

Assessing the Hierarchical Structure of L2 Mental Lexicon: An Analysis of Categorical and Non-categorical Word Association¹

Mari KIKUCHI

Kobe Shoin Women's College

Midori YAMAMOTO

Ritsumeikan University

Machiko YOSHIMURA

Kyoto University of Education

Satoshi YABUUCHI

Osaka University

Midori TANIMURA

Osaka University of Foreign Studies Graduate School

1. Introduction

Nobody would deny that words in our mind are stored in an orderly way after they are acquired. Otherwise, how could we gain access to a word among numerous others in our mind and retrieve it so fast when we want to use it? However, it is not entirely clear how words are stored in our mental lexicon (Aitchson, 1994).

In order to explicate the storage structure we have employed the method of word association that has been used in a number of psychological and linguistic studies in the past. This method began in psychological studies and later came to be made use of in the field of linguistics. In the early stages of its development in linguistic studies, researchers were more interested in the analytical study of nonsense words than of meaningful words. Gradually, the latter has become the main stream in studies of this kind.

For instance, Umemoto (1969) conducted a large-scale study using 210 meaningful words in Japanese and identified a variety of relationships between stimulus words and associated words such as antonymy, synonymy and hyponymy. The main purpose of his research was to standardize free association tests and have a reliable measurement tool for language study and psycholinguistic analyses. As another example, Hakota, Egusa and Goryou (1986) examined the priming effects regarding the relationships among different types of word association in Japanese, and found that hyponymy had the shortest reaction time.

The word association method is also applied to the study of network building of language and memory. Ogawa (1972), for instance, observed and analyzed the clustering phenomena in the lexical network structure of the human mental inventory. While past research has shed some light on the problem of the mental lexicon, there is still a scarcity of studies into how words are organized in our mind.

2. Purpose

In order to investigate the network of connections between lexical items and find a clue

that provides information about the organizing process of acquired vocabulary, the present study addresses the following four research questions:

1. Is there any difference in the numbers of associated responses between categorical noun and non-categorical (i.e. abstract-concrete) noun stimulus words?
2. Is there any difference in the numbers of associated responses between abstract and concrete noun stimulus words?
3. Is there any difference in the numbers of associated responses between English and Japanese?
4. How are the association tests above correlated with a standardized test of L2 vocabulary size, Nation (1990)'s Vocabulary Levels Test (VLT)?

3. Method and Procedure

3.1 Subjects

A total of 432 Japanese undergraduate students of both sexes participated in this study. Most of them were freshmen from seven universities in the Kansai area and their majors were manifold.

3.2 Materials

Two types of stimulus words, shown in Table 1, were used: Type A was composed of ten categorical nouns and Type B of ten non-categorical nouns (five abstract and five concrete). These words were selected according to Umemoto (1969), *JACET 4000 basic words* (JACET, 1993), Takahashi and Tanaka (1994), and the results of a pilot study². Low-frequency words in the fourth and fifth levels of *JACET 4000 basic words* and words less familiar to Japanese college students were excluded. The English stimulus words were made by translation from the Japanese ones, so both the English and Japanese stimuli were semantically equivalent. Thus, forty stimulus words were prepared. In addition, Nation's VLT at the 2000 and 3000 word levels were used in this study.

Table 1 Stimulus words

Type A: Categorical nouns
a) English: science, animal, travel, food, family, education, music, health, environment, job
b) Japanese: 科学, 動物, 旅行, 食べ物, 家族, 教育, 音楽, 健康, 環境, 仕事
Type B: Abstract-concrete nouns
a) English: <u>spirit</u> , student, <u>peace</u> , <u>importance</u> , writer, apple, <u>relation</u> , sister, <u>religion</u> , car
b) Japanese: <u>精神</u> , 学生, <u>平和</u> , <u>重要</u> , 作家, りんご, <u>関係</u> , 姉妹, <u>宗教</u> , 自動車

Note: The underlined words above are abstract nouns.

3.3 Procedure

The subjects were divided into two groups: Group A consisting of 160 subjects was given the categorical word association test (Test A), while Group B (272 subjects) was given the abstract-concrete word association test (Test B). The homogeneity of these two

groups was confirmed by the total results of the two levels of Nation's VLT ($z = -1.04$, $p < .01$) (Appendix 1).

