUAL DISTANCE AND SECOND LANGUAGE PROFICIENCY

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Two experiments exploring the structure of bilingual memory as a function of second language proficiency and distance between the two languages are reported. Experiment 1, manipulating categorization of word lists, explored bi-directional translation in Japanese-English, two distantly related languages, while Experiment 2 did the same using Japanese-Korean as more closely related languages. The findings, indicating that asymmetry of translation occurs only in more proficient Japanese-English bilinguals (Expt. 1), while occurring at both levels of proficiency Japanese-Korean bilinguals (Expt. 2), provide support for the asymmetric model of links between lexical and conceptual systems of bilingual memory (Kroll & Stewart, 1994). They demonstrate that the functional architecture of the model alters with changes in second language proficiency. The findings also indicate that the relationship between the two languages of a bilingual plays an important role in the nature and lexical organization of the mental lexicon.

Key words: translation asymmetry, bilinguals and second language proficiency

One of the central issues in research in bilingualism has been the way in which bilinguals’ languages are represented and stored in memory. The view that emerged from early research (Potter, 1979) and is still favored (Heredia, 1997; Schreuder & Weltens, 1993) is that the two languages are represented at the lexical level in separate memory stores but have a common amodal conceptual store. But the way in which these stores are related has continued to be a matter of debate. Potter, So, Von Eckhardt, and Feldman (1984) proposed two possibilities. One, a word association model, posited that the two languages were linked at the lexical level, but it was only lexical representations of the first language (L1) that could access the conceptual store, so that words in the second language (L2) had to rely on their translation equivalents in L1 to activate conceptual representations. The alternative was a conceptual mediation model, both lexicons having direct connections to the conceptual memory store, allowing independent access for each language.

Furthermore, Kroll and Stewart (1990) combined the features of both models to...
produce a revised hierarchical model of a bilingual memory system (Fig. 1). Kroll and Stewart (1994) also attempted to incorporate a dynamic developmental aspect within the model. When individuals start to acquire L2, there are already strong links between the L1 lexicon and the conceptual representational system. Initially, the second language is associated to L1 by lexical links and it is only subsequently that direct links between the L2 lexicon and the conceptual system are acquired. Both lexical and conceptual links are then bi-directional, but differ in strength between the two languages.

According to the revised hierarchical model, both lexicons were linked to each other and, independently, to the conceptual system. A crucial feature of this new model was that of differential strength of links. Lexical associations from L2 to L1 were assumed to be stronger than those from L1 to L2, while links between lexical representations and concepts were assumed to be stronger for L1 than for L2. Thus the model predicted an asymmetry in bilingual processing. Evidence for an asymmetry in translation and hence, for asymmetrical strength of links, comes from studies showing faster translation times from L2 to L1 than in the reverse direction (Kroll & Curley, 1988; Kroll & Stewart, 1994; Scholl, Sankaraharayanan, & Kroll, 1995).

These findings suggest that forward translation from L1 to L2 may involve an additional step of conceptual activation while L2 to L1 translation, because of the weak lexical-conceptual links for L2, avoids this and proceeds directly via lexical connections to L1. Kroll and Stewart (1994) demonstrated that when lists were presented for translation in a semantically categorized form, forward L1 to L2 translation suffered interference effects (slower translation times) while backward L2 to L1 translation did not. They saw this as further evidence for the asymmetry of links, arguing that, in the forward translation case, lexical items easily accessed the conceptual representational system, activating other semantically associated representations, hence delaying response times. L2 to L1 translations, because of the weaker L2-conceptual links, were less susceptible to semantic characteristics of material. Further evidence of greater sensitivity to semantic factors of L1 to L2 translation is provided by De Groot, Dannenburg, and van Hell (1994).
To investigate the structure of bilingual representation, many bilingual tasks (e.g., the Stroop task, direct translation and priming task) have been conducted from the standpoint of the level of L2 proficiency. Kroll and Stewart (1994) used highly proficient Dutch-English bilinguals in reading and translating tasks to examine the revised hierarchical model. Kroll, Michael, Tokowicz, and Dufour (2002) showed that translation asymmetry was larger at lower levels of L2 proficiency, suggesting a developmental shift in the links between concept and lexicon. In addition, the findings of Magiste (1984), Tzelgov, Henik and Leiser (1990) and Chen and Ho (1986), all of which explored cross-lingual Stroop interference as a function of L2 proficiency using two different languages to name the colors of the presented patches and words, provided support for the asymmetrical dynamism of the Kroll and Stewart (1994) model. Magiste (1984) found that interference was largely determined by L2 proficiency, cross-lingual interference increasing with increasing proficiency, though with some complex patterns dependent on stimulus and response language. Kawakami (1994), using the semantic priming paradigm, also found that more direct links are formed between lexical and conceptual representations of the language with increasing L2 proficiency. This view, however, contrasts with that of Altarriba and Mathis (1997), who have suggested, on the basis of their finding of a Stroop effect in both within- and between-language conditions in completely novice L2 learners, that even novice bilinguals form L2-conceptual links at the initial stage of learning a second language, though this conclusion needs to be tempered by the fact that L2 learning was limited to the highly concrete color names required for the Stroop task.

