Effects of Involvement Load of the Task on Japanese EFL Learners' Lexical Network Changes

Noriko Aotani, Tokai Gakuen University, Japan
Shin'ya Takahashi, Tokai Gakuen University, Japan

The Southeast Asian Conference on Education 2023
Official Conference Proceedings

Abstract
This study investigated the effects of task-induced involvement load (the Involvement Load Hypothesis; Laufer & Hulstijn, 2001), *Search* and *Evaluation* in particular, in an extensive reading on a change of lexical network perceived by EFL learners. Fifteen words from a reading material were chosen as target words. Ninety-five Japanese university students were divided into four groups resulting from a multiplication of *Search* (+/-) and *Evaluation* (+/-). *Evaluation* (+) groups were assigned a partial translation task of the passage. *Evaluation* (-) groups were assigned multiple-choice questions about its contents. *Search* (+) groups were allowed to use dictionaries, whereas *Search* (-) groups were not. Participants judged a perceived relation between target words three times, a week before the task, immediately after the task, and three weeks after the task. The results showed that differences of involvement index among the four groups did not affect the perceived relation among target words, though the effect of extensive reading itself (with any accompanying task) was confirmed. Data was also analyzed and visualized by Gephi, a data-visualization platform, to show how participant's lexical network changed through the three tests. As a result, some qualitative features of individual's network change were revealed, which shows the importance of investigating individual differences as well as group data. The present findings raised new research questions; if the task-induced involvement load does not work for the lexical network change of already-known words, and if there are any involvement components other than *Need*, *Search*, and *Evaluation* to be considered.

Keywords: Extensive Reading, Japanese EFL Learner, Lexical Network Change, Task-Induced Involvement Load

Introduction

There has been much debate about the extent to which extensive reading can contribute to vocabulary acquisition. Krashen (1989), in support of his Input Hypothesis, proposed that extensive reading is sufficient for vocabulary acquisition in the target language, and many studies have been conducted regarding incidental vocabulary learning through extensive reading using a variety of methods. While most of these studies have focused mainly on acquisition of new vocabulary, Horst et al. (1998) argued that extensive reading only plays a limited role in vocabulary acquisition, especially for beginning learners of a second language, but it can increase the knowledge of known vocabulary to build word-to-word networks. Waring & Takaki (2003) stated that editors of graded readers should not be too concerned only with how new vocabulary should be introduced, but should take care to provide a variety of collocation information for previously learned words.

Questions on how we store vocabulary in our mind have also been attracting many researchers in the field of vocabulary acquisition. The conceptual model of the mental lexicon as having a network structure is widely accepted (e.g., Aitchison, 1994). This conceptual model of the mental lexicon is inspired by the fact that our brain is, in fact, composed of a neural network structure, with each lexical item (node) metaphorically mapping a neuron and the links connecting items metaphorically mapping synapses. The increase in vocabulary corresponds to an increase in the number of nodes, and the increase in knowledge of each word corresponds to a creation of new links with other nodes, giving the model a reality of such a phenomenon actually occurring in our brain. In fact, there has been much effort to use such network metaphors for acquiring and retaining semantically related words. However, in many cases, this association is theoretically derived, and there has been little empirical data on how target language users actually associate these words (Wilks & Meara, 2002).

We have been analyzing lexical data from learners using the Asymmetric von Mises Scaling (AMISESCAL; Shojima, 2011, 2012), which enables visualization of network structure, and have accumulated empirical data on how extensive reading deepens and expands the lexical network structure of Japanese learners of English (Aotani et al., 2016, Aotani & Takahashi, 2021). Through the visualization process, we have found that the depth of cognitive processing (processing level) induced by the task assigned to learners with extensive reading is related to the reconstruction of the lexical network structure. The Level of Processing Theory was proposed by Craik & Lockhart (1972), which asserts that the depth of processing of a memorized item influences its retrieval performance. The Involvement Load Hypothesis by Laufer & Hulstijn (2001), which applied the Craik & Lockhart's theory, proposes a measure that predicts the effect of task-induced incidental vocabulary learning due to extensive reading. Although many studies have tested this hypothesis, most have focused primarily on the rate of retention of new words, not the lexical network change of learned words.

In our latest study (Aotani & Takahashi, 2022), we have applied the involvement index proposed by Laufer & Hulstijn (2001), *Need, Search, Evaluation,* to investigate the effects of task-induced involvement load in an extensive reading on a change of the lexical relation that EFL learners perceive. We, however, could not find enough empirical evidence to clarify if different levels of task load result in the difference in the growth of lexical network. Therefore, in the present study, we have made some improvements in the experimental design, increased a number of target words, and employed a data-visualizing tool Gephi, instead of AMISESCAL, to examine participant's lexical network more dynamically.

