L1 Lemma Mediation in Form-Meaning Mapping in Acquisition of L2 Mental Lexicon[*]

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A word consists of form and meaning and the mapping of lexical form to meaning is important in L2 vocabulary acquisition. Psycholinguistic research suggests that L2 words are learned through the mediation of L1. This study investigates this assumption more specifically by proposing that the semantic specification of L2 lexical forms is mapped to existing concepts in L1. Two experiments were conducted to examine acquisition of English word pairs by Korean L2 learners. Experiment 1 assessed the degree of semantic relatedness and experiment 2 assessed whether the word pairs were semantically related. Word pairs sharing the same L1 translation equivalents showed higher rating scores and faster reaction time than those with different translation: Strong evidence was found for L1 meaning presence in L2 lexical entries. In addition, noun pairs were performed better than verb pairs and advanced learners did better than intermediate learners. We also discuss the frequency and length effect in L2 word production and the pedagogical implications of lexical development and vocabulary teaching.

I. INTRODUCTION

This study examines L1 involvement in the processing of L2 word use in Korean (L1) learners of English (L2). Numerous studies on lexical development in both L1 and L2 have explored how learners associate a lexical form to its meaning (Jiang, 2000, 2002; Kroll & De Groot, 1997; Kroll & Stuart, 1994 to name a few) It is suggested that children connect form to meaning simultaneously with other lexical information, including syntactic and

morphological components, and contextual information in which the word is used. On the other hand, adult L2 learners are not presumed to acquire their lexicon in the same manner as children. One hypothesis is that the connection between L1 words and L2 words is hierarchical and that the strength of connection between L1 and L2 is different between lexical representation level and conceptual representation level in bilingual lexicon development (Kroll & De Groot, 1997).[1] An alternative hypothesis is that during lexicon development in L2, all necessary information is represented in a lexical entry without hierarchical representation, although the internal structure of the L2 lexical entry is not similar to that of L1 (Jiang, 2000, 2002). In this hypothesis, the L1 semantic component is mapped onto the semantic specifications of corresponding L2 lexical entries.

The results of the present study suggest that in Korean learners of English, L2 lexical forms are often mapped to the existing semantic content of their first language. In semantic judgment tasks, L2 word pairs of comparable semantic relatedness had higher rating scores (experiment 1) and faster reaction times (experiment 2) when comparing pairs of English words with the same Korean translation, than for such pairs with different translations. This is strong evidence for L1 meaning presence in L2 lexical entries.

The present study is organized as follows: section II provides theoretical background, describing bilingual lexicon models with hierarchical representations, and a model without hierarchical representations, which is relevant for adult L2 learners in lexical development. Research questions and hypotheses are formulated in section III. Experimental methodology, results and discussion are presented in Section IV. General discussion is in section V, and the final section concerns pedagogical implications of the study of form-meaning mapping in development of the L2 mental lexicon.

II.   THEORETICAL BACKGROUND

The first section reviews research on bilingual lexicon models and points out potential difficulties in relating the bilingual lexicon research to the form-meaning mapping issue addressed in the present study. The second section introduces an alternative model which seems more relevant to explain adult L2 vocabulary acquisition.

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[1] The terms 'bilingual' and 'second language (L2) learners (users)' need to be distinguished. Bilinguals are individuals who learned a second language from early age and use it at a relatively high proficiency. Optimal bilinguals are those who are balanced in their use of the two languages. By contrast, L2 learners, are late learners, and learner variation is an inevitable consequence. Most L2 learners have limited proficiency in L2 and fossilization occurs in many cases. Furthermore, the terms 'concept' and 'meaning' are used interchangeably in the present study.

1. Bilingual Lexicon Models

Potter, So, Von Eckardt and Feldman (1984) reported the first attempt to test two alternative models regarding development of the bilingual lexicon in terms of mapping L1 and L2 words. These were: the Word Association model and the Concept Mediation model. According to Word Association hypothesis, words in L2 access concepts via words in L1, i.e. L2 words are mediated via direct connection to their translation equivalents in L1. In contrast, the Concept Mediation model proposes that L2 words are connected directly to their meanings without L1 mediation, allowing direct access to concepts for words in both languages. The contrast between the Word Association and Concept Mediation models is illustrated in Figure 1 and 2, respectively.

FIGURE 1
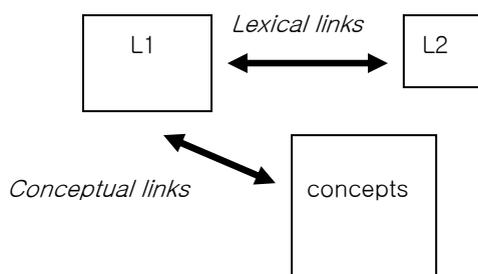**Word Association Model (adapted from Potter et al., 1984)**

FIGURE 2
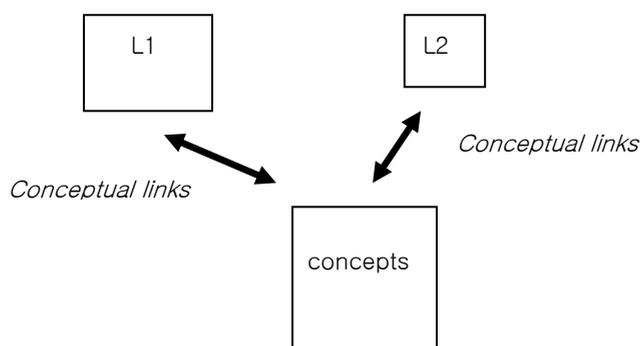**Concept Mediation Model (adapted from Potter et al., 1984)**