In addition to changes in the translation processes occurring as a function of L2 acquisition, another factor that needs to be considered when examining the structure of the bilingual lexicon is the relationship between the two languages used in cross-language tasks. In general, much of the research on bilingual memory has been based on languages which have some similar characteristics. For instance, Kroll and Stewart (1994) used Dutch and English, Altarriba and Mathis (1997) used English and Spanish, and the study of Magiste (1984) was based on German and Swedish. These languages share not only a common alphabetic script but, because of their common Indo-European ancestry, share many cognates (words with similar phonological and orthographic structure in the two languages, e.g., the French “chat” and English “cat”), and there is evidence that cognates may be represented differently from non-cognates in the bilingual lexicon. (Sanchez-Casas, Davis, Garcia-Albea, 1992). Languages sharing surface characteristics may well be organized differently than those which are further apart (Chen, Cheung, Lau, 1997).

There are some experiments using languages which share less similar characteristics. For instance, Chen and Ho (1986) used Chinese and English, languages which not only have different historical roots, Chinese belonging to the Sino-Tibetan group, English to the Indo-European group, but also employ different scripts (logographic and alphabetic, respectively), and this may account for the differences between their findings and those of, for example, Magiste (1984) and Altarriba and Mathis (1997). Chen and Ho (1986) suggested that extreme differences between languages make it easier to resist competing stimuli in the second language, reducing the inter-lingual Stroop interference effect. This is in line with the findings of Fang, Tzeng, and Alva (1981) who analyzed the difference in
Stroop interference in Chinese-English, Japanese-English and Spanish-English bilinguals and showed that as the similarity between the two languages decreased, the difference between within- and between-language interference increased. On the other hand, Costa, Santesteban, and Ivanova (2006) reported that language similarity did not affect the way bilinguals control their speech. Spanish-Basque and Spanish-English highly proficient bilinguals performing a picture reading task showed no language similarity effects.

Despite L2 proficiency and similarity between the languages being important issues in the exploration of the structure of bilingual memory and lexicons, each has been examined in isolation within its own respective experimental paradigm. There seems to be little work on the architecture of bilingual organization in relation to both perspectives simultaneously. The present research aimed to rectify this by exploring the nature of bilingual organization in the context of the revised hierarchical model taking both L2 proficiency and similarity between the two languages into consideration.

Specifically, the research sought to examine first, translation processes as a function of different levels of second language proficiency (more and less fluent bilinguals). Although a developmental shift in second language acquisition was an important feature, the Kroll and Stewart (1994) study that proposed the revised hierarchical model used only highly fluent bilinguals, with data about other levels of proficiency coming from different studies. The aim of the present research was to combine different levels of proficiency within one and the same study. It sought to examine how the translation process shifts as the level of second language proficiency increases and how the revised hierarchical model could account for this transition. The prediction would be that, at the lower level of proficiency, with the second language not fully acquired, translation would take place through the lexically-based link, while for more fluent bilinguals translation would involve the conceptual level with which the second language would have a more direct link.

