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Korean EFL Learners' L2 Mental Lexicon: Vocabulary Size and Word Association Types*

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This paper examined factors affecting Korean EFL learners' word association types in their L2 mental lexicon. Specifically, vocabulary size of the learners was examined to see if it had any significant relationship with word association types. To this end, experiment procedures that included vocabulary size test and the lexical decision task as well as the word association task were conducted on 40 Korean EFL learners. Reaction time and accuracy of responding to word associations in the lexical decision task were measured. Subsequently, a correlation analysis was conducted with their vocabulary size. Additionally, learners' word association types were analyzed based on the results of word association task. The results showed that Korean EFL learners' vocabulary size had significant correlations with their accuracy in identifying syntagmatic and paradigmatic associations, but not in the phonological association. However, their accuracy was not correlated with reaction times. The results indicate that L2 learners' mental lexicon is partially dependent on their vocabulary size of the target language, and it is variable depending on word association types.

Key words: mental lexicon, vocabulary size, word association, Korean EFL learners

1. INTRODUCTION

Vocabulary has always received much attention by L2 learners and teachers alike, and thus led to an ample number of studies examining how L2 learners acquire their words

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(Nation, 2001). Meara (2009) and Meara and Wolter (2004) claimed vocabulary size, organization and accessibility are three dimensions of vocabulary knowledge. Vocabulary size refers to how many words that learners know and is also referred to as vocabulary breadth (Daller, Milton & Treffers-Daller, 2007). Vocabulary organization is similar to the concept of depth of vocabulary knowledge (Henriksen, 1999) and refers to how the words that learners know are linked to each other in their mental lexicon. According to Carroll (2010), a mental lexicon is the representation of words in permanent memory. The vocabulary accessibility is concerned with how easily and automatically learners access and process vocabulary.

Compared to other aspects of vocabulary knowledge, vocabulary organization has only begun to receive attention in recent studies of the mental lexicon (Takac, 2008). Yet, it is only in recent decades that researchers have started to investigate how the words are represented in mental lexicon (Lee, 2011), especially in L2. In fact, we have been witnessing the growth of research concerning the mental lexicon of L2 learners over the years (Greidanus & Nienhuis, 2001; Jiang, 2002, 2004; Li, 2011; Meara, 2018). Persisting questions have been investigated regarding the basic properties of the representations of L2 mental lexicon.

Previous studies on L1 mental lexicon have attested that when activating the words that are represented in the lexicon, all properties including but not limited to phonological, morphological, syntactical as well semantic information would be made accessible. What would be an important inclusion at this stage would be various associations with other words. Once a word is retrieved successfully, the access to all words that have associations with it in any way would be accelerated (Fitzpatrick & Izura, 2011).

One of the most widely used methods in measuring the representations of the mental lexicon has been word association task (WAT). The method devised in the early 20th century has continued to be used widely to investigate L1 mental lexicon in recent studies (Fitzpatrick, 2007). In this task, language users would first be presented with a priming word, and then required to produce one word immediately after the presentation. The basic tenet of this would be that language users' production of a word followed by the presentation of a prime word would reveal how the words are organized in one's mental lexicon. The associations that were observed in WAT were generally divided into three types. According to Chad (2011), the categories indicated that mental lexicon is composed of syntagmatic, paradigmatic and phonological associations among words.

Recently, there has been a number of L2 studies have investigated the role of word associations in examining the mental lexicon (Jiang, 2002; Lee, 2011, 2016). However, few studies exist which have dealt with L2 learners with different vocabulary size. Indeed, Meara and Wolter (2004) claimed that vocabulary size and organization are the

two most important features in investigating L2 mental lexicon. Thus, the present paper will focus on the relationship between L2 learner's vocabulary size and word associations in L2 mental lexicon. In addition to WAT, lexical decision task (LDT) was also employed to provide a complementary look at forced choices of word association.

2. LITERATURE REVIEW

Although word associations in L2 mental lexicon are invisible, previous studies have tried to represent them by using various methods. Early studies during the 20th century mostly employed WAT, which was first invented and used during the 19th century to diagnose mental diseases. Later, it has been used to explore the mental lexicon. In this task, participants were told to write or speak a word immediately after they saw or heard the given word. The relationship between the stimuli and the reaction words were analyzed. Many previous studies using this method have come up with the reactions that can be categorized into taxonomic relations such as coordinate, hypernym, and hyponym. For instance, when the prime word of 'chair' was presented to the participants, a vast majority of the participants responded 'table' since 'chair' and 'table' are in coordinate relationship; 'furniture' for this is in hypernym relationship; 'rocking chair' for being in a hyponym relationship, etc (Kent & Rosanoff, 1910, as cited in Carroll, 2010). So far, this has been the most widely used approach as evidenced in many related experiments (Miller, 1999).