Both models are hierarchical in that they distinguish between word (i.e., lexical) representations and concept representations. Lexical representations do not include meaning but only aspects of word form. Potter et al. (1984) compared the results of translation tests (lexical level tests) and picture naming tests (conceptual level tests), and

found that less-fluent L2 learners performed in accordance with the predictions of the Word Association model: They were faster to translate words than to name pictures in L2 (Chen & Leung, 1989; Kroll & Curley, 1988). Lexical Mediation through L1 appears to apply to non-fluent bilinguals, whereas Concept Mediation appears to apply to the performance of more fluent bilinguals (Kroll & De Groot, 1997, p. 172).

Subsequent research on the acquisition of a bilingual lexicon has suggested that the Word Association and Concept Mediation models can be linked into a developmental hypotheses: i.e, that during initial phases of L2 learning, individuals use Word Association and as fluency increases, the degree of direct conceptual mediation increases until more advanced learners use Concept Mediation almost entirely. (Chen, 1992; De Groot, 1993; Kroll et al., 2002; Kroll & Tokowicz, 2001). Thus, the two models describe opposite ends of a continuum of learning strategies.

To account for this apparent continuum in the development of a bilingual lexicon, Kroll and Stewart (1994) proposed the Revised Hierarchical model (Figure 3). This model merges the Word Association and Concept Mediation alternatives into a single model, in which the strength of lexical-to-conceptual connections between L1 and L2 is asymmetrical. Because L2 depends initially on L1 for access to meaning, the lexical connection from L2 to L1 is stronger than the corresponding lexical level connection from L1 to L2. Likewise, the connections between words and concepts are stronger for L1 than for L2, because L1 initially holds privileged access to meaning. The empirical evidence for the Revised Hierarchical model is that highly fluent Dutch-English bilinguals translated more slowly from L1 to L2 (direction of translation more likely to rely on conceptual processing) than from L2 to L1 (direction of translation more likely to activate direct lexical-level connection) (Kroll & De Groot, 1997).

FIGURE 3
Revised Hierarchical Model (adapted from Kroll & Stuart, 1994)
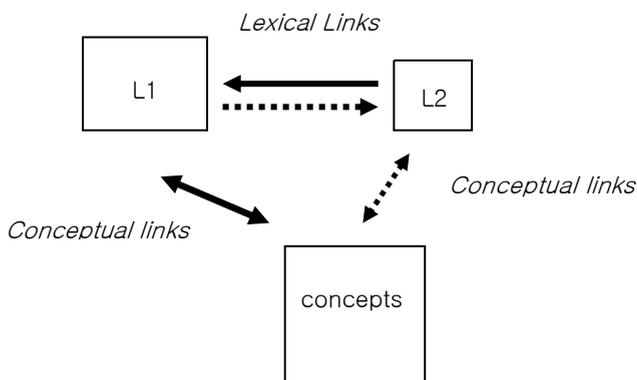
The Word Association and Lexical Mediation models describe opposite ends of a continuum of learning strategies used in acquisition of bilinguality, with the developmental transition going from word association to concept mediation, and eventually to a completely bilingual lexicon, which is modeled by the Revised Hierarchical model. The Revised Hierarchical model (and the embedded Word Association and Lexical Mediation models) explicitly adopts a *hierarchical* approach with two levels of representation: lexical and conceptual. No semantic component is included in the lexical level. Most bilingual lexicon studies adopt the separation of the lexical and conceptual level. This means that no semantic information is present between L1 and L2 words when they are linked at the lexical level.

The approach in the present study is quite different from that used in the bilingual lexicon models described above. First, according to Jiang's (2000) model, based on Levelt's (1989) model, a semantic component is included in the lexical entries; this semantic component is the focus of the present study.

The second difference is that the present study addresses the issue of precisely what semantic information is integrated into L2 lexical entries during L2 vocabulary acquisition. Unlike the bilingual lexicon models mentioned above, the present model makes no claim about the connections between L1 words and L2 words. The study of bilingual lexicon, on the other hand, has been primarily concerned with the interconnections between L1 words and L2 words on the lexical level by lexicon test (e.g., translation test from L1 to L2 and L2 to L1, assuming that no semantic information is involved in the translation processes). Both the Word Association and Concept Mediation models deal with such interconnections and do not address directly whether L2 words are mapped to new or existing concepts. The Concept Mediation model, now widely accepted in bilingual lexicon research, postulates that L2 words are directly related to concepts and share the same conceptual system with L1. However, this model makes no claim regarding whether the L2 words are related to the present L1 concept or to some new concept in the conceptual system. The L1 Mediation model, discussed in the following section, on the other hand, assumes that L1 lemma information is copied into L2 lexical forms and thus, that L2 words exhibits L2 formal information (phonology and orthography) in the lexeme and the syntactic and semantic information of its L1 translation in the lemma.