Second, the research sought to examine any asymmetry in translation in relation to the similarity between the two languages. The seminal Kroll and Stewart (1994) study used Dutch-English bilinguals, languages with a common root and a relatively high level of similarity, although the question of similarity was not under consideration. In the present research the concept of similarity will be defined from the viewpoint of grammar, the language family and cultural background. Japanese and Korean are closely related languages with respect to these factors and share certain similarities. In contrast, Japanese and English may be considered, on all three counts, to be distantly related languages (Kuno, 1973; Martin, 1991; Tanaka et al., 1975; Tsukamoto, 1997). Linguistic similarity has an impact on the commonality of conceptual representations in the two languages. Closely related languages may give rise to a common representation for each word within the conceptual system, and hence a communal semantic network, while distantly-related languages may have individually constructed, and hence different, conceptual representations and networks for each language. This would lead to differences in conceptual activation during the translation process. Japanese-English bilinguals might suffer greater categorical interference since they would have to activate their two conceptual representational systems, while Japanese-Korean bilinguals may suffer little interference since only a single shared semantic representational system would be activated.
As outlined in the introduction, much of the research into the structure of bilingual representational systems has been based on languages belonging to the same Indo-European family (Altarriba & Mathis, 1997; Kroll & Stewart, 1994; Magiste, 1984). Relatively little is known about the bilingual cognitive system when the languages in question have very different historical roots, and as recently intimated by Chen et al. (1997), extreme differences between languages may give rise to somewhat different processing patterns in the bilingual lexicon.

The first question which Experiment 1 aimed to address was whether the asymmetrical hierarchical model was applicable to bilinguals who spoke languages belonging to very different language families (Japanese and English) and who had different cultural backgrounds. It also sought to examine the nature of the conceptual-lexical organization in such bilinguals. A second theme of Experiment 1 was to compare the translation process of the more and less-proficient bilingual groups identified in this study by examining possible asymmetry of translation. Kroll and Stewart (1994) suggested that translation asymmetry arises from interference produced in the process of retrieving a single appropriate lexical candidate when a multiple set of corresponding lexical representations are activated through conceptual activity. If this is the case, then the extent of interference may give an indication of the relationship between the conceptual system and the two lexicons, which in turn may vary as a function of the level of proficiency in the second language.

**METHOD**

**Participants.** Japanese-English bilinguals (distantly related languages) were divided into two groups on the basis of their proficiency in L2 (English). One group, the Japanese-English group at the lower proficiency level of the second language, consisted of 16 university students (aged 19–22) who had studied English (on average 8.3 years) as their second language in Japan but had had no experience of living abroad in an English-speaking environment. Assuming their Japanese proficiency as 10 points for the four skills of speaking, listening, reading and writing, the mean of their self-ratings on English skills were 3.1 for speaking; 3.7 for listening; 5.5 for reading; and 4.2 for writing. The second group, the Japanese-English group with the more proficient level of the second language, consisted of 16 participants (aged 19–31) who had lived abroad in an English-speaking environment (on average 5.2 years). Assuming their Japanese proficiency as 10 for all 4 skills, their mean self-ratings on English skills were 6.6 for speaking; 7.6 for listening; 6.8 for reading; and 6.2 for writing; that is, higher on each skill than those in the first group.

**Materials.** 16 items from eight semantic categories (vegetables, vehicles, animals, fruits, birds, instruments, insects and furniture) were selected in both Japanese and English generating a total of 256 words, 128 in each language. They were equated as far as possible for familiarity and typicality of category membership. To derive an index of familiarity in Japanese and English, 20 Japanese students were asked to rate these words on a scale of 1 to 5, with 5 representing the maximum familiarity value. Ratings were made on the basis of frequency of seeing or hearing the words. The mean familiarity rating for Japanese words was 3.4, that for English words, 2.8. To assess typicality, existing norms were used. The average rating of good examples in the 8 categories were 2.7 in Japanese (Ishige & Hakoda, 1983) and 2.6 in English (Rosch, 1975). In the case of Japanese words, the most generally used notation was selected from Chinese characters, hiragana, katakana and a mix of Chinese characters and hiragana (Kashu, 1994).
Each participant received eight 16-item lists, four with a categorized structure, four with a randomized structure. Categorized lists consisted of 16 items drawn from a single semantic category and randomized lists consisted of 16 items with 4 items drawn from each of the remaining four semantic categories (Table 1). Items in the randomized lists were selected in such a way as to keep the mean frequency and typicality of words from each category constant. The four lists of each type were assigned on a random basis to reading and translation conditions in each language. Order of items in each list was randomized across participants.