Methods

Participants

Ninety-five Japanese university students (55 males and 40 females, mean age: 20.0 years old, mean TOEIC score: 377.8) were randomly divided into four groups as shown in Table 1.

Group	*Need*	*Search*	*Evaluation*	Number (M / F)	TOEIC (SD)
MCQ-	+	-	-	23 (16 / 7)	381.7 (67.7)
MCQ+	+	+	-	24 (16 / 8)	381.5 (77.6)
TR-	+	-	+	24 (12 / 12)	369.9 (93.6)
TR+	+	+	+	24 (11 / 13)	378.5 (94.0)

Table 1: Task-induced involvement load and participants in four groups.

Materials

Fifteen target words (*available*, *charge*, *commercial*, *container*, *delivery*, *follow*, *gift*, *include*, *obtain*, *personal*, *send*, *service*, *standard*, *track*, *urgent*) were chosen from a reading material (word types 152, word tokens 306) about the mailing system in India.

Procedure

The experiment consisted of three parts.

Part I: All participants did the lexical relation test (LRT). They were instructed to judge a perceived relation between two target words (105 pairs resulted from a combination of 15 words) on a 4-point scale (0: not related at all, 1: not related strongly, 2: slightly related, 3: strongly related).

Part II: A week later, participants were divided into four groups, that is a multiplication of *Search* (+/-) and *Evaluation* (+/-) of the Involvement Load Hypothesis (see Table 1). MCQ- group was given the reading material and instructed to answer four TOEIC style multiple-choice questions without using dictionaries. MCQ+ group did the same task as MCQ-, but was instructed to use dictionaries actively. TR- group was given the same reading material with partly-translated Japanese, and was instructed to complete the translation without using dictionaries. TR+ group did the same task as TR-, but was instructed to use dictionaries actively. After finishing the assigned task, all participants did the same LRT as in part I.

Part III: Three weeks later, all participants did the same LRT as in parts I and II. Then, they answered ten questions asking about their intrinsic and extrinsic motivations for the task.

Results

Quantitative Analysis

Ratings for the LRT were averaged for each participant and in each test. Figure 1 shows mean LRT score in three tests in each group. Three-way (Test × *Search* × *Evaluation*) ANOVA showed a significant main effect of Test ($F(2,182)=4.447$, $p=.013$, $\eta^2=.047$). Post hoc analysis revealed a significant difference between Test 1 and Test 2. Any interaction

among factors or main effect of *Search* (MCQ-/TR- vs. MCQ+/TR+) and *Evaluation* (MCQ-/MCQ+ vs. TR-/TR+) were not significant.

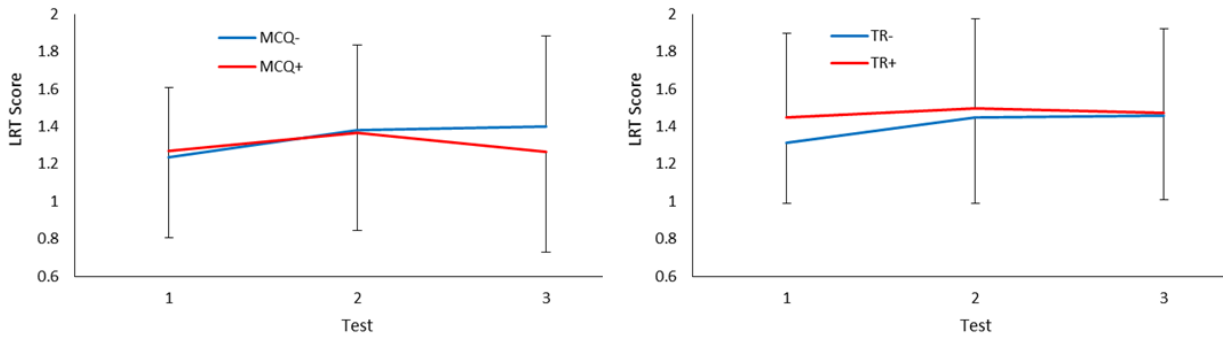
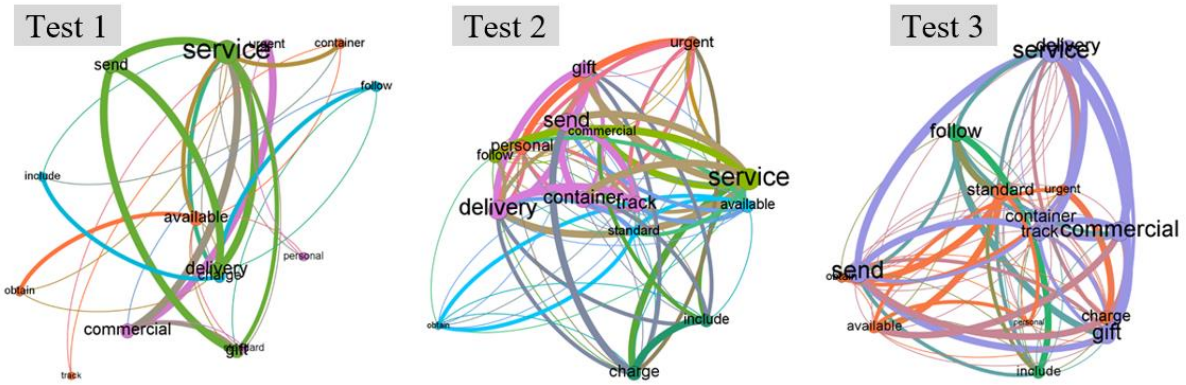