2. A Model Relevant for Adult L2 Learners

1) Internal Structure of Lexical Entries

Before I discuss the acquisition of L2 lexicon, it is necessary to examine lexical representation in L1. Levelt (1989) suggests that each item in a speaker's mental lexicon,

has at least four features. The first is a specification of the item's *meaning*, a set of conceptual conditions for the item to be selected for the fulfillment of message. For the entry *eat,* the meaning is something like "to ingest for nourishment or pleasure".

The second feature is a set of syntactic properties, including the category of the entry (V for *eat*), the syntactic argument it can take (an external subject and an internal object for the verb *eat*; it is a transitive verb), and other properties. The semantic and syntactic properties in a lexical entry are termed 'lemma'.

The third feature is a morphological specification of the item. For *eat*, it is a root form, the 3rd singular form is *eats* and the simple past tense form is *ate*. The fourth feature concerns phonological structure, i.e. its syllable and accent structure. For *eat*, the segment structure is a monosyllabic vowel/consonant sequence (/i/ as vowel, and /t/ as consonant) The morphological and phonological information in a lexical entry are lexemes.

In sum, the internal structure of a lexical entry is believed to consist of two components: lemma and lexeme, each being divided into two components (Figure 4).

FIGURE 4
The Internal Structure of the Lexical Entry (adapted from Levelt, 1989)
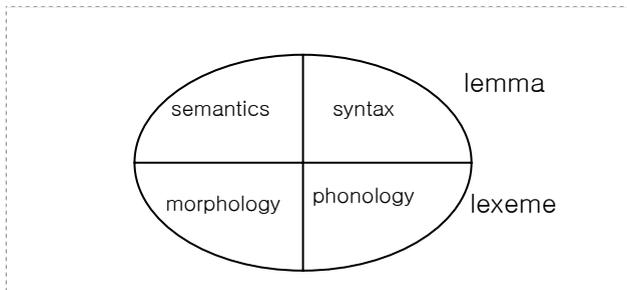
One major difference between Levelt's (1989) Lemma and Lexeme model and the bilingual lexicon models is that Levelt's model includes lexical-semantic function in the lexical entry whereas the bilingual lexicon models do not. The bilingual lexicon models use hierarchical representation and restrict semantic information to the conceptual level. Since the semantic specification of L2 words is the focus of the present study, a close examination of the conceptual level, whether the existing meaning or new meaning is available for L2 words, can be provided by the internal structure of the lexicon model, not by the bilingual lexicon models.

2) L1 Lemma Mediation Model

As L2 learning experience increases, coactivation of L2 lexical forms and the lemma

component of their L1 translation also increases. This stage can be called "L1 lemma mediation or copying." That is, L1 lemma information can be said to have been copied into a L2 lexical entry from its L1 translation and become part of lexical knowledge represented in L2 lexical entries.

What evidence is there to support the continued mapping of L2 words to L1 meanings? One line of evidence can be found in the word-choice errors in L2 production. Even advanced L2 users make lexical errors in form-meaning mapping. The following examples are from the writing samples of Korean college students. The intended words are provided in parenthesis.

(1) He had a happy *wedding* life (cf. *marriage*)
(2) My grandfather always *told* with me. (cf. *talked*)

The cause of the errors is the same: A lexical distinction is made in L2 but not in L1. The English words *wedding* and *marriage* share the same Korean translation *kyulhon*; *tell* and *talk* have the same verb form *malhata* in Korean. For these words, two L2 words are mapped to the same semantic information as the shared L1 translation. For even easy and high frequency words, such as *tell* and *talk,* (also *speak* and *say* with the same L1 translation), L2 users connect L2 form to L1 meaning, failing in form-meaning remapping. Although the user's error of word choice in L2 clearly indicates that the use of L2 words are based on L1 lemma information, such lexical errors do not always occur, particularly with advanced L2 learners. The absence of lexicon errors can be considered a successful form-meaning remapping in L2 vocabulary acquisition (see Jiang (2002) for similar explanation for justifying L1 lemma mediation hypothesis).

The purpose of the current study is to investigate the evidence for the L1 Lemma Mediation hypothesis in experimental settings. If the semantic specification of the L2 word comes from the L1 translation equivalent, different semantic overlap will result in different translation equivalents. For example, the English words *choice* and *selection* are translated into the same Korean word *sentayk*. On the other hand, *security* and *protection* are translated into *ancen* and *poho,* respectively, even though the words are semantically comparable with English native speakers.

The critical stimuli of the experiment in the present study consist of two components: "same translation" pairs (i.e., paired English words which share the same Korean translation) and "different translation" pairs, (i.e., paired English words which translate into different Korean forms). If L1 Lemma Mediation hypothesis is correct in predicting that the semantic specification of L2 comes from the L1 meaning, then the "same translation" and the "different translation" pairs will have different semantic overlap. The former will have a common source of semantic information, but the latter will not, because it has two

different sources of semantic information. As shown in figure 5, the same translation pair *choice* and *selection* has a common L1 lemma source, but the different translation pair *security* and *protection* would have a lower degree of semantic overlap, because their semantic content comes from different L1 translations.