**Design and Procedure.** A $2 \times 2 \times 2$ factorial completely within-participants design was used. The factors were Task (reading or translation), Type of list (categorized or randomized) and Presentation language (Japanese or English). This gave rise to 8 experimental conditions, and participants performed once in each condition. Thus they read or translated 16 words presented in Japanese or English in a categorized or randomized list, depending on the experimental condition. The order of the conditions was randomized across participants.

Items were presented on a computer monitor (Macintosh Performa 588) and verbal responses of the subjects were recorded through a microphone. In the reading task, participants were instructed to read the word aloud in the language in which it was presented on the screen. In the translation task they were instructed to translate the word from the language in which it was presented on the screen into the alternative language. Reaction times were measured from the onset of the stimulus to the onset of the verbal response. The inter-trial interval, from response completion to onset of the next stimulus, was two seconds. The 128 test trials (8 lists $\times$ 16 items per list) were preceded by 16 practice trials, consisting of 4 trials each from reading and translating conditions in Japanese and English using categorized and randomized lists. An additional 2 second pause separated blocks of 16-item trials.

**RESULTS AND DISCUSSION**

Occasional errors and voice key failure responses were discarded, the median RTs of correct responses were calculated for each participant, and the means of these scores across participants were calculated for each task. The data for each task, reading and translation were subjected to logarithmic conversion before analysis. (Median scores and logarithmic conversion were used as a basis to reduce the effect of occasional excessively long latencies, particularly in the translation condition). The mean reading and translation latencies are shown in Fig. 2. Inspection of these data indicates that while the more and less proficient groups produce a similar pattern of responses on the reading task, differences between them emerge on the translation task. This was supported by initial 4-way analyses of variance (ANOVAs) by participants ($F_1$) and by items ($F_2$) carried out on
the reading and translation latencies with Second language proficiency (more proficient vs. less proficient), Task (reading vs. translation), List (categorized vs. randomized) and Present language (Japanese vs. English) as factors, where a triple interaction of Second language proficiency by Task by Language emerged \( F(1, 30) = 8.21, p < .01; F(1, 254) = 29.71, p < .001 \). As in the study of Kroll and Stuart (1994), reading latencies was faster than translation latencies as shown by a significant main effect of Task \( F(1, 30) = 927.68, p < .001; F(1, 254) = 2721.75, p < .001 \).

For further analyses in each task, the data of the more and less proficient groups were subjected to separate ANOVAs in which Type of list and Present language were treated as within-participants factors.

**Second Language Proficiency and Reading Latency.** Both groups showed that mean reading latencies were significantly shorter in Japanese than in English [the less proficient
The second experiment was designed to investigate translation processes in bilinguals of two closely related languages, Japanese and Korean, as a function of second language proficiency. The experimental paradigm was the same as that of experiment 1.
METHOD

Participants. Two groups of Japanese (L1)-Korean (L2) speakers as bilinguals of closely-related languages took part. One group, the Japanese-Korean group with the less proficient level of the second language, consisted of 16 university students who had studied Korean (on average 2.2 years) in a language course at beginners level in a Korean university. Assuming their Japanese proficiency as 10 points for the four skills of speaking, listening, reading and writing, the mean of their self-ratings on Korean skills were 4.4 for speaking; 4.8 for listening; 4.8 for reading; and 3.8 for writing. The second group, the Japanese-Korean group with the more proficient level of the second language, consisted of 16 participants who had studied Korean at advanced level or graduate school in Korea (on average studying for 5 years and staying for 2 years). Assuming their Japanese proficiency as 10 for all 4 skills, their mean self-ratings on Korean skills were 6.8 for speaking; 7.3 for listening; 7.2 for reading; and 6.0 for writing.