Results from most WAT studies have found that there are four categories of word associations in general: syntagmatic, paradigmatic, phonological and non-related. Syntagmatic associations indicate words with a sequential association to a stimulus or primed word, and often result in left-to-right relationship in most languages (Schmitt, 2000). In a sense, they illustrate collocational representations. Collocations may often be explained as grammatical co-occurrences (McCarthy, 1990). Paradigmatic associations can range from general associations such as synonymy, antonymy, hyponymy, etc. Lastly, phonological associations need to be mentioned since words can also be stored and accessed according to phonological as well as orthographical similarities (Aitchison, 2003). Meara (2009) points out that words such as 'coat' and 'boat' may be closely associated in any English speakers' mental lexicon. Finally, there could be no explainable reason as to why some words are stored and accessed with certain associations; it could be due to a personal experience and strictly remain exclusive to a certain individual or could be due to an erratic reason (Fitzpatrick, 2007).

Results from the studies that have investigated word associations in L2 learners are rather inconsistent. For instance, Meara and Wolter (2004) found out that L2 learners

produced less regular responses compared to native speakers. The study also showed that L2 learners produced definitely more erratic or non-related associations. Meara (2009) further went on to show that L2 word-association develops in a linear fashion, with more advanced learners showing more native-like word association than lower level learners. However, McCarthy (1990) claims otherwise in that word associations based on syntagmatic, paradigmatic, and phonological associations are not dependent on proficiency levels of L2 learners.

So far, results from the WAT remain inconclusive as to L2 learners. In line with this, Aitchison (2003) pointed out some problems with WAT. For instance, learners have to think of immediate reactions only when a single prime word is presented to them. The very presence of prime word is far from reflecting the natural processing of mental lexicon. More importantly, WAT does not allow us to look into an entire picture of mental lexicon because it does show what L2 learners do not know. For instance, even when an L2 learner produced a paradigmatically associated word as a reaction to the primed word, we cannot preclude whether this person does not know syntagmatic or phonologically related words as well.

In ways to complement such problems, more recent studies have employed LDT, where learners are forced to make decisions whether a certain pair of words have word associations. In doing so, both accuracy and reaction time (RT) are measured. In Lee's (2016) experiment, participants' RT was recorded in determining whether the strings of letters were words. The result of the LDT showed that participants responded more quickly when the priming word was semantically related to the target, and slowly when there was no semantic relation between the two.

In a study that compared the difference between L1 and L2 mental lexicon, Li (2011) performed WAT on English native speakers and Chinese EFL learners respectively and analyzed their reactions. The result showed that native speakers' reactions presented more syntagmatic and paradigmatic associations with the stimulus while EFL learners showed more phonological and erratic associations. However, Fitzpatrick (2007) addressed that L1 and L2 reactions were not comparable because native speakers' word association patterns were always consistent unlike those of L2 learners.

In the present study, to complement the problems discussed above, both LDT and WAT were employed to Korean EFL learners in order to more accurately examine their L2 mental lexicon. Many previous studies have attested that L2 learners are different from native speakers because of their preexisting language experience (Singleton, 1999). It is often the case that they bring in their L1 experience when processing L2. Previous studies on the role of L1 in L2 use have attested that the level of L2 proficiency may exert differences in L1 transfer. Thus, it may be the case that Korean EFL learners with differing vocabulary size in English may show differences in their L2 mental lexicon.

Thus, two EFL groups with different vocabulary size in their L2 were examined in this study. To this end, the following research questions were investigated:

1. Would Korean EFL learners' mental lexicon as measured by LDT be related to their overall vocabulary size in the target language?
2. Would Korean EFL leaners' mental lexicon as measured by WAT be related to their overall vocabulary size in the target language?
3. What are the similarities and differences in the results of LDT and WAT?

Based on the previous studies that differentially treated receptive and productive vocabularies, it is presumed that WAT will measure productive part of the mental lexicon whereas LDT measures its receptive counterpart.

3. METHOD

3.1. Participants

Forty Korean native speakers whose L2 proficiency ranged from low to intermediate were recruited in this study. They were recruited through SNS or contacted by intermediaries. There were 23 females and 17 males. The average age was 23.1 (SD = 2.22). They were in various majors attending three different universities in Korea, but none of them were in language-related majors. Language-related majors were avoided due to the consideration that they could be more sensitive to language than the average population. Most students began learning English as their foreign language since the third grade of elementary school, so it was assumed that the participants had a similar length of English education. Each participant was given a monetary reward for their participation.