Each group was further divided into two groups: one began with the test in English and three weeks later had the test in Japanese, while the other group took the two tests the other way round. All the subjects were given a stack of papers with one stimulus word and an instruction typed on each (Appendix 2). They were required to write down as many associated words as possible with each stimulus within two minutes. A 30-second practice session preceded the experiment to familiarize the subjects with the procedure. In the English association test, they were instructed to write the meaning of the stimulus word in Japanese. Those who gave wrong answers or no meaning were excluded from the data for analysis. Following the first test, Nation's VLT was carried out.

4. Results

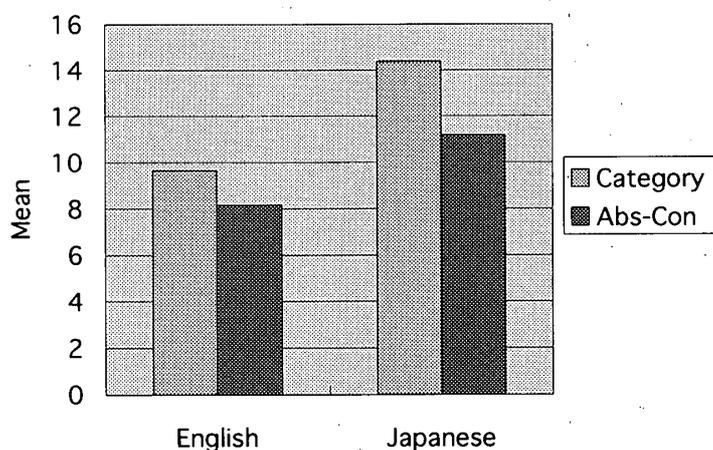
4.1 Numbers of Associated Responses for Categorical and Abstract-Concrete Noun Stimuli

Table 2 shows means and standard deviations for Test A and Test B. The average numbers of associated responses for the categorical noun stimuli were significantly higher than those for the abstract-concrete noun stimuli in both English and Japanese ($p < .01$). As shown in Figure 1, the disparity was larger in Japanese than in English (3.21 and 1.50 respectively).

Table 2 Mean Numbers of Associated Responses for Categorical and Abstract-Concrete Noun Stimuli

	Categorical Noun Stimuli ($N=160$)		Abstract-Concrete Noun Stimuli ($N=272$)	
	Mean	<i>SD</i>	Mean	<i>SD</i>
English	9.65	5.07	8.15	4.43
Japanese	14.39	5.86	11.18	5.61

Figure 1 Comparison of Numbers of Responses between Categorical and Abstract-Concrete Noun Stimuli in English and Japanese



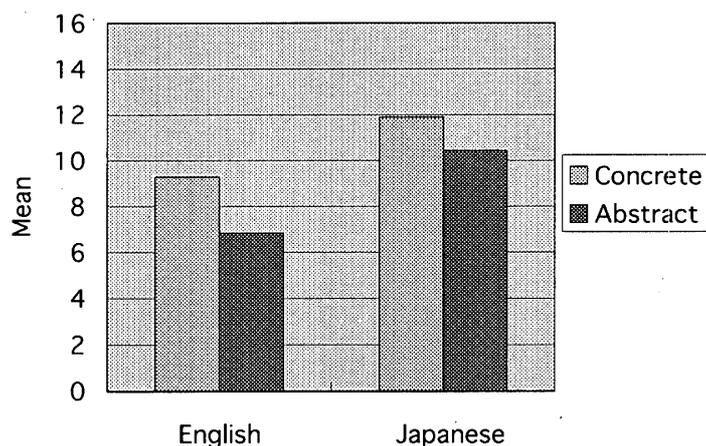
4.2 Numbers of Associated Responses for Abstract and Concrete Noun Stimuli

Table 3 shows that the average numbers of associated responses for the concrete noun stimuli were significantly higher than those for the abstract noun stimuli in both English and Japanese ($p < .01$). The disparity was larger in English than in Japanese (2.44 and 1.45 respectively), as shown in Figure 2.