Materials. 67 Korean students were asked to rate the familiarity of Korean and Japanese words on a scale of 1 to 5 and their typicality on a scale of 1 to 7. The mean familiarity rating of Korean words was 3.9 and that of Japanese words was 3.2. The average rating of typicality was 2.2 for Korean words and 2.3 for Japanese words. Categorized and randomized lists were selected in exactly the same way as in Experiment 1 (Table 2).

Design and Procedure. The design and procedure of Experiment 1 were replicated exactly in Experiment 2.

RESULTS AND DISCUSSION

The data from both the more and the less proficient groups were collected in the same way as in Experiment 1 and the means of these data for each task were calculated. The mean reading and translation latencies are shown in Fig. 3. The pattern of each condition was similar in both groups, with reading latencies being faster than translation latencies and the reading latencies of L1 words (Japanese) being faster than those of L2 (Korean) words. This pattern was supported by a 4-way ANOVA by participants and by items, where the effect of Task and Presented language were both significant [Task: $F_{1}(1, 30) = 649.29, \ p < .01; \ F_{2}(1, 254) = 2294.48, \ p < .001$, Presented language: $F_{1}(1, 30) = 57.27, \ p < .01; \ F_{2}(1, 254) = 489.727, \ p < .001$]. In addition, for both reading and translation tasks, 2-way ANOVAs with Type of list (categorized vs. randomized) and Presented language (Japanese vs. Korean) were performed for each group in the same way.
Second Language Proficiency and Reading Latency. Reading Japanese words was significantly faster than reading Korean words in both the more and the less proficient groups [Less proficient group: $F_1(1, 15) = 58.46, p < .01; F_2(1, 127) = 350.57, p < .001$; more proficient group: $F_1(1, 15) = 26.38, p < .01; F_2(1, 127) = 267.95, p < .001$] and the Type of list did not have any effect on reading latencies in either group [Less proficient group: $F_1(1, 15) = 6.40, p > .10; F_2(1, 127) = 4.35, p > .10$; more proficient group: $F_1(1, 15) = 0.11, p > .10; F_2(1, 127) = 1.95, p > .10$]. The lack of list effect in both groups, suggests that the process of reading a word does not necessarily involve access through the conceptual system. Rather, it seems to require only the activation of the phonological representation in each lexical system and in both groups lexical activation was more direct or easier in L1. The difference in L2 proficiency of the two groups did not appear to have
a significant influence on the reading task and reading in L1 was still faster than in L2 in the more proficient group despite greater proficiency in L2.

In Experiment 1, the Japanese-English group showed a significant interaction between Second language proficiency and the Presented language, with the smaller difference of the two languages in the more proficient group. In contrast there was no such interaction within the Japanese-Korean group.

In L2 reading in the Japanese-English groups, the more proficient group read significantly faster than the less proficient group, but latencies in the Japanese-Korean groups were uninfluenced by second language proficiency. This demonstrates a tendency for reading speed to improve with increasing second language proficiency when the second language is distantly related to the first (Japanese-English group) but with no effect of increased second language proficiency when the second language is closely related to the first (Japanese-Korean group).

It is possible that these results are explicable in terms of differences in the writing systems of the two second languages involved in this study. English and Korean languages share a basic alphabetic principle, where graphemes (letters) correspond to phonemes. However, the Hangul letters of Korean alphabet have more strokes (from one to eight) than those of the English alphabet, containing from one to four strokes, so that it is visually more complex. Moreover an orthographic feature of Hangul is nonlinear spatial layout arranged from left to right and from top to bottom (Wang, Park, & Lee, 2006). These differences in orthographic features may have had a stronger influence on reading than second language proficiency in the Japanese-Korean groups. That is, the reason for an absence of difference between the more and less proficient groups in Japanese-Korean (in contrast to the proficiency difference which emerged in the Japanese-English groups) was that the complexity of the Korean orthographic system made visual recognition of characters difficult, even for the more proficient group. Thus even that group read faster in Japanese than in Korean.

