Word associations by Japanese learners of English: analyses of response type distribution

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1. INTRODUCTION

This research conducted a word association for the purpose of examining the typical word associations of Japanese English learners. Word association tasks have been developed for experimental research in fields such as pathology, information technology, psychology, and linguistics and are used to measure word fluency in the assessment of the communication problems associated with brain injury in speech pathology (Baker, et al., 2001) and in the assessment of the communication skills in the applied linguistics. They are also employed to form databases for word association norms for experimental research in psycholinguistics and information technology (Ferrand L, 2001).

One of the main purposes of word association in psycholinguistics is to account for the mental lexicon of native speakers. The mental lexicon of the average adult is very large (Gernsbach, 1994); it is estimated that adults may be familiar with 75,000 or more word types (Oldfield, 1966). The prediction of what kinds of information should be included in a lexical representation is still controversial. Gairns and Redman (1986) conducted psycholinguistic experiments and proved that semantically-connected words were stored in the adults' mental lexicon. On the other hand, Fay and Cutlar (1977) predicted that the mental lexicon was composed of multiple association networks such as phonological in addition to the semantic networks.

There are two main perspectives on the semantic connection of the words in the mental lexicon. One is atomic globule theory, according to which words are built up from a common pool of 'meaning atoms' and related words have "atoms" in common. The other is cobweb theory, according to which words are recognized as related because of the links which speakers have built between them (Aichison, 1994). Word association tasks have been employed in experiments to largely support the latter theory. The way words are semantically linked by the native speakers is discussed in the field of information technology, too, and several models of the semantic network theory are proposed. In these models, the algorithm for word clustering is written on the basis of words' thematic features (relating objects to objects) rather than their defining features (such as IS_A hierarchies)[1] (Basili, et al., 1996).

In the psycholinguistics, some of the predictions on the nature of the semantic connection of the words in the native speakers' mental lexicon were presented. Aichison (ibid.) and Meara (1980) have noted the tendencies of adults to give co-ordination associations and of children to give syntactic collocations to words in their native language. Aichison (ibid.) proposed four main types of associations found in word association tasks for native speakers. They were, in order of frequency, co-ordination (e.g. *salt* and *pepper*), collocation (e.g. *salt* and *water*), super-ordination (e.g. *dog* and *animal*), and synonymy (e.g. *hungry* and *starved*).

In the research on foreign language learners' associations, Meara (1996) observed more varied and unpredictable associations in learners' responses to those of native speakers. The same tendency was found in an experiment which examined the number and the kinds of associations of Japanese learners of English to English and Japanese abstract noun words (Kikuchi et al., 2001). Orita (2002) observed syntagmatic-paradigmatic[2] shift revealed by an advanced group of Japanese learners of English. We surmised that foreign language learners, especially in the early-learning stage, have to deal with a limited lexicon and that this may cause the association of inappropriate words, resulting in a wider disparity of responses than in the native language.

The way in which words are stored in the mental lexicon of native speakers is still a controversial issue. There are not many empirical studies in this area. There is also a scarcity of studies into the relation between the mental lexicon of native-and foreign-language words (Tohno, 1997). Foreign language learners, especially in early-learning stage, may not have formed the semantic networks of the native adults and may response

like the native children who are still acquiring a language. It is thus predicted that the types of the word associations of the non-native language learners are different from those of the native speakers as observed in the Aichison's experiment. It is also predicted that the foreign language learners may associate words with target words not on the basis of a complete semantic network but on the basis of other factors such as the frequency of the occurrence of the words in their learning environment, the recent learning memory of the words, cultural experiences (not only the target language society, but also their own society), and daily life experiences. In this study, a word association task was conducted to investigate the validity of these predictions.

2. EXPERIMENT

2.1 Hypotheses

We hypothesized the following:

1. For each target word, non-native language learners would associate certain words more frequently than others.

2. The types of the associations of non-native language learners would differ from those of native speakers.

3. The types of associations of non-native language learners would depend upon the exposition of the words in their learning environments.

4. The types of the associations of non-native language learners would be influenced by the culture and daily life experiences (and their understanding of native-language equivalents) of individuals.

2.2 Method

Subjects: Sixty eight native Japanese-speaking university technology-major freshmen of both sexes participated in the research.