3.2. Materials

3.2.1. Vocabulary size test

The vocabulary size test was composed of two parts, in a paper-and-pencil format. The first part was taken from Nation and Beglar (2007), and had 80 multiple choice questions into Korean version. To complement the nature of the multiple choice questions, a second part of the vocabulary test was devised to ask the participants to translate additional 80 English words into their L1, chosen from the 8,000-word families

in the British National Corpus (BNC) and the Corpus of Contemporary American English (COCA) headword list. This was based on Nation's (2012) assertion that vocabulary size around 8,000-word families constitutes a critical goal for EFL learners in understanding authentic written and spoken texts such as newspapers.

3.2.2. Lexical decision task (LDT)

Korean EFL learners participated in LDT in order to examine their word association types measured by the two consecutively presented words. In the mental lexicon, if a part of collocation is stored in ways that are strongly associated with the other, then the reaction time is expected to be shorter. The LDT in this study was measured by a program of PsychoPy version 1.90 (2018). There were 90 pair items created in three conditions: collocation, non-collocation, a combination of words and non-words (fillers). The initial word of each collocation acted as the prime. For example, 'feel' is the prime for 'pain' (target word). The same prime is used to coin the non-collocation, e.g., 'feel-drug' and the pair of words with non-word, e.g., 'feel-gwane'. The list of the experimental items is presented in Appendix A. To counterbalance, 90 students (45 with high exposure and 45 with low exposure) were divided into three groups to use different set of experimental items, namely group A, B, and C. Each group contained 30 participants, 15 students with high vocabulary size and the other 15 with low vocabulary size.

3.2.3. Word association task (WAT)

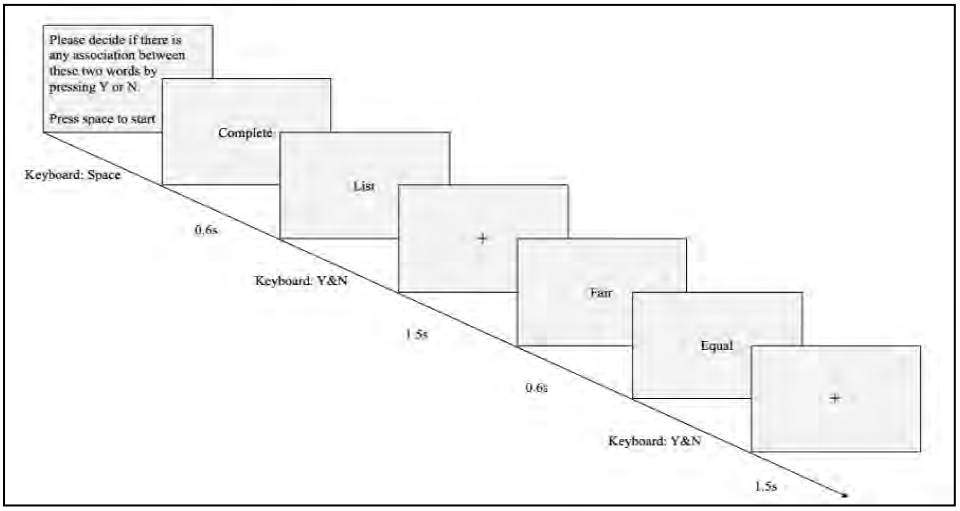
The WAT was a paper-and-pencil test conducted to investigate the organization of the L2 mental lexicon. The cue words used in this study include 30 verbs and 30 nouns used in the LDT so that the reactions in the WAT could be compared with the LDT (see Appendix B). The participants were presented with a single cue word at a time. After they saw the cue word, they were asked to write the first English word coming to their minds in the reaction sheet. The reaction of WAT is open-ended because it activates a complex association of words. The assumption is that the responded words are stored closely with the cue words in the participants' mental lexicon. The relationship between the reactions and the cue words can be identified as having a meaning-based association, position-based association, form-based association, or erratic association (Fitzpatrick, 2007).

3.3. Procedure

Participants were instructed to finish the vocabulary size test and LDT, where they had to determine if two words that were presented in sequence on the screen have any relations by pressing Y(yes) or N(no) buttons. The vocabulary size test was in a paper-and-pencil test format. LDT measuring both accuracy and reaction time (RT) was performed on the laptop individually. Each prime was sequentially presented with either one of the four targets which had syntagmatic, paradigmatic, phonological and no association respectively with it. In total, 18 prime words and 72 target words were prepared in this study. After they made their decisions for one pair, + mark was shown for 1.5s for rest and reducing the influence of the previous word pair on the next one. Two words as a new pair would be presented following the + mark and other word pairs would be presented in the same way until all word pairs were finished. The schematic diagram of how the program processes went is illustrated in Figure 1 below.