FIGURE 5
L1 Lemma Mediation Model (adapted from Jiang, 2002)
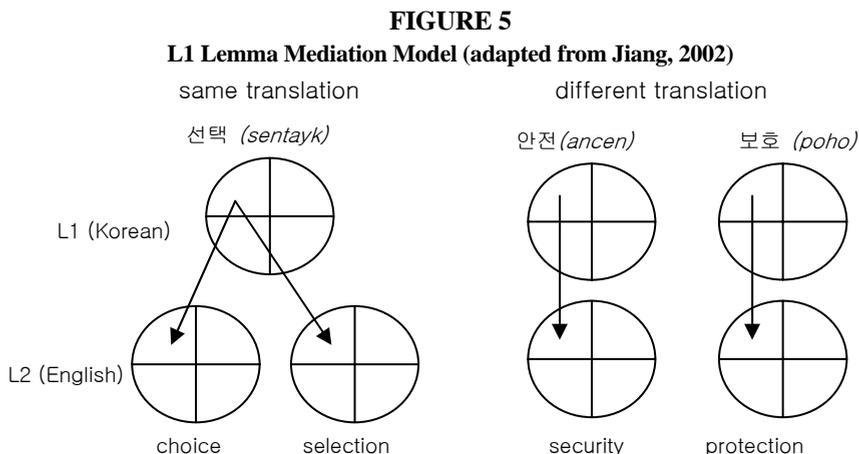
It is hypothesized that L2 users will rate a set of words in the "same translation" pairs more related than in the case of the "different translation" pairs. Specifically, if L1 lemma is copied by form-meaning mapping to the L2 lexicon, the degree of semantic relatedness will be higher for the "same translation" pairs than for the "different translation" pairs, even though the degree of semantic relatedness of the two types of English word pairs is comparable to native speakers of the language. On the contrary, if L2 lemma is integrated into the lexical entry, that is, if form-meaning remapping occurs successfully, L2 users will judge the two types of word pairs to be equally related. Thus, L1 Lemma Mediation hypothesis can be tested by comparing the L2 speakers' assessments of the degree of semantic relatedness of the two types of word pairs.

3) Lexical Category and Processing Difference

Another research interest in the form-meaning mapping in L2 lexicon lies in the role of lexical category. Under the L1 Lemma Mediation hypothesis, it will be easier to access the lemma component for nouns than for verbs. This is mainly because nouns are simpler and have clearer referents than verbs. Argument structure of verbs includes a complex entry of lexical information, such as transitivity, raising and control properties. Nouns, on the other hand, include a simpler definitional style. Thus, it is assumed that the process of retrieving lemma information for nouns will be easier than for verbs, leading to a better performance

for nouns than for verbs.

In various psycholinguistic research on L1 acquisition, different lexical categories (e.g., nouns, verbs, or adjectives) have been compared in terms of either definitional style or developmental order. Different kinds of words will take different routes during retrieval of meanings. For example, the retrieval processes for nouns may not be the same as those for verbs in terms of syntactic and semantic functions.

According to Markman (1989), nouns are structured categories that are stored in richly interconnected networks. The richly structured, hierarchical nature of the internal organization of nouns (e.g., apple and fruit) may result in simpler, more predictable semantic relations than other parts of speech such as verbs and adjectives. Johnson and Anglin (1995) found that it was easier for school-age children to produce conventional syntactic forms (e.g., use a noun phrase to define a noun) for nouns than for verbs or adjectives. They suggested that while a noun is more likely to activate a synonym with high quality definition, a verb may require a more deliberate and systematic search for the relevant definitional element. Marinellie and Johnson (2004) also found from school-age children that in the study of definitional style of nouns and verbs there was no significant difference between nouns and verbs for content scores, but a significant difference for form scores. The prominence of nouns and their early appearance in child language development suggest that verbs are more difficult to learn of the two forms (e.g., Bates, Marchman, Thal, Fenson, Dale, Reznick, Reilly & Hartung, 1994; Benedict, 1979). Snow (1990) reported that children gain more exposure and practice defining nouns than verbs in the course of typical school instruction. For instance, in a commonly used book by elementary school teachers, over 150 words are listed and approximately 87% of the words are nouns and 13% are verbs and adjectives. Most likely, nouns comprise the foundational vocabulary of most academic subjects that children are expected to learn (Marinellie & Johnson, 2004, p. 220).

Thus, it is possible to predict that an L2 learner will find it more challenging to define a verb than a noun. The present study on adult L2 acquisition assumes that the development of semantic specification in the lexicon is strongly facilitated by high-frequency exposure to the contextualized input and opportunities to practice. Since nouns are more prevalent in the input than verbs in L2 learning process, leading to more frequent exposure and practice, a stronger reinforcement for nouns than verbs can be established in L2 learning. Therefore, it is conceivable that L2 learners in the present study will perform better for nouns than for verbs in terms of semantic specification. The "same translation" and "different translation" pairs used in experiments of the current paper consist of both nouns and verbs in order to compare the semantic specification of L2 words between the two lexical categories.

III.   RESEARCH QUESTIONS AND HYPOTHESES

Based on the models of lexical representation and processing in second language in terms of mapping the lexical form to meaning, I formulate the following research questions and hypotheses.

Q1. Will there be any differences between the "same translation" and "different translation" pairs in rating scores with respect to the degree of semantic relatedness and in reaction times (RTs) with respect to semantic judgment tasks?

H1. If L1 Lemma Mediation hypothesis is correct, the same translation pairs will provide higher rating scores and shorter RTs than the different translation pairs.

Q2. Will there be any differences in rating scores and RTs in terms of lexical category? That is, will nouns provide higher rating scores and shorter RTs than verbs?