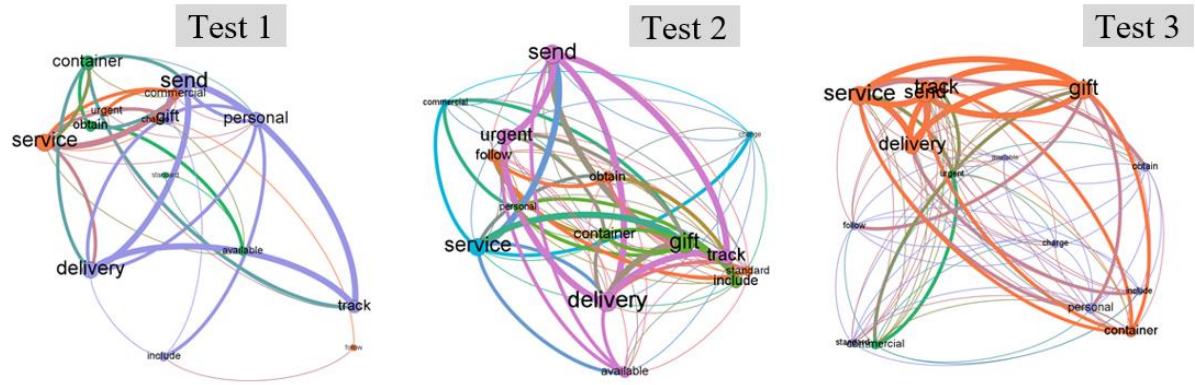
Figure 1: Mean LRT score in three tests in each group.

Qualitative Analysis

The individual LRT score data was analyzed and visualized by Gephi, a data-visualization platform, to show how participant's lexical network among target words changed through three tests. Figure 2 shows two samples.



(a) A female in TR+ group
(TOEIC score 320; LRT score Test 1: 0.51, Test 2: 1.62, Test 3: 1.57)



(b) A female in TR- group
(TOEIC score 445; LRT score Test 1: 0.64, Test 2: 1.29, Test 3: 1.24)

Figure 2: Samples of a visualized lexical network among target words generated by Gephi.

Correlation Analysis

Results of the motivation questionnaire underwent a factor analysis (maximum likelihood method, Promax rotation), which yielded two factors; *positiveness* and *obligation*. Table 2 shows correlation among parameters in all participants. There was no significant correlation between the LRT scores and individual attributes (TOEIC score, *positiveness*, and *obligation*).

		Test 1	Test 2	Test 3	TOEIC	*positiveness*
LRT	Test 1	—				
	Test 2	.599**	—			
	Test 3	.603**	.841**	—		
TOEIC		.038	-.024	-.040	—	
positiveness		.142	.064	-.011	.262*	—
obligation		.075	.033	-.049	.153	.212*

Table 2: Correlation among the LRT scores and individual attributes. ** $p<.01$, *$p<.05$

Discussion

The present study investigated the effects of involvement load of the task on EFL learner's lexical network of already-known words. Especially, a degree of *Search* and *Evaluation* was systematically manipulated by the task requirement according to Laufer & Hulstijn (2001), and a change of participant's understanding of relation among target words was examined through three lexical relation tests (LRTs). Despite such a clear factorial design (see Table 1) and relatively sufficient number of participants, the results did not show any group difference. Considering some of the reasons that lead to these results, the first possibility would be that the effect of extensive reading outweighed that of the tasks. In other words, different tasks in this experiment may not have influenced participant's motivation or a sense of necessity for reading so much, and the effort made by participants toward reading was not very different among groups. In fact, ANOVA revealed a significant difference of LRT score between Test 1 and Test 2 in all groups, demonstrating that participants have deepened their lexical network immediately after the reading regardless of assigned tasks. In order to solve this problem and to make involvement index work more effectively, features of tasks assigned to participants should be more distinguishable from each other.