Materials: Five target concrete nouns, *abacus, cactus, ear, ice berg* and *jack*, whose difficulty level was higher than the 5,500 basic words of *Shogakukan Progressive English -Japanese Dictionary* (SPEJD), were chosen. The partial definitions of the key words are listed in Appendix A. Nouns, especially concrete nouns were chosen for this association task research, as they were more familiar and more efficiently remembered than abstract words (Dukes and Bastian, 1966). Words outside SPEJD's basic 5,500 words were used as

we had tested such words previously in a spoken corpus.

Procedures: Sixty eight subjects, who knew the meaning of the target words as was ascertained in a pre-test, were given the five target words and asked to write down three words that they associated with each one (Appendix B). They were required to write down only three of associated words because our aim was to collect the most closely associated words.

2.3 Results

2.3.1 Dominant associations

All the responses to each target word were collected and the number of identical groups of associations were determined as shown in Table 1.

Table 1　Kinds of Associations in Number

Key Words	Number of Responses	Number of Groups of Identical Responses
abacus	204	64
cactus	204	46
ear	204	68
ice berg	204	52
jack	204	57

The smaller the number of groups of identical responses, e.g. 46 of *cactus*, the less variation of associations with the target word and the possibility of finding dominant associations is likely higher.

Table 2 lists the incidence of occurrence of the 5 most frequent associations for each target word and their accumulated percentages for each level of ranking and, if any, higher level(s). The top five ranking associations for *abacus* were *calculation, wood, mathematics, old,* and *calculate*; for *cactus* were *desert, green, needle, plant,* and *water*; for *ear* were *rice, wheat, fall, plant,* and *corn*; for *ice berg* were *cold, ice, Tytanic, big,* and *sea*; for *jack* were *car, tire, repair, heavy,* and *lift*. As the accumulated percentages in the fifth column of the Table 2 shows, the five most frequently-occurring associations accounted for from 40 % to 61 % of the associations.

Table 2 Incidence and Accumulated Percentages of the Five most Frequent Associations

Key Words	1	2	3	4	5
abacus	28 (13.7)	18 (22.5)	15 (29.9)	12 (35.7)	10 (40.6)
cactus	43 (21.0)	33 (37.2)	23 (48.5)	15 (55.8)	11 (61.2)
ear	56 (27.4)	12 (33.3)	11 (38.7)	9 (43.1)	8 (47.0)
ice berg	43 (21.0)	18 (29.9)	15 (37.2)	14 (44.1)	12 (50.0)
jack	59 (28.9)	24 (40.6)	9 (45.0)	7 (48.5)	7 (51.9)

2.3.2 Types of the associations

Analyzing all the words associated with the target word according to the four categories of Aichison (ibid.) plus three categories, sub-ordination, antonymy and others, we found, for example, for target word *cactus*, there were 7 co-ordinations, *desert, needle, water, spine, prickle, sand, sun*, 2 collocations, *sting, rough*, 4 super-ordinations, *green, plant, flower, thorn*, one sub-ordination, *pin*, no antonymy, no synonymy and 33 others. Analyzing all the associated words with the other target words (Appendix C) using these categories, the following results shown in Table 3 were obtained.

Table 3 Semantic Categories of Associated Words

Key Word	Co-ordination	Collo-cation	Super-ordination	Sub-ordination	Synonymy	Antonymy	Others	Total
abacus	11	4	4	3	1	0	44	64
cactus	7	2	4	1	0	0	33	46
ear	24	8	7	0	0	0	29	68
ice berg	10	4	2	0	0	0	36	52
jack	5	6	3	0	0	0	43	57

The types of associations for non-native language learners were, in order of frequency, co-ordination, collocation, super-ordination, subordination, synonymy and antonymy. This was the same order as was observed in the tasks for native speakers in Aichison (ibid). These types, however, were not the main types of the associations, and there were many other types of associations.

2.3.3 Associations based on the frequency of exposition

Foreign-language learners may associate words with target words not on the basis of a developed semantic network but on the basis of other factors such as frequency of examples in exposition or the recent memory of the words from their learning environment. These factors, however, are not easily measurable. We supposed that the difficulty levels (as shown by the word list) would correspond to a learner's exposure to that word. Analyzing all the associated words with each of the target word on the basis of the difficulty levels, level 1 to level 12 stated in *Standard Vocabulary List*[3], the following results shown in Table 4 was obtained.

Table 4　Average Difficulty Levels of Associated Words

Key Words	N	Mean	SD
abacus	204	2.60	2.27
cactus	204	1.88	2.00
ear	204	1.61	1.63
ice berg	204	2.13	3.02
jack	204	1.78	1.92

The lowest mean score was 1.61 and the highest mean score was 2.60 and generally, the difficulty levels of the associated words were very low.