H2. Because nouns are learned at a faster rate than verbs in L1 acquisition, and nouns are believed to have clearer referents and be conceptually simpler than verbs, if L2 learning shows similar developmental stages, L2 learners will do better for nouns than for verbs.

Q3. Are there any differences between the intermediate learners and the advanced learners?

H3. It is hypothesized that intermediate-level learners will rely more on L1 translation equivalent for L2 words than advanced-level learners. Therefore, advanced-level learners will perform better than intermediate-level learners.

IV.   THE STUDY

1. Experiment 1

1) Participants

Participants in the current study were 25 intermediate-level learners and 29 advanced-level learners who were undergraduate students at POSTECH. The intermediate-level learners had TOEFL scores between 450 and 500 (or TOEIC scores between 500 and 700) and the advanced learners had TOEFL scores higher than 600 (or TOEIC scores higher than 900). They had received an average of 10.5 years of formal training in English. Most

of the participants had not attended any language institutes outside the college classes. All of them had at least two semesters of experience of learning English from native English speakers.

2) Materials

Word pairs used in the experiments of this study were selected from the Brown Corpus. Three steps of word-selection procedure were involved. Using the Brown Corpus frequency list, I first selected the most highly frequently used 4,000 nouns and 4,000 verbs out of 30,577 nouns and 11,858 verbs, respectively.[2]

In the second step, the length of the words was controlled. Only words with 6-9 characters were selected. It was found from the pre-pilot test that to compare word pairs such as *door-gate* and *knowledge-information* was not relevant for the purpose of the current study, because their word length was not comparable, which may bias the reaction time results. Shorter word pairs require shorter response time than longer word pairs, simply because of their length difference. After this procedure, 1113 nouns and 893 verbs were chosen, each with 6-9 characters.

In the third step, 250 synonym pairs for each category were assembled from these words, using the online Miriam-Webster Visual Thesaurus, which shows the degree of relatedness of meanings of a word in a chain. A pair in each category (e.g., *country—nation* and *determine—decide*) consisted of words with the strongest relatedness of meanings in the Thesaurus chains.

Preliminary trials were performed to establish categories of nouns and verbs. First, ten Korean learners of English were presented with the pairs in random order and asked to translate each word into Korean, Five informants worked with nouns and the other five with verbs. Words translated with the same form by more than three informants were put in the "same translation" pairs, and words with different translation forms by more than three informants went to the "different translation" set. This procedure produced 32 noun pairs and 29 verb pairs for the "same-translation" set and 48 noun pairs and 41 verb pairs for the "different translation" set.

In the second phase of the preliminary trial, these two sets of word pairs produced in the

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[2] The reason why I limited the number of preliminary words to 4000 was that words below the 4000th frequency in the Brown Corpus frequency list had very low number of usage in both the noun list and the verb list. For example, the 4000th frequently used noun was used 12 times among 30, 577 nouns and the equivalent verb was used 4 times among 11,858 verbs. These occurrences of usage were considered too few. Although the number 4000 came from arbitrary calculation, considering the several steps of word selection to compose the appropriate word pairs for the current experiment, it was not a complete ad hoc number to limit the selection boundary for the preliminary pool.

first part of the preliminary trial were given to five native speakers of English who were asked to rate their degree of semantic relatedness. Based on their ratings, 80 pairs, comprising 40 from each set (20 pairs of nouns and 20 pairs of verbs from each set), which were matched in semantic relatedness were chosen and used in the experiments. The 80 word pairs to test the degree of semantic relatedness consisted of 20 noun pairs of same translation (SN) and 20 verb pairs of same translation (SV), and 20 noun pairs of different translation (DN) and 20 verb pairs of different translation (DV). Some examples of these word pairs are given in Table 1.

TABLE 1
Examples of English Word Pairs Used in Experiment 1

	Same translation pairs		Different translation	pairs
	English word pair	Korean translation	English word pair	Korean translation
Nouns	choice-selection (SN)	*sentayk*	suspicion-distrust (DN)	*uysim -pwulsin*
Verbs	suggest-propose (SV)	*cayanhata*	invent-devise (DV)	*palmyenghata -koanhata*

It should be noted that the two words in the "same translation" and the "different translation" pairs were semantically comparable, that is, the degree of semantic relatedness between SN pairs and DN pairs are comparable in English, as confirmed by the 5 native speaker informants.

In sum, the words in each translation set used in this study were controlled for frequency and length. High frequency words with comparable length in the Brown Corpus were chosen in order to eliminate any unexpected bias, such as familiarity effect and word length effect. The 80 word pairs in the current experiment were comparable in the degree of semantic relatedness in English, as required to test L1 Lemma Mediation hypothesis.

3) Procedure

Eighty word pairs were randomized and given to the participants in the form of semantic judgment tests, in which participants were asked to indicate the semantic relatedness of each pair. They were told that all the pairs were related in meaning but their degree of relatedness varied. The word pairs were followed by 5-point rating scale with 5 indicating the strongest semantic relatedness and 1 the weakest. Instructions were given in Korean and 10 pairs were given for practice before the main test. After completing the task, participants were asked to complete a questionnaire about their English learning background. The task took about 20 minutes for each participant. Each participant was paid a moderate reward after completing the questionnaire.