Second Language Proficiency and Translation Latency. The more and less proficient groups showed a similar pattern of translation latencies, with L1 to L2 translation being faster than L2 to L1. This is demonstrated by the results of a 2 way ANOVA which showed a significant main effect of direction of translation in both groups [Less proficient group: $F_1(1, 15) = 19.40, p < .001; F_2(1, 127) = 114.15, p < .001$; more proficient group: $F_1(1, 127) = 26.30, p < .001$]. However, the effect of Type of list was not obtained in either group, and this coupled with the absence of an interaction between direction of translation and L2 proficiency in the main analysis [Less proficient group: $F_1(1, 15) = 0.24, p > .10; F_2(1, 127) = 152, p > .10$; more proficient group: $F_1(1, 15) = 0.66, p > .10; F_2(1, 127) = 214, p > .10$]. Translation latencies in both groups were similar to reading latencies.

These results suggest that both groups showed translation asymmetry but that there was no category interference in either group, i.e. translation latencies were not influenced by semantic context. In addition, the asymmetry observed here, with L1 to L2 translation time being shorter than L2 to L1 translation time, is in direct contrast to that found in previous studies (Kroll & Curley, 1988; Kroll & Stewart, 1990, 1994).
GENERAL DISCUSSION

The purpose of this study was to explore the lexical and conceptual structure in two languages of bilinguals and to examine the effect of proficiency in the second language and the similarity of the two languages on the word recognition process. Translation asymmetry and category interference were analyzed in a distantly-related language group (Japanese-English) in Experiment 1 and a closely-related language group (Japanese-Korean) in Experiment 2 with different levels of second language proficiency in each of the language groups.

Influence of Second Language Proficiency. The Japanese-English bilingual group read Japanese words (L1) faster than English words (L2) and the more proficient group read English faster than the less proficient group. These results show that as a bilingual becomes more proficient in the second language, phonological information is encoded more quickly. In the translation process, latencies in the less proficient bilingual group were not influenced by the semantic context or translation direction. This suggests that their word recognition process was based on direct lexical links between L1 and L2 without access to conceptual links. On the other hand, translation asymmetry was found in the more proficient bilingual group, with L1 to L2 latencies being longer than those from L2 to L1 where semantic context could play a role (organized list condition) but there was no semantic effect in L2 to L1 translation.

In the case of the closely-related language Japanese-Korean bilingual group, second language proficiency had no effect either on reading or translation latencies. Both the more and the less proficient group read L1 words significantly faster than L2 words. These results in the reading task were interpreted as indicating that words in L1 had more direct lexical access and stronger activation in the L1 lexicon than those of the L2 lexicon even after increasing second language proficiency. In the translation task, the two groups showed translation asymmetry, translation latencies from L2 to L1 being larger than those of L1 to L2. This translation asymmetry is in the opposite direction to that observed in past studies. In seeking an explanation for this atypical pattern, the feature of Korean orthographic system needs to be considered. The composition of the Korean alphabet, Hangul, has a square-like syllable block and each Hangul syllable is constructed from 2-4 symbols in various types of combination (Wang et al., 2006). Furthermore, a Hangul syllable block contains between one and eight strokes. The system thus has a high degree of visual complexity. It is likely that the Japanese participants for whom Korean is a second language need to take longer for orthographic and phonological processing of L2 words in a reading task. This would explain the results of translation latencies. Japanese-Korean participants translated L1 words to L2 words faster than L2 words to L1 words because the visual complexity of Hangul letters (L2) caused difficulties of L2 activation at the lexical level.

Similarity of the Two Languages. In the present study, two types of bilingual groups with different degrees of L1 to L2 similarity were selected on the basis of the cultural background or linguistic features of the two languages. The Japanese-English group showed a different pattern of results in the reading and translation tasks as a function of
increasing of second language proficiency. In contrast, the Japanese-Korean group showed a similar pattern in both the more and the less proficient group. That is, when the two languages of a bilingual were distantly related, second language proficiency had a strong effect on reading and translating latencies. However, when the two languages were closely related, there was no effect of L2 proficiency on reading and translating latencies. These findings suggest that similarity of languages and second language proficiency do not act on the word recognition process independently. When one factor, language similarity, is high, it has the effect of weakening the typical effect of second language proficiency.