Table 3 Mean Numbers of Associated Responses for Abstract and Concrete Noun Stimuli

	Abstract Noun Stimuli (<i>N</i> =160)		Concrete Noun Stimuli (<i>N</i> =160)	
	Mean	<i>SD</i>	Mean	<i>SD</i>
English	6.83	4.22	9.27	4.29
Japanese	10.44	5.41	11.89	5.71

Figure 2 Comparison of Numbers of Responses between Abstract and Concrete Noun Stimuli in English and Japanese



As for the average numbers for each individual stimulus word in both types, see Note 3.

4.3 Association Test and Nation's VLT

Tables 4 and 5 show that the correlation coefficients between both the numbers of associated responses for categorical and abstract-concrete noun stimuli and Nation's test score (total) were relatively low (0.25 and 0.14 respectively), though both were statistically significant ($p < .01$). These data indicate that the association test for categorical word stimuli correlates with Nation's VLT to a very low degree, and that the correlation with the test for abstract-concrete noun stimuli is even lower.

Table 4 Correlation between Test A and Nation's VLT (* $p < .05$ ** $p < .01$)

	Responses (E)	Responses (J)	N-test(2000)	N-test(3000)	N-test(total)
Responses (E)	1.00				
Responses (J)	0.42(**)	1.00			
N-test(2000)	0.18(**)	0.04	1.00		
N-test(3000)	0.25(**)	0.06(*)	0.63(**)	1.00	
N-test(total)	0.25(**)	0.05(*)	0.88(**)	0.90(**)	1.00

Table 5 Correlation between Test B and Nation's VLT (* $p < .05$ ** $p < .01$)

	Responses (E)	Responses (J)	N-test(2000)	N-test(3000)	N-test(total)
Responses (E)	1.00				
Responses (J)	0.54(**)	1.00			
N-test(2000)	0.12(**)	0.10(**)	1.00		
N-test(3000)	0.13(**)	0.07(**)	0.66(**)	1.00	
N-test(total)	0.14(**)	0.09(**)	0.90(**)	0.92(**)	1.00

5. General Discussion

Findings:

1. The numbers of associated responses for categorical words were larger than those for abstract-concrete words in both languages. The disparity was larger in Japanese than in English.
2. The numbers of responses for the concrete stimuli were larger than those for the abstract words in both languages. The disparity was larger in English than in Japanese.
3. The correlation coefficients were relatively low between the two association tests and Nation's VLT.

Discussion

The first finding indicates that the categorical stimuli worked more effectively in producing responses. Besides, the larger disparity in Japanese along with the distinctively high average number of responses for categorical stimuli in Japanese (14.39) implies that categorical stimuli worked more effectively in L1 than in L2; the degree of categorization is likely to be more advanced in a well-acquired language.

The second finding seems to make a sharp contrast with Finding 1, where a larger disparity was found in L1. Apparently, the subjects tended to produce more responses for concrete stimuli than abstract ones since concrete words are more familiar and more efficiently remembered than abstract words, as Dukes and Bastian (1966) point out. The larger disparity is also predictable in that the subjects have more difficulty in performing association tasks for abstract stimuli in L2. The subjects have acquired both abstract and concrete vocabulary quite well in L1, while in L2 the level of their acquisition is unbalanced.

On the other hand, in the comparison between Test A and Test B, both the fact that the difference between the numbers of responses for categorical stimuli and abstract-concrete stimuli was larger in Japanese than in English and the fact that its size, 3.21, was outstanding provide us with a plausible explanation for the categorization phenomena discussed above. Moreover, in a comparison between the higher score group (upper one-third) and the lower score group (lower one-third) on Nation's VLT, the differences in the numbers of responses to categorical stimuli and abstract-concrete stimuli in English were found to be 1.65 in the upper group and 0.25 in the lower group ($p < .01$) (Appendix 3). The fact that the disparity in the lower group was so small also seems to suggest a positive relation between proficiency level and the degree of lexical categorization.

Likewise, this fact suggests that language learners have an inclination to store their acquired vocabulary in a categorical structure. This fact has been recognized by several researchers in the past, such as Ogawa (1972:1), who stated that "language study or memory is a process which develops into an organized structure".

The result found in #3 could be expected because these two kinds of tests are supposed to assess different aspects of vocabulary knowledge. Nation's VLT measures vocabulary size, or "breadth of vocabulary knowledge" (Reads, 1997:311), while the association test is more concerned about "the quality, or depth, of word knowledge" (ibid:314).