FIGURE 1

Procedures in Lexical Decision Task



Following the instruction, the participants performed eight practice pairs before beginning the actual task. In total, 72 pairs were randomly presented on the computer screen in the LDT. Their choices and reaction time were recorded as files in the computer automatically as soon as they finished the task. The LDT took approximately five minutes for every participant.

In the WAT, an additional 18 English words that had not been used in the vocabulary size test and the LDT were presented to the participants. Once the words were presented, the participants were asked to write the first English word that came up to their minds as

soon as they saw. The task took approximately five minutes to finish. The words that were written as reactions by participants in WAT were categorized into different word association types according to the association that was revealed between the given and reaction words.

Following the vocabulary size test, the LDT and the WAT, the last step of the procedure was lexical knowledge test. Participants were provided with a list of words from the LDT and the WAT and asked to choose the ones they did not know the meaning for. Since participants' decisions on unfamiliar words could not reveal their knowledge on word association in L2 mental lexicon and their reaction time to those words may have taken to consider the meanings instead of word association, the data of those words were removed from the analysis to ascertain reliable results.

4. RESULTS

4.1. Vocabulary Size Test Results

First, participants' results were graded following the answers from Nation and Beglar (2007). Secondly, in grading the second part of the vocabulary size test, where learners had to provide answers to the given words regarding their meanings, only the direct translations of the given English words were counted as correct answers. The following table illustrates the results.

TABLE 1

Results of Vocabulary Size Test

Overall	Vocab Size Test 1		Vocab Size Test 2		Range
Total Mean	Mean	*SD*	Mean	*SD*	38-116
82.53	49.43	10.56	33.1	12.36	

Overall, learners performed higher on multiple choice questions of vocabulary size test 1 than on test 2 where the production skills were being measured by writing down the translation in L1. Standard deviations are relatively higher with test 2, indicating that more individual differences were examined in a test where productive skill is measured.

4.2. LDT Results

Table 2 shows the participants' accuracy and RT. In the analysis, RTs plus or minus above two standard deviations were excluded. Consequently, 2757 reactions were

analyzed out of 2880 reactions. Overall, the RTs with only accurate responses (ACC) were included. Then, to see if incorrect reactions changed the overall mean of RTs, overall RTs were measured. As shown in Table 2, the accuracy in identifying syntagmatic, paradigmatic and phonological associations increased simultaneously as the RT decreased. The trend was identical in both accurate and overall reactions. The results indicated that the largest difference between the overall and accurate was observed in the phonological association (1.078 ms. vs. 1.023 ms.). That is, learners' RT slowed down most when they had encountered words that they were unsure of in case of phonological associations.

TABLE 2

Mean Accuracy and RT in LDT

	Syntagmatic		Paradigmatic		Phonological		Nonrelated	
	RT	ACC	RT	ACC	RT	ACC	RT	ACC
Accurate Response	1.196	100%	1.052	100%	1.023	100%	1.115	100%
Overall Response	1.220	58.74% (382/ 652)	1.092	82.0% (546/ 666)	1.078	43.17% (272/ 630)	1.129	43.17% (272/ 630)

Note. RT in millisecond (ms.)

As was shown in section 4.1, the total accuracy of the vocabulary size test was 82.53. To see whether the participants' vocabulary size correlated with the accuracy of four different association types, a correlation analysis was conducted. The results indicated that the participants' vocabulary size was significantly correlated with syntagmatic and paradigmatic associations, but not with the phonological association. That is, participants with larger vocabulary sizes showed more syntagmatic and paradigmatic association in their L2 mental lexicon. However, those with larger vocabulary sizes did not seem to illustrate more phonological association in their L2 mental lexicon. Table 3 shows the result.