4) Results and Discussion

The raw data were averaged for each word pair from the two participant groups (Table 2). A three-way ANOVA was carried out to examine the data, with translation type (same vs. different translation), group type (intermediate vs. advanced), and category type (noun vs. verb) as variables. It produced main effects for translation type and category type. The same translation and different translation pairs received an average rating score of 4.00 and 3. 27, respectively, on the 5-point scale; the difference was significant, $F(1, 52)=235.3$, $p < .05$. Additionally, nouns tended to provide a higher rating score (3.71) than verbs (3. 57); this difference was also significant, $F(1, 52)=15.9$, $p < .05$. There was no significant difference between intermediate and advanced groups. There was an interaction effect between the group and category type variables, $F(1, 52)=48.1$, $p < .05$. Figure 6 shows the graphic information of Table 2.

TABLE 2
Average Rating Scores for Each Word Pair by Two Proficiency Groups

	SN	SV	DN	DV
Intermediate (N=29)	3.92 (.33)	4.01 (.37)	3.41 (.55)	2.96 (.51)
Advanced (N=25)	4.01(.44)	4.1 (.54)	3.52 (.54)	3.25 (.58)
Total	3.96 (.39)	4.05 (.46)	3.46 (.54)	3.09 (.56)

* Numbers in parentheses indicate standard deviation.

FIGURE 6
Average Rating Scores for Each Word Pair by Two Proficiency Groups
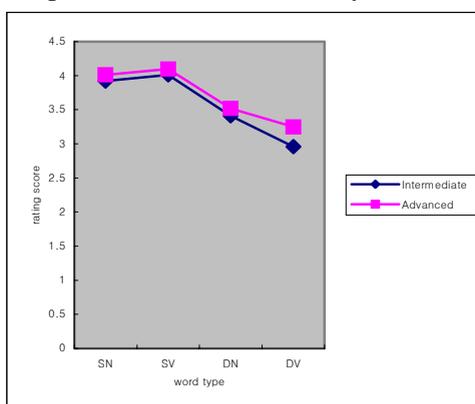
Experiment 1 shows that Korean L2 learners of English provided a significantly higher rating score for the "same translation" pairs than for "different translation" pairs as

predicted by the L1 Lemma Mediation hypothesis. As was predicted from the properties of nouns and verbs, they also provided a higher semantic similarity scores for nouns than for verbs.

Although the findings confirmed the first and the second research hypotheses, the third one, which postulates the differences between proficiency groups, was not confirmed. This lack of difference in performance may be due to the experimental method: because there was no time constraint, the intermediate learners may have had enough time for their translation processes to attain a performance level comparable with that of the advanced-level learners.

The general view of the interpretation of mental lexicon for nonnative speakers includes the assumption that nonnative speakers' rating performance is primarily determined by the retrieval and matching of semantic specifications from L2 lexical entries (cf. Jiang, 2002, p. 625). However, it is possible that the participants in the current study translated the English words into Korean words while performing the task. If two English words were given the same Korean translation (e.g., *country* vs. *nation*), they would receive a higher score. On the other hand, if given the different Korean translation, a lower rating score would be given (*strength* vs. *intensity*). Thus, it is plausible to assume that the rating performance was based on whether the English words activate the same Korean translation or not, and therefore, the decision of semantic relatedness of English words could have made only based on Korean semantic specifications without retrieving from the semantic specifications represented in L2 entries. This problem is dealt with in experiment 2 through the use of an online semantic judgment test.

2. Experiment 2

1) Participants

Twenty seven intermediate-level students and twenty one advanced-level learners who participated in experiment 1 were also used as subjects in experiment 2. The rest were unavailable. Again, each participant was paid a moderate reward after completing all the experiments.

2) Materials

The same stimuli as in experiment 1 were used in experiment 2. In addition to 80 semantically related word pairs (40 same translation set and 40 different translation set), 80 unrelated pairs were constructed for use as distracters in this experiment.

3) Procedure

Experiment 2 was conducted through a self-paced reading test on a laptop computer screen. Test items were presented in the center of the computer screen side by side separated by three spaces. Participants were tested individually and presented with 80 test items and 80 distracters. Participants were asked to determine whether the two words on the screen are related semantically, and to indicate their judgment by pressing one of two buttons on the key board, one for a positive response ("yes" button) and the other for a negative response ("no" button). The duration of time was measured between the appearance of a new item and pressing the response button. Immediately after the response feedback was given on the screen. If the response was correct, "You're correct" sign appeared in the middle of the screen. Otherwise, "You're wrong" appeared. Twenty practice items were given before the test trials. The test program was written and administrated with Superlab Pro program, a psycholinguistic experimental software package. Each subject took about 20 minutes to complete the test.

4) Results and Discussion

In analyzing the results of experiment 2, only related 80 pairs were included, and outliers were treated by the cutoffs established at two standard deviations above or below the mean for each participant. A three-way ANOVA was carried out on means, with group type (intermediate vs. advanced), translation type (same vs. different translation) and category type (noun vs. verb) as variables. The average reaction times from the two groups of participants are presented in Table 3.