6. Concluding Remarks

The discussion above provides some useful suggestions for future research. First, the fact that language learners have an inclination to store lexical items in a categorical structure can be taken as a suggestive hint for language teachers for classroom practice, though further careful investigation is required. Secondly, as to the different aspects observed in the low correlations between the results of Nation's VLT and those of word association tests, we hope that they will work as a useful clue to capture a picture of vocabulary knowledge in future language study.

Finally, we would like to propose that categorization, or the construction of hierarchical lexical structure, may provide a sensitive measurement for assessing the degree of vocabulary development in L2, which is not measured by breadth-of-vocabulary tests like Nation's VLT. Lexical categorization may offer a conceptual framework for future L2 vocabulary acquisition research.

Notes

1. This paper is based on and developed from an oral presentation given at the JACET 39th Annual Convention in Okinawa, on Nov. 4, 2000.
2. In 1999 the authors gave a categorical word association test in English to their students, and then improved the answer sheet format as well as the procedures of the experiment.
3. The tables below show means and *SD*s for each individual stimulus word. A few points must be made about these data. The difference in the numbers of responses between

English and Japanese is the smallest for “sister”, which has the second lowest score of all the words in Japanese. On the other hand, the disparities in scores for “animal”, “music”, “travel”, “food”, “religion” and “job” are large, more than 5 points. It is noted that all these words are categorical noun stimuli, except religion, which could also be classified as a categorical word though included in Type B in the present test.

Mean Numbers of Associated Responses for Categorical Noun Stimuli in English

	science	animal	travel	food	family	education	music	health	environment	job
Mean	6.91	10.38	10.76	11.01	11.94	9.54	10.69	7.84	8.21	9.04
SD	4.15	4.52	4.77	5.30	5.24	4.89	5.13	4.25	4.80	5.31

Mean Numbers of Associated Responses for Categorical Noun Stimuli in Japanese

	科学	動物	旅行	食べ物	家族	教育	音楽	健康	環境	仕事
Mean	10.48	16.87	16.59	16.77	14.71	12.96	16.99	11.79	12.35	14.36
SD	4.46	6.30	4.74	6.35	5.19	5.35	5.65	4.88	5.44	5.44

Mean Numbers of Associated Responses for Abstract-Concrete Noun Stimuli in English

	spirit	student	peace	importance	writer	apple	relation	sister	religion	car
Mean	4.75	10.73	7.08	7.57	8.29	9.22	8.14	7.62	6.48	10.52
SD	3.61	4.27	3.68	4.68	3.64	3.75	4.34	4.23	4.26	4.65

Mean Numbers of Associated Responses for Abstract-Concrete Noun Stimuli in Japanese

	精神	学生	平和	重要	作家	りんご	関係	姉妹	宗教	自動車
Mean	7.79	13.16	10.52	10.85	11.20	12.24	10.43	8.26	12.23	14.60
SD	3.88	5.64	5.47	5.87	5.21	4.92	5.62	4.97	4.85	5.75

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Appendix 1

Total results of Nation's 2000-word level test and 3000-word level test

	Group A (N=160)	Group B (N=272)
Mean score	26.05	25.50
SD	5.03	5.88
Statistic: z	-1.04	

No significance, $p < .01$

Appendix 2 Test papers

単語選択テスト No.6

りんご

1.		16.	
2.	りんご	17.	
3.		18.	
4.	りんご	19.	
5.		20.	
6.	りんご	21.	
7.		22.	
8.	りんご	23.	
9.		24.	
10.	りんご	25.	
11.			
12.	りんご		
13.			
14.	りんご		
15.			

Wait!
指示があるまで次へ進んではいけません

単語選択テスト No.4

food

1.		16.	
2.	food	17.	
3.		18.	
4.	food	19.	
5.		20.	
6.	food	21.	
7.		22.	
8.	food	23.	
9.		24.	
10.	food	25.	
11.			
12.	food		
13.			
14.	food		
15.			

Wait!
指示があるまで次へ進んではいけません

意味 (日本語)

Appendix 3

Comparison of Numbers of Responses between Categorical and Abstract-Concrete Noun Stimuli in English