Investigating the Revised Hierarchical Model. In Experiment 1 translation asymmetry in categorized lists appeared only in the more proficient Japanese-English bilingual group, while the results of Experiment 2 involving more closely related languages, Japanese and Korean, revealed translation asymmetry in both the more and the less proficient bilingual groups.

The data of the more proficient Japanese-English bilingual group fit the asymmetrical hierarchical model of bilingual memory and the results of Experiment 1 support the notion of dynamic changes within its architecture. The absence of category-based translation interference in the less proficient group suggests that the translation process from English to Japanese does not access the conceptual system, in accordance with the word association model. (See Fig. 4).

For example, the English word “apple”, after activating its representation within the English lexicon, would be directly translated into its translation equivalent “りんご” (=apple) in the Japanese lexicon and be produced as a response. Categorization of lists would have little effect, since an individual stimulus in English would not be routed through the conceptual system (since L2 lexico-conceptual links are tenuous or underdeveloped in this, less proficient, group) and so would not have the opportunity to arouse associated representations within the English semantic network which could give rise to interference.

Translation from Japanese to English, because of stronger L1 lexico-conceptual connections, would involve stimuli passing through the conceptual system during the translation process. Thus the Japanese word “りんご” would access the conceptual system where it may activate the superordinate concept of “kudamono” (fruit) and related items such as “桃” (peach) or “スイカ” (watermelon) within the Japanese semantic network. However, because connections from these items in the conceptual system to the English lexicon have not formed yet, they could not activate their translation equivalents in English, and so the main candidate for response, the item activated initially, “りんご” would be relatively immune to interference. Besides, the conceptual representations of “りんご” and/or its Japanese semantic relatives, do not have the power to evoke many or any other items within the English semantic network since these two languages are distantly related and do not share precisely the same semantic features for individual items or the same pattern of semantic networking systems. Through the direct lexical links from Japanese, the main candidate “apple” is the dominant activated candidate in the English lexicon and is not prone to confusion from other category members. This is precisely
what the data show—relatively little difference between L1-L2 and L2-L1 translation in the less proficient group.

The model posits much stronger L2-conceptual connections when L2 proficiency is higher, and the fact that category-based translation interference was found in the more proficient group is in line with this. Translation in this group would involve activation of conceptual representations from Japanese to English, and categorization of lists would
activate related items at the conceptual level irrespective of the language of the initial stimulus. The Japanese “りんご” would also activate items in the English semantic network as well as its related items in the Japanese network, giving rise to potential interference (See Fig. 4).

In the translation process from English to Japanese, English words still have a strong connection to the Japanese lexicon. With increasing L2 proficiency, L2-conceptual links are created but the connection would be relatively weaker than the lexical links between the two languages. The English “apple” would activate directly the translation equivalent “りんご” in the Japanese lexicon. The data indicate some language asymmetry in this process, in that category interference is greater for L1 to L2 translation. This suggests that Japanese (L1) words produce stronger or more widespread activation of the Japanese semantic network in the conceptual system. Thus the influence of the Japanese “りんご” at the conceptual level may spread further than that of the English “apple”.

The above explanation of the pattern of differences between more and less proficient bilinguals, and of differences within the more proficient group in direction of translation, imply a slightly different conceptualization of bilingual memory from that provided by the standard dual-level lexico-conceptual model (Kroll, 1993; Kroll & De Groot, 1997; Kroll & Stewart, 1994). That model does not entertain possible differences between concepts in the two languages and sees a conceptual representation as a single and language-independent entity. The above explanatory scenario makes a distinction between the conceptual system and semantic representation by implying that there are separate semantic networks for each language, closely linked and overlapping, so that a conceptual representation may be organized somewhat differently in the two languages. This view is consistent with recent developments (Francis, 1999; Grosjean, 1998; Paradis, 1997; Pavlenko, 1999) in the thinking on the nature of bilingual memory.