TABLE 3

Correlations Between Vocabulary Size and Accuracy in LDT

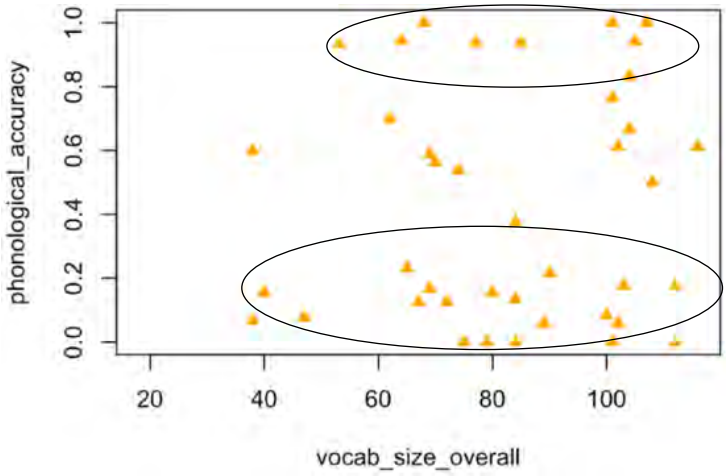
	Syntagmatic Accuracy	Paradigmatic Accuracy	Phonological Accuracy
Vocabulary Size	.562**	.495**	.172

** Correlation is significant at the 0.01 level (2-tailed).

In line with the above results, we can find that different patterns exist regarding syntagmatic and paradigmatic accuracy. Figure 2 illustrates the scatterplot of the correlation between vocabulary size and phonological accuracy. Although it does not

manifest a clear correlation, the pattern is that a predominant number of learners manifested either high or low phonological association. Thus, unlike syntagmatic or paradigmatic associations, it seems likely that while some participants have either formed phonological associations, there are others who clearly have no phonological association in their mental lexicon regardless of their vocabulary size.

FIGURE 2
Vocabulary Size and Accuracy, Phonological Association



Regarding the reaction times of the participants, their average reaction times in correctly identifying word association types were analyzed and then compared to their accuracy to find out the relationship between the vocabulary size and reaction times. The results of vocabulary size test and reaction time in LDT from the two groups were taken into Pearson correlation analysis. The result is shown in Table 4.

TABLE 4
Correlation Between Vocabulary Size and Reaction Time in LDT

	Syntagmatic	Paradigmatic	Phonological	Non-related
Vocabulary size	-0.02	0.14	-0.02	0.05

The results indicate that no significant correlations exist with vocabulary size and reaction times of syntagmatic, paradigmatic and phonological associations. That is, learners with larger vocabulary sizes did not necessarily exhibit shorter reaction times in any of the three association types. The result of the reaction time is in contrast with the

result of the accuracy with the syntagmatic and paradigmatic associations. It seems that although learners with larger vocabulary sizes showed more accurate syntagmatic and paradigmatic associations, their accuracy did not show faster access to these associations.

4.3. WAT Results

Participants were asked to write the first word that came into their mind as a response to 18 stimuli words in WAT. The expected numbers of response words were 720 (18*40), but 50 blanks were left by participants. Consequently, a total of 670 responses were produced from 40 participants.

According to the results, a total of 49 words were chosen as unfamiliar words. As responses to those unfamiliar stimuli words, 20 out of the 49 stimuli did not yield any answers. The rest of the 29 out of the 49 did produce responses. However, these were not taken into account in the analysis since the participants responded to their unfamiliarity in the lexical knowledge test.

The participants produced 21 words with wrong spellings respectively. Two out of these were responded to be participants' unfamiliar stimuli and were removed first. Words with spelling errors were considered identifiable if there were only one or two letters were misspelled and only one intended word could be assumed. Accordingly, 14 out of 19 responses with spelling errors that were produced were successfully identified. The rest of the 5 out of 19 wrong-spelling responses were excluded from the analysis. In total, 636 valid responses out of 720 possible ones were taken into the final analysis.

Valid response words in WAT were divided into different categories according to the association types between stimuli and response words. The classifications of responses in the present study were made in reference to Fitzpatrick (2007) with some revisions. Association types were divided into four types of syntagmatic, paradigmatic, phonological, and non-related.

The syntagmatic association was mainly constituted of consecutive collocation, which meant two words were used frequently together in contexts, such as 'read' and 'book'. Three subcategories of synonym, antonym, and contexts related were included in paradigmatic association. Response words in the synonym subcategory had the same meaning with stimuli directly or in some specific contexts, such as 'autumn' and 'fall', 'combine' and 'mix'. Meanings of responses in antonym subcategory were directly opposite to the stimuli words or in the same specific contexts, such as 'dirty' and 'clean', 'silent' and 'noisy'. Context-related indicates that response and stimuli words can be coordinates, subordinates, and superordinates. For example, the response word 'topic' to stimuli 'article' can be divided into context-related since 'topic' is a part of 'article'.