TABLE 3
Reaction Times for Each Word Pair by Two Proficiency Groups (millisecond)

|	SN	SV	DN	DV	Total
Intermediate (N=27)	1785 (461)	1760 (392)	1935 (503)	2062 (575)	1885 (482)
Advanced (N=21)	1482 (313)	1448 (274)	1606 (319)	1590 (286)	1531 (298)
Total	1652 (427)	1624 (376)	1791 (458)	1855 (523)	

* Numbers in parentheses indicate standard deviation

The ANOVA produced a main effect of group type. Intermediate-level learners and advanced-level learners averaged 1885ms and 1531ms, respectively to respond. This difference was significant, $F(1, 46)=9.35$, $p < .05$, which means that response was faster as proficiency level increased.

There was also a main effect of translation type. On average, the response to "same translation" pairs (1638ms) was 185ms faster than to "different translation" pairs (1823ms) and the difference was significant, $F (1, 46)=66.432, p < .05$.

There was no significant main effect of category type (i.e., verb vs. noun). Figure 7 shows the information of Table 3 graphically.

FIGURE 7
Reaction Times for Each Word Pair by Two Proficiency Groups (millisecond)
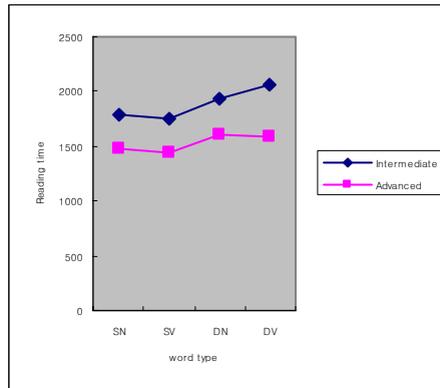
There was an interaction effect between group type and translation type, $F (1, 46)=4.42$, $p < .05$, and between group type and category type, $F (1, 46)=4.24, p < .05$. The interaction effects suggest that the 301ms difference between same- and different translation pairs produced by the intermediate-level learners was significantly greater than the 195ms difference produced by the advanced learners. Again, the 51ms difference between noun and verb pairs produced by the intermediate-level learners was significantly greater than the 25ms difference produced by the advanced-level learners. The greater reaction time differences in translation types and category types suggest that intermediate-level learners responded more slowly than advanced-level learners throughout experiment 2. This contrasts with experiment 1, which showed no group differences in rating scores. I will return to this matter in the next section.

V. DISCUSSION

In this study, L2 word pairs that show comparable semantic relatedness were found to produce differential semantic-relatedness rating scores and reaction times by L2 speakers, depending on whether the words share the same L1 translation or not. I will revisit each research question mentioned above and answer it.

Q 1: Will there be any differences between the "same translation" and the "different translation" pairs in rating scores with respect to the degree of semantic relatedness and in reaction times (RTs) with respect to semantic judgment task?

   The "same translation" pairs showed higher rating scores and faster reaction times than the different translation pairs. Word pairs in both the "same translation" and the "different translation" sets were comparable in their length and frequency of use. More importantly, translation status did not affect the performance by the native speakers in the preliminary study. This means that the differential rating scores and reaction times would not stem from the L2 lexical properties of semantic specifications. Rather, a strong involvement of L1 in lexical processing of L2 can be assumed. Put differently, the findings are compelling evidence for L1 involvement in lexical processing in L2. As L1 Lemma Mediation hypothesis predicts, L2 lexical entries contain the semantic information copied from their L1 translations. If L2 words share the same translation, their lexical entries are also shared and the same semantic content is copied from their L1 equivalent. These word pairs will have the same source of semantic contents and thus, show higher semantic-relatedness scores and faster reaction latencies. On the other hand, when equally related L2 word pairs have different L1 translations, different semantic content is copied into their lexical entries, resulting in lower rating scores and longer reaction times. Therefore, we can conclude that the semantic content, or lemma of L2 lexical entries is copied from their L1 translations and thus, L1 lemma is mediated in L2 use.

Q 2: Will there be any differences in rating scores and RTs in terms of different lexical category? That is, will nouns provide higher rating scores and shorter RTs than verbs?

   Nouns are believed to have clearer referents and to be conceptually simpler and more basic than verbs (e.g., Gentner, 1982). It is hypothesized that the internal lexical organization of verbs is less structured and less predictable than the organization of nouns. This is evident in argument structure for verbs, in which different subcategories of verbs occur with specific subjects or objects (e.g., Pinker, 1989). Thus, nouns were found to present higher rating scores and faster reaction latencies than verbs. One of the reasons is that nouns are structured categories that are stored in richly interconnected networks. The richly structured, hierarchical nature of the internal organization of nouns may result in simpler, more predictable semantic relations than other parts of speech such as verbs and adjectives (Markman, 1989). In contrast, lexical relations for verbs and adjectives may be less structured and less predictable. Verbs may be represented by nonhierarchical dimensions such as change, intentionality, causality and manner (Miller, 1991).
   Although nouns are believed to be easier than verbs, interestingly, nouns were scored

significantly higher than verbs in experiment 1, but not responded to more quickly than verbs in experiment 2 in the current study. That is, the noun/verb distinction was observed in an offline test, but not in an online test. The syntactic component of lemma information seemed to be available in the offline test only, although the semantic component was available in both online and offline tests, as demonstrated by the translation-type difference (i.e., "same translation" pairs were performed better than "different translation" pairs in both tests.) In other words, in the offline test, both semantic and syntactic components were available by learners but only the semantic component was available in the online test. One reason may be that participants could have more time to think about the meaning of the words in the offline test, obtaining enough time to access syntactic component as well as semantic component. In contrast, in the online test, there was not enough time to get access to the syntactic component because of the time limit after the semantic component had been already used.