In Experiment 2, both the more and the less proficient groups of Japanese-Korean bilinguals showed a similar pattern of results. The most remarkable feature of the results was that Japanese words were translated significantly faster than Korean words and translation latencies were not influenced by semantic context. In the present experiments, the two types of lists, categorized and randomized, both consisted of concrete nouns. De Groot (1992) has suggested an effect of concreteness where concrete words are recognized and translated relatively fast in the distributed model of bilingual memory. The Japanese and Korean languages are closely related and share linguistic and cultural background aspects, so that these semantic representations in the conceptual system may be assumed to overlap to a high degree across the two languages. In the case of Japanese-Korean bilinguals, the absence of a categorization effect would be due to the fact that concrete nouns of closely-related languages share the same conceptual representations and so all L1 words would have accessed the shared conceptual representations, regardless of list structure. This would result in concrete noun stimuli facilitating translation of L1 words to L2 words in relatively-closed languages.

To summarize, while the Kroll and Stewart’s model (1994) in general proposes interference in the conceptual system during L1- L2 translation, the present study suggests that accessing the conceptual system can facilitate L1 to L2 translation in a situation
where the two conceptual systems are closely related and share many aspects. Thus the Japanese stimulus “りんご” would activate, through the Japanese lexicon, its own representation and related items both in the Japanese and Korean conceptual systems and then activate the Korean equivalent “사과” (=apple) in the Korean lexicon (See Fig. 5).

Translating from Korean words to Japanese words is assumed to be performed in the lexically based processing system across the two languages, since, as the data have revealed, there is no influence of semantic context. Although the Japanese and Korean languages may be regarded as closely related from the cultural and linguistic point of view, these languages have orthographic differences in the writing system. The Korean language has a visually complex orthographic system. Korean Hangul letters represent the phonogram system, that is, letters only map onto phonological representations, while Japanese uses two systems, the ideogram of kanji (Chinese characters) and kana symbols to represent phonemes. Kanji (Chinese characters) can represent meaning. For example, 木 represents Wood so that we can recognize the meaning of “木” without knowing the pronunciation of the letter, without accessing the phonology.

In the current research reading could have been achieved via two types of strategy of cognitive word processing, one a direct grapheme-phoneme conversion, and the other lexical processing, involving accessing phonological information via the mental lexicon (Abe, Momouchi, Kaneko & Yi, 1994). Cho (1997) suggested that recognition processes for words written in the Hangul scripts are performed via lexical access rather than simple symbol-to-sound conversion, so that reading latencies would be increased as a result of involvement of lexical decision. For example, the Korean word “사과” would access the Korean lexicon and the combination of symbols should be analyzed from orthographic
level to phonological level in that lexicon to produce the main candidate “りんご” in the Japanese lexicon. In contrast to accessing overlapped conceptual representations in translating from L1 Japanese to L2 Korean words, participants face the visual complexity of Hangul letters, which causes interference in phonological processing. As a consequence Japanese-Korean participants need more time when translating L2 words to L1 words and this emerges in translation asymmetry with L2 to L1 translation slower than L1 to L2 translation.

In summary, the findings of the present research in Japanese-English bilingual groups are in line with those of Kroll and Stewart (1994), De Groot, Dannenburg, and van Hell (1994), Altarriba and Mathis (1997) and Chen et al. (1997), in that they support the basic architecture of the asymmetrical hierarchical model of bilingual memory and indicate that the functional connections within the model change with increasing proficiency in the second language. The present experiment suggests that word recognition processes in Japanese-English bilingual groups could be described by a transition from the word association model to the asymmetrical hierarchical model. That is to say, the revised hierarchical model is applicable and appropriate bilingual organization in distantly-related languages. On the other hand, the pattern with Japanese-Korean, two similar languages, showed a different translation asymmetry with respect to direction of translation. The best explanation for this is that the visual complexity of the orthographic system has an important effect on lexical processing. The similarity of the two languages was defined in the context of the language family and linguistic point of view, but the present research indicates that the orthographic system of the language must also be taken into consideration in the examination of the bilingual lexical and conceptual systems.

REFERENCES


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