Next, the associated words for each target word were divided into three groups with 68 words each, according to their frequency of occurrence (Appendix C), high-frequency, normal-frequency and low-frequency, and the mean scores of difficulty levels for each group were calculated as were shown in Table 5.

Table 5　Difficulty Levels and Frequency of Occurrence of Associated Words

Key Words	Difficulty Level		
	High-frequency	Normal-frequency	Low-frequency
abacus	2.45	2.61	2.60
cactus	1.63	1.33	2.67
ear	1.35	1.45	2.02
ice berg	1.17	2.64	2.73
jack	1.13	1.77	2.44

For the three target words, *ear*, *ice berg* and *jack*, the higher the frequency of the association was, the lower the difficulty level of the words was, but as for the target words, *abacus* and *cactus*, no tendency could be observed. Correlation coefficients between the frequency of the occurrence of the words and their difficulty level were -0.01 for *abacus*, 0.13 for *cactus*, 0.09 for *ear*, 0.14 for *ice berg* and 0.13 for *jack*. They were all relatively low and there was no strong correlation observed.

2.3.4 Associations based on the culture of individuals

The foreign language learners may associate words with target words on the basis of cultural experiences (not only language-bound culture but subculture) and daily life experiences. Analyzing the associations from this point of view, it was found that some of the learners' associations were definitive features to the target words and the others, many in number, were thematic features to the target words and some of them seemed to be associated with the target words on the basis of learners' cultural or daily life experiences. For example, with the target word, *cactus*, the associated words such as *plant* in super-ordination and *spine* in co-ordination, which were definitive features, were observed, and *Mexico, music, eat, ouch, warm* categorized in others, which were thematic features, were observed. The learners had the ideas, although some of them are obscure associations, the typical places for the cactus to be grown were Mexico, where some type of the music was popular, and also some kinds of the cactus were very popular food these days, the floral language for cactus was warmth in heart and so on.

The associations with the other target words, *old days, difficult, children, grade, roller skate, tradition* with *abacus*, and *brown, delicious, energy, festival, busy, moon viewing, Thailand* with *ear*, and *Tytanic, dead, white bear, ship, penguin* with *ice berg* and *convenient, useful, father, handy, man, quick* with *jack* seem to be associated with the target words on the basis of the learners' cultural or daily life experiences.

2.4 Discussion

It was generally clear which of the word associated with each was most typical. This bears out the first hypothesis; for each target word, non-native language learners will associate certain words more frequently than others.

Analyzing the associated words on the basis of the categories of Aichison (ibid.), the types of associations found in this word experiment were, in order of frequency, co-

ordination, collocation, super-ordination and synonymy. These types, however, are not the main types of the associations and there are many other types of associations, some of which are sub-ordinations and others filling no category. With these results, the second hypothesis, the types of the associations by the non-native language learners are different from those by native speakers, is also supported.

Analyzing the associated words on the basis of the difficulty levels, two points were clarified. First, the difficulty levels of the associated words in this research were fairly low. Second, the coefficient correlation between the difficulty levels of the associated words and their frequency of the occurrences was relatively low. With these results, the third hypothesis that the types of the associations of the non-native language learners depends upon the exposition of the words in their learning environments was not supported. Here the learner's exposure to the word in their learning environments was supposed to correspond to the difficulty levels stated in the word list, and this way of measuring the learner's exposure to the words must be contrived furthermore.

The forth hypothesis, that the types of the associations by the non-native language learners would depend upon the culture or daily life experiences of individuals, was not proved statistically, but several examples which seemed to be associated with the target words on the basis of the learners cultural or daily life experiences were found. Some of these culture or daily-life based associations were not definitive features for the target word and were based on the obscure or wrong images of the target words. Nonetheless, features gained by examining these types of associations further could be utilized for the construction of a spoken corpus of learner-based definitions, another aim of our project.

3. CONCLUSION

The purpose of this study was to examine the types of the language learners' associations with foreign-language target words. To do this, an experiment was conducted by means of word association tasks with concrete noun target words. We found that language learners associate certain words more frequently than others and that the types of these associations were different from those of native speakers. The coefficient correlation between the difficulty levels of the associated words and their frequency of occurrence was relatively low, and some of the associations were based on the learners' cultural or daily life experiences.