The phonological association consisted of two subcategories. Response words similar in sounds or spellings but not in meaning with stimuli were classified into a subcategory of phonological association, such as ‘cake’ and ‘lake’, ‘code’ and ‘cold’. Additionally, response words that had the same roots with stimuli but different in affix were also included in the subcategory of phonological response association, such as response ‘combination’ to stimuli ‘combine’. The last type was no association, which did not belong to any of the above three relations between stimuli and responses, such as ‘liquid’ and ‘square’. Classifications of responses are presented in Table 5.

TABLE 5

Classification of Responses, WAT

Category	Subcategory	Definition	Example
Syntagmatic Association	Consecutive collocation xy/yx	y follows x or precedes x directly	read-book
Paradigmatic Association	Synonym	x means the same as y or in some specific contexts	autumn-fall
	Antonym	x means the opposite as y or in some specific contexts	dirty-clean
	Context related	x and y have taxonomic and attributive relations, such as coordinates, subordinates, and superordinates	topic-article
Phonological Association	Similar form not meaning	y looks or sounds similar to x but has no meaning link	cake-lake
	Morpho-phonology	y is x plus or minus affix	silent-silence
Non-related	No link in aspects above	y has no decipherable link to x	liquid-square

Some response words had two kinds of association with stimuli words simultaneously. For example, response ‘cream’ to stimuli word ‘cake’ can be classified into categories of syntagmatic and paradigmatic association, since the two can be used consecutively as ‘cream cake’ and also belong to the food category. Additionally, the response ‘pack’ to stimuli ‘back’ can be categorized into syntagmatic and phonological association categories due to a compound word ‘backpack’ and also form a minimal pair as well. Response ‘encode’ to stimuli ‘code’ shows paradigmatic and phonological association. They are synonyms and also share a stem with either a presence or absence of an affix.

In the data, 33 responses had syntagmatic and paradigmatic associations with stimuli words. Responses that had both paradigmatic and phonological associations were 8, and the ones showing syntagmatic and phonological associations 3. These 44 responses were counted in both categories.

According to the classifications of responses, the results of both groups in WAT are presented in Table 6. As shown, 211 out of 680 responses have a syntagmatic association, 318 out of 680 responses have a paradigmatic association, 61 out of 680 reactions have a phonological association and 90 out of 680 reactions have no association with stimuli words.

TABLE 6

Number of Responses in Each Word Association Category

Category	Number	%
Syntagmatic	211	31%
Consecutive collocation		
Paradigmatic	318	47%
Synonym	80	
Antonym	66	
Context related	172	
Phonological	61	9%
Similar form not meaning	47	
Morpho-phonology	14	
Non-related	90	13%
Total	680	100%

4.4. Correlation Between Accuracy in LDT and WAT Results

A significant correlation was found between the Korean group's accuracy in identifying syntagmatic association (e.g., LDT) and in producing the number of syntagmatically-related words (e.g., WAT). Similarly, this significant correlation also existed between accuracy in identifying paradigmatic association and the number of paradigmatically-related words. The result is in Table 7.

TABLE 7

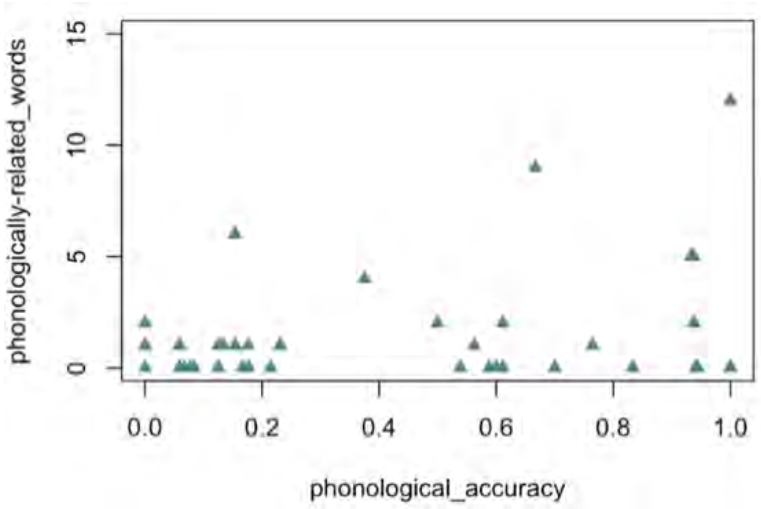
Correlation Between LDT and WAT

		WAT			
		Syntagmatic	Paradigmatic	Phonological	No relations
LDT	Syntagmatic	0.34*			
	Paradigmatic		0.39*		
	Phonological			0.27	
	Non-related				0.05

From Table 7, no correlation was found between accuracy in identifying phonological association and the number of phonologically-related words that they produced. However, there are a few with high accuracy in identifying phonological association produced slightly more phonologically-related words in WAT, as is illustrated in Figure 3.