Other assumed reason for the present results are rather technical problems. As shown in Figure 1, the LTR score in Test 1 is not at equal level among groups; TR+ group is considerably higher than other groups in particular. That means a starting line of four groups was not well-controlled, which can be a critical weakness of the experiment. To improve this, participant's assignment to each group should be done by considering individual LRT score in Test 1. In addition, great individual differences in LRT score, as shown in Figure 1 with error bars indicating SDs, are also problematic for finding the expected effects. In this regard, the method of asking perceived relation of two words (a direct 4-point scale used in this experiment) could be reconsidered.

An analysis of the individual data using Gephi yielded some interesting findings. In a sample shown in Figure 2(a), we can see the words *service*, *send*, *gift*, and *delivery* form a simple network in Test 1. In Test 2, immediately after the task, these key words seem to separate to make unique networks. Finally, in Test 3, these separate networks are reunified into a larger network including new words such as *commercial*, *container*, and *track*. In Figure 2(b),

though chief key words (*service*, *send*, and *delivery*) remain almost unchanged through three tests, the network formed by them becomes more and more complex from Test 1 to Test 3. These figures depict exactly what has occurred in individual's mental lexicon, which could never be revealed when the data was analyzed as a whole. In our future research, we would consider it an important task to investigate a correspondence between visualized network change and individual's subjective impression of the deepening of word linkages.

Conclusion

The results of this study did not support the Involvement Load Hypothesis (Laufer & Hulstijn, 2001), when it was adapted to the deepening of lexical network of already-known words, not the retention of newly-learned words. However, some possible improvements of the experimental procedure were pointed out for further investigation. Moreover, the significance of analyzing and visualizing individual data was presented. It is important to conduct both the quantitative analysis of group data and the qualitative analysis of individual data in the future studies. Finally, new research questions arose from the present findings; (1) if the task-induced involvement load does not work for deepening of the lexical network of already-known words, and (2) if there are any involvement components other than *Need*, *Search*, and *Evaluation* that we have to consider. Further accumulation of data samples and observation for a longer period will be needed to clarify these research questions.

Acknowledgements

This study is supported by Grant-in-Aid for Scientific Research (C) (21K00663) from the Japan Society for the Promotion of Science.

References

Aitchison, J. (1994). *Words in the mind: An introduction to the mental lexicon.* (2nd ed.). Oxford UK & Cambridge USA: Blackwell.

Aotani, N., Sugino N., Fraser S., Koga Y., & Shojima K. (2016). An asymmetrical network model of the Japanese EFL learner's mental lexicon. *Journal of Pan-Pacific Association of Applied Linguistics, 20(2), 95-108.*

Aotani, N., & Takahashi S. (2021). An analysis of Japanese EFL learners' lexical network changes. *Frontiers in Education 5:621437*. doi: 10.3389/feduc.2020.621437

Aotani, N., & Takahashi S. (2022). Effects of involvement load in extensive reading on lexical relations among already known L2 words. *Education and New Developments 2022, 1, 519-523.*

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11, 671-84.*

Horst, M., Cobb T., & Meara, P. (1998). Beyond a clockwork orange: Acquiring second language vocabulary through reading. *Reading in a Foreign Language, 11, 2, 207-23.*

Krashen S. (1989). We acquire vocabulary and spelling by reading: Additional evidence for the Input Hypothesis. *The Modern Language Journal, 73, 4, 440-464.*

Laufer, B., & Hulstijn, J. H. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics, 22, 1, 1-26.*

Shojima, K. (2011). Asymmetric von Mises scaling. *Proceedings of the 39th Annual Meeting of the Behaviormetric Society of Japan, 261–262.*

Shojima, K. (2012). On the stress function of Asymmetric von Mises Scaling. *Proceedings of the 4th Japanese-German Symposium on Classification, 18.*

Waring, R., & Takaki, M. (2003). At what rate do learners learn and retain new vocabulary from reading a graded reader? *Reading in a Foreign Language, 15, 130-163.*

Wilks, C., & Meara, P. (2002). Untangling word webs: Graph theory and the notion of density in second language word association networks. *Second Language Research, 18, 4, 303-24.*

Contact email: aotani@tokaigakuen-u.ac.jp