The phenomena observed in this study must be examined further both by collecting data for a larger number of target words and by using learners of differing backgrounds. The subjects of this study were Japanese university freshmen majoring in technology, and it is possible that the subjects' learning stage and social and cultural backgrounds affect the results of association task. Furthermore, such associations as *Titanic* with *ice-berg* show that current topics, that is, the movie *Titanic* affects their associations. Large scale research using many target words with variety of subjects over a long time span needs to be conducted to clarify the types of language learners' associations. Word association research with a limited number of key words may, however, be useful in finding some portions of language learners' associations, some of which could suggest cue words for other learners' improved comprehension. Some of the frequent associations by learners who know the meaning of words could become effective cues for learners who do not know the meaning of the target word (Tomita, et al. 2002).

One commonly recommended strategy in vocabulary learning is to infer the meanings of new words from context. There is a strong conviction among educators that contextualized vocabulary learning is more effective than learning words in lists (Paribakht and Wesche, 1996). In addition to context clues, learners can infer meanings from teachers' explanations. Foreign-language learners' word comprehension is based largely on classroom explanations and context, both of which are influenced by the scope and nature of the foreign language teacher's experience. Drawing from the resources of other foreign-language learners might provide an additional resource for teachers and learners in improving vocabulary. To examine the types of the Japanese language learners' associations, the research using the words association tasks will be pursued furthermore.

NOTES

[1]In psycholinguistics, it has been proposed that the concepts are defined in terms of defining features and thematic features, and it has been experimentally observed that some concepts are better defined in terms of defining features, whereas the others are more naturally defined by their thematic features (Keil, 1989; Schwarts, 1989; Jackendoff, 1983).

[2]In syntagmatic associations, responses are words that could plausibly precede or follow the stimulus word in a sentence, as with the stimulus *letter* eliciting the response *write*, *run* eliciting *fast*, and *mountain* eliciting *climb*. In paradigmatic associations, on the other hand, the response could be substituted for the

stimulus in a sentence. This includes co-ordinates (e.g. *yellow* and *red*; *mother* and *father*) synonyms (e.g., *hard* and *difficult*; *old* and *ancient*), antonyms (e.g., *last* and *first*; *long* and *short*), super-ordinates (e.g., *dog* and *animal*; *rose* and *flower*), and subordinates (e.g., *bird* and *pigeon*; *fruit* and *apple*).

³ALC's SVL (Standard Vocabulary List) selects 12,000 words on the basis of frequency of usage by native speakers and usefulness for Japanese English learners. They are divided into 12 groups with 1000 words each, which are graded into 1 to 12 (basic—advanced) levels.

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APPENDIX A

Definitions

Abacus: a frame holding wires on which small balls can be moved, used for teaching children how to count, or especially in eastern countries, for calculating

Cactus: any of a number of desert plants protected by sharp prickles, with thick fleshy stems and leaves

Ear: the head of a grain-producing plant such as corn or wheat, used for food

Ice berg: a large piece of ice floating in the sea, most of which is below the surface

Jack: an apparatus for lifting off the ground anything of heavy weight, such as a car

APPENDIX B

Answer sheet for word association task

Name   Number

Five key words are listed in the followings. Put the words that you associate with these key words in English without looking up dictionaries.

abacus

associated words: (   ) (   ) (   )

cactus

associated words: (   ) (   ) (   )

ear

associated words: (   ) (   ) (   )

ice berg

associated words: (   ) (   ) (   )

jack

associated words: (   ) (   ) (   )

APPENDIX C

Associated words with five key words

The frequency of the association is in the parenthesis.

abacus

calculation (28)	wood (18)	mathematics (15)
old (12)	calculate (10)	arithmetic (15)
finger (8)	difficult (6)	Japan (6)
number (6)	school (5)	addition (4)
hand (4)	calculator (3)	children (3)
subtraction (3)	teacher (3)	tool (3)
ball (2)	brown (2)	buyer (2)
elementary (2)	fast (2)	input (2)
money (2)	multiplication (2)	plus (2)
quick (2)	tree (2)	add (1)
analogue (1)	black (1)	business (1)
classroom (1)	commute (1)	dagashi shop (1)
examination (1)	five (1)	frame (1)
fun (1)	grade (1)	grandmother (1)
hit (1)	justice (1)	late (1)
learn (1)	lesson (1)	mental (1)
multiply (1)	old days (1)	old days money (1)
old woman (1)	plastic (1)	primary school (1)
rank (1)	roller (1)	roller skate (1)
sound (1)	speed (1)	square (1)
store (1)	subtract (1)	tetra (1)
top (1)	tradition (1)	use (1)

cactus

desert (43)	green (33)	needle (23)
plant (15)	water (11)	flower (7)
strong (6)	Mexico (5)	dry (4)

hot (4)

thorn (4)

hot (2)

sand (2)

warm (2)

dangerous (1)