Put differently, it is possible that the semantic component may be more fully available than the other syntactic component in the lemma level of a lexical entry in second language acquisition. This can be extended to the assumption that the morphological component may not be fully available even though the phonological component is in the same lexeme level. This is often observed in L2 production errors, such as morphological endings (e.g., 3rd singular –s) or regular/irregular verb inflections made even by advanced learners whose pronunciation (phonological performance) sounds irresistibly penetrable. Thus, it is possible to postulate that each internal component in the lexical entry is not simultaneously available according to test type or proficiency level of L2 learners in the process of second language learning.

Q 3: Are there any differences between the intermediate learners and the advanced learners?

A developmental process in L2 acquisition was found, showing different performances in differential proficiency groups. The intermediate-level learners relied more on L1 translation equivalents for L2 words than the advanced-level learners. Although the different performance was observed according to the proficiency levels of learners, there was a significant gap between intermediate-level learners and advanced-level learners in experiment 2 (online), not in experiment 1 (offline). The reason may be due to the characteristics of the experiment itself. In the offline test, when asked to decide the degree of semantic relatedness of a word pair, a participant could have enough time to translate the L2 words into L1 translation equivalents. By so doing, intermediate-level learners might have had sufficient time to rely on their L1 lemma information to retrieve the meaning of L2, thus reducing the potential gap of rating scores against the advanced-level learners. It is in line with this speculation that the online test seems to shed a clearer light on testing the

form-meaning mapping in the development of L2 lexicon.

In general, the results of the analysis taken as a whole are consistent with the three research hypotheses. Two experiments examined whether a L2 word is processed and produced through L1 Lemma Mediation. "Same translation" pairs were resolved faster than "different translation" pairs, which confirms the prediction of the L1 Lemma Mediation hypothesis. Furthermore, nouns were rated higher and processed faster than verbs, suggesting that nouns are more precise and simpler in semantic content than verbs. Proficiency level of learners played a distinguishing role in semantic specification of L2 words in online semantic judgment task, which is also consistent with the research hypothesis.

VI.   PEDAGOGICAL IMPLICATIONS

In this section, I would like to consider the pedagogical implications of lexical development in terms of form and meaning remapping. In presenting a new L2 word to the students, what can be an efficient way and to what extent can the L1 lemma mediation be controlled?

L1 lemma mediation can be prevented by increasing frequency effect of particular words. For example, a L2 learner may map a very frequently exposed word, such as *apple* to the object without resorting to the L1 meaning, while he/she will tend to get its meaning from the L1 meaning for a less frequently exposed word, such as *tandom*. Therefore, L2 words exposed with sufficient frequency can be processed directly without L1 meaning intervening by strengthening the lexical link from L1 to L2 as predicted by the Revised Hierarchical Model (Kroll & Stuart, 1994). As the proficiency level and the frequency of the exposure of L2 learners increases in second language acquisition, the lexical link should be able to get stronger.

In presenting L2 words to Korean students, it is possible that the same translation pairs will be more difficult than different translation pairs because the former shares the same translation in Korean. Then, how can a teacher advise to use one word instead of the other when the two words, used differently depending on different context, have the same translation form? One of the often-used methods by teachers is the contextualized approach (Kyungsook Cho & Krashen, 1994; Day et al., 1991; Watanabe, 1997). This approach aims to demonstrate that vocabulary learning can take place through exposure to context. Vocabulary acquisition can be accomplished through reading and inference of meaning from context. I suggest that extensive reading is a very effective and useful method in L2 vocabulary acquisition, although what the learners should read is very important. Some simplified reading texts, usually known as graded readers may not be proper, because they

are not "authentic"; the process of simplification involves rewriting, elimination of much of the normal syntactic and pragmatic usage of an ordinary text and less frequent vocabulary. Incidental vocabulary learning can occur through extensive reading. For authentic reading materials, I recommend beginning-level native language readers which are compatible with young adults' level of linguistic and cognitive growth (see Rigg, 1991 for an application of this approach to TESOL).

Let me point out a situation where contextualized approach is more meaningful in solving a competition dilemma of words which share the same translation. Imagine that a learner encounters a situation where English words *choice* and *selection* are competing with each other for a description. Since the two words share the same translation in L1, translation does not provide any clue. It is the context including syntactic information which gives her the proper usage between the two words.

However, there is research evidence which may invalidate the contextualized approach. Tudor and Hafiz (1989) set up a 3 month ESL extensive reading program using graded readers. Compared with a control group, the experimental group showed significant improvement in both reading and writing, but the "subjects' vocabulary remained relatively unchanged" (p. 164, cited by Coady). In subsequent study, they also found no significant vocabulary gain in EFL learners. On the other hand, Paribakht and Wesche (1997) showed that with university students, 'reading for meaning only' did result in significant growth in L2 vocabulary. However, direct instruction led to even greater number of words and more depth of knowledge.

Considering the persisting L1 reliance, limited contextualized input, different representation of L2 lexicon according to proficiency, and most of all, the specific situation of English learning and teaching in Korean situation, frequently exposed input seems to suggest a possible solution to maximizing the effect of vocabulary acquisition in a second language.

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