As with the results of LDT and WAT, individual variation exists in the phonological association.

FIGURE 3
Correlation Between LDT and WAT, Phonological



In general, learners who show more accurate results with LDT in syntagmatic and paradigmatic associations tend to show higher accuracy in WAT. Learners who can better perceive syntagmatic and paradigmatic associations tended to better produce words with syntagmatic and paradigmatic associations respectively. However, in the case with phonological association, learners with higher accuracy in LDT did not necessarily show higher accuracy in WAT. It seems that perceiving phonological association is not related to having to produce phonologically related words. What is consistent throughout the study is that phonological association shows patterns that are distinct from both syntagmatic and paradigmatic associations

5. DISCUSSION AND CONCLUSION

The present study investigated the L2 mental lexicon of Korean EFL learners with different levels of proficiency by using two psycholinguistics tasks of LDT and WAT. The findings from the LDT illustrated that participants with larger vocabulary size were more accurate in identifying and retrieving syntagmatically and paradigmatically-

associated words. The same correlation was not found with phonologically-associated words. Additionally, the correlation was not found with RT.

The findings suggest that those who have larger vocabulary size may have stored words that often co-occur (e.g., *read-book*) closely in the mental lexicon, or with meaning-based relations. The frequent exposure may be responsible for their larger vocabulary sizes, and thus led to more accurate access. The results of the WAT also implicated that words are stored in the mental lexicon with certain types of associations. We have seen that the predominant number of associations is meaning-based, followed by collocational ones. L2 learners are more likely to store synonyms and antonyms and other meaning-related words closely together (e.g. *gift-present*). As was evidenced by the absence of correlation in RT, the findings suggest that EFL leaners' vocabulary size is not related to speed. That is, higher vocabulary size does not entail faster access. The opposite also stands, in that lower vocabulary size is not necessarily linked to slower access. This may entail that regardless of their vocabulary size, automaticity in access often seen in L1 speakers is not observed in the EFL learners in the present study.

Especially in Korean EFL settings, a vocabulary size is often taken as an index of English proficiency, not only by students but by teachers and ELT practitioners alike. However, the present study has shown that larger vocabulary size may not always coincide with better L2 mental lexicon, especially when it comes to the speed of access. Also, although Korean EFL learners in this study showed an overall correlation of vocabulary size and with syntagmatic and paradigmatic relations, a closer look at each participant revealed that there were approximately 30% of the participants whose vocabulary size indicated higher syntagmatic associations but not paradigmatic or vice versa. Overall, the RT did remain consistently significant with their overall vocabulary size. Those who responded faster to syntagmatic, paradigmatic and phonological associations were showed larger vocabulary size.

We may infer that with the development of vocabulary size, the speed of lexical access can be accelerated, even when accuracy is not increased. Finally, participants showed different patterns of accuracy and RT albeit its lack of correlation. For example, RT to the syntagmatic association was the slowest, but not with the highest accuracy; paradigmatic associations had the highest accuracy, but its RT was not the fastest. Thus, the access to the three types of word associations was different, indicating that syntagmatic, paradigmatic and phonological knowledge shows variability and may be dissociated from one another.

The findings of this study partially support the claim made by Hoey (2005). The argument was that words that are used in collocation tend to be stored in the mental lexicon in close proximity and connected via either syntagmatic or paradigmatic links. However, we have seen that the results pointed to the fact that L2 mental lexicon prefers

paradigmatic associations over syntagmatic associations. This raises the possibility that L2 mental lexicon is preferably sematic-oriented rather than syntactic-oriented. L2 learners tend to store things according to the semantic relations of the words. When presented with new words, L2 learners may look for similarities, contrasts, etc. with the meanings of their preexisting L2 words. Yet, syntagmatic associations still exert some meaningful influence in their mental lexicon.

Phonological association acts differently from both syntagmatic and paradigmatic associations, in that there may be learners who indeed show phonological associations in their L2 mental lexicon regardless of their vocabulary size. On the contrary, there are those who do not show any inclination towards phonological association yet exhibit a relative larger vocabulary size. It is noteworthy that the presence or absence of phonological association does not significantly correlate with their vocabulary size. By far, phonological association, compared to two other associations remains most variable.