FF8 (1)

long (1)

oasis (1)

pyramid (1)

roof (1)

spike (1)

typical (1)

pain (4)

Africa (2)

pin (2)

sting (2)

ask (1)

easy (1)

Getsu 9 (1)

music (1)

ouch (1)

pornography (1)

rough (1)

summer (1)

Western (1)

spine (4)

danger (2)

prickle (2)

sun (2)

big (1)

eat (1)

little water (1)

need (1)

painful (1)

pretty (1)

sore (1)

thirst (1)

ear

rice (56)

plant (9)

water (7)

food (4)

eat (3)

agriculture (2)

country (2)

farmer (2)

harvest (2)

ripe (2)

catch (1)

earth (1)

grass (1)

hammer (1)

iris (1)

moon viewing (1)

nut (1)

plantation (1)

wheat (12)

corn (8)

brown (5)

barley (3)

relax (3)

beer (2)

energy (2)

festival (2)

Japan (2)

bear (1)

clip (1)

flower (1)

green (1)

Hitomebore (1)

kind of plant (1)

my home (1)

peanut (1)

rye (1)

fall (11)

autumn (7)

field (4)

delicious (3)

seed (3)

bread (2)

farm (2)

gold (2)

rice field (2)

busy (1)

cut (1)

garden (1)

ground (1)

home (1)

malts (1)

natural (1)

piece (1)

school (1)

sesame (1)

soft (1)

sun (1)

village (1)

white (1)

small (1)

spring (1)

Thailand (1)

wall (1)

wide (1)

soba (1)

strong (1)

tree (1)

weed (1)

ice berg

cold (43)

big (14)

bear (5)

water (5)

white (4)

cool (3)

North Pole (3)

danger (2)

refrigerator (2)

beautiful (1)

climb (1)

elephant (1)

injustice (1)

large (1)

natural (1)

snowstorm (1)

terrible (1)

winter (1)

ice (18)

sea (12)

penguin (5)

arctic (4)

white bear (4)

freeze (3)

ship (3)

dead (2)

snow (2)

blow (1)

climber (1)

flood (1)

kakigouri (1)

melt (1)

ocean (1)

solid (1)

tip of the iceberg (1)

Tytanic (15)

mountain (10)

South Pole (5)

hard (4)

Antarctic (3)

high (3)

adventure (2)

huge (2)

Antarctica (1)

blue (1)

CO_2 (1)

Greenland (1)

Kilimanjaro (1)

move (1)

rock (1)

tent (1)

titan (1)

jack

car (59)

heavy (7)

machine (6)

metal (5)

puncture (3)

wheel (3)

tire (24)

lift (7)

strong (6)

power (5)

trouble (3)

accident (2)

repair (9)

tool (7)

convenient (5)

iron (3)

turn (3)

barbell (2)

change (2)	factory (2)	rescue (2)
truck (2)	up (2)	useful (2)
beer (1)	big (1)	brake (1)
bus (1)	China (1)	drink (1)
exchange (1)	father (1)	flat (1)
flat tire (1)	force (1)	gear (1)
handy (1)	heavy (1)	instrument (1)
item (1)	lozenge (1)	man (1)
mend (1)	mountainous (1)	oil (1)
overhand (1)	pack (1)	pressure (1)
quick (1)	screw (1)	spare (1)
spin (1)	steel (1)	tire change (1)
train (1)	tree of beans (1)	work (1)

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1. INTRODUCTION

This research conducted a word association for the purpose of examining the typical word associations of Japanese English learners. An experiment was conducted by means of word association tasks with concrete noun target words. We found that language learners associate certain words more frequently than others and that the types of these associations were different from those of native speakers. The coefficient correlation between the difficulty levels of the associated words and their frequency of occurrence was relatively low, and some of the associations were based on the learners' cultural or daily life experiences. The phenomena observed in this study must be examined further both by collecting data for a larger number of target words and by using learners of differing backgrounds. The subjects of this study were Japanese university freshmen majoring in technology, and it is possible that the subjects' learning stage and social and cultural backgrounds affect the results of association task. Word association research with a limited number of key words may, however, be useful in finding some portions of language learners' associations, some of which could suggest cue words for other learners' improved comprehension. Some of the frequent associations by learners who know the meaning of words could become effective cues for learners who do not know the meaning of the target word.