The implications are twofold here. First, at least some learners are capable of increasing their vocabulary size independent of their phonological association. On the contrary, others may not always pay attention to the phonological association, either implicitly or explicitly, yet are able to increase their L2 vocabulary size. Second, this implicates that phonological knowledge may be independent of other linguistic knowledge such as syntactic or lexical knowledge. Whether different sets of linguistic knowledge work independently of one another or whether they feed onto one another to form a multitude of complex language knowledge has always intrigued psycholinguists (Marslen-Wilson, 1984; Marslen-Wilson & Tyler, 1980; Taft, 1991). The results of the present study indicate that there is at least some level of independence when it comes to phonological knowledge of L2 learners.

Additionally, the results from the WAT clearly indicate that L2 learners with larger vocabulary sizes show a tendency to access their L2 mental lexicon in ways that are different from those with smaller vocabulary sizes. We have seen that there is less consistency when it comes to lower proficiency level learners' L2 mental lexicon. Learners with lower proficiency may not always lag behind high level learners in their WAT, but they tend to be inconsistent in their performance throughout. The finding partially supports the previous study on L2 in that learners do indeed show inconsistency in their mental lexicon when compared to native speakers (Zareva, 2007).

Based on the above findings, we can construe that language experience, provided that it leads to a larger vocabulary size, plays a crucial role in affecting L2 mental lexicon at least with forming syntagmatic and paradigmatic associations. It implicates that additional input hours may be needed to L2 learners in and out of their classrooms, and an increased amount of input certainly will allow them to improve their mental lexicon

both for storage and access. Whether language experience will lead to larger vocabulary size is the scope of another research.

The present study may provide some pedagogical implications. At least when it comes to Korean EFL learners, we have seen that their phonological association in L2 mental lexicon exists differently from their syntagmatic as well as paradigmatic associations. EFL teachers and learners need to be aware that special attention needs to be given to Korean EFL learners' acquisition of phonological knowledge. A simple increase in the amount of implicit input may not necessarily lead to an increase in phonological knowledge, and explicit feedback may be necessary.

It is unclear as to the cause of the difference between learners in phonological knowledge. It could be due to the learning environment of Korean EFL learners where a predominant focus is put on written input, especially in adult learning situations. Otherwise, it could very well be due to the fact that phonological features of English and Korean are vastly different. Future studies that compare Korean learners who have learned English in classrooms vs. natural settings, as well as studies that compare learners with different L1s could provide further insights.

In relation to this, the limitations of the present study should be noted. The present study dealt with only Korean L2 learners in EFL settings. It is questionable whether learners with different L1 background, possibly with a typologically and phonologically different language from Korean would shed some light on the role of L1, what could be one of the most compelling factors in L2 mental lexicon. Additionally, in the present study, the categorization of reactions produced by L2 learners in the WAT has shown at least some level of ambiguity. The study followed the format from Fitzpatrick (2007), yet some responses could be classified as having an either paradigmatic or syntagmatic relationships (e.g., *telephone-call*). Thus, the classification or reactions in WAT needs to be reconsidered, since there is much ambiguity in its categories.

Lastly, although the present study measured the vocabulary size of the participants through two different types of tasks, there is a need for assessing learners' overall proficiency in the target language. It is because one's vocabulary size may not always coincide with their overall proficiency in the language. Although the present study tried to complement the problem by including two different types of vocabulary size test, multiple-choice questions followed by translating the meaning type of questions, it is still questionable as to whether those who know more meaning of vocabulary is also more proficient in other aspects of linguistic knowledge. Future studies need to address these limitations by including a more comprehensive proficiency test, as well as participants with different L1 backgrounds.

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APPENDIX A

List of Word Pairs in LDT

bottle			
empty	Container	bottom	father
bag			
plastic	backpack	bat	post

mountain			
rocky	hill	fountain	ball
work			
hard	job	word	tooth
sense			
humor	Feel	tense	river
group			
members	Class	ground	hand
crazy			
driving	Mad	lazy	extra
silly			
sounds	Stupid	daily	teach
normal			
life	natural	formal	happy
large			
number	big	charge	yellow
kind			
of	Friendly	mind	total
obvious			
reasons	Clear	envious	West`
move			
forward	Act	love	trust
agree			
strongly	Admit	degree	flower
arrive			
early	Reach	drive	sure
make			
money	Produce	fake	raise
understand			
why	know	underwear	stay
talk			
about	speak	tall	fix

Note. Actual choices were provided in a randomized order in LDT

APPENDIX B

List of Stimuli in WAT

back	article	code	autumn	borrow	delay
cake	brain	fiction	climb	combine	liquid
dirty	electric	silent	soft	native	obtain

Applicable levels: Tertiary, secondary

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