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Investigating the Japanese Learner's L2 Mental Lexicon Through Word Associations

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Introduction

As lexis continues to assume a more central role in ESL pedagogy, we have seen a renewed interest on the part of researchers attempting to gain a better understanding of the L2 mental lexicon. Much of the debate has focused on psycholinguistic considerations addressing the nature of the interaction between the L1 mental lexicon and the L2 mental lexicon in an effort to determine to what degree they are (or are not) separate entities, and whether or not they are accessed, both receptively and productively, via different channels of mental processing.

During this resurgence of interest regarding the L2 mental lexicon, however, one issue that has been largely ignored is to what extent the L2 learner's mental lexicon comes to resemble that of native speakers as the L2 learner improves in proficiency. In the past, the bulk of the research addressing this issue attempted to determine to what degree responses on a word association test correlate with general language proficiency in terms of stereotypy, as compared to common native-speaker responses. At best, past studies have found only weak support for the notion that as learners improve in proficiency, the stereotypy of their responses comes to resemble responses of native speakers. Kruse, Pankhurst, and Sharwood Smith (1987), in attempting to a develop a word association test as a means of assessing language proficiency, described the results of their experiment as "disappointing." Other researchers (Randall 1980 and den Dulk 1985 both cited in Kruse, Pankhurst, and Sharwood Smith 1987) have obtained similarly low or statistically insignificant coefficients in studies designed to correlate language proficiency with stereotypy of responses.

Therefore, as other investigative tools used for assessing the L1 mental lexicon such as error analysis have limited application in L2 research, where errors are believed to occur as a result of an unperfected language system, it may be of use to approach the data from a more ethnographic perspective. The purpose of this paper, then, is to consider the responses on an L2 word association test not only as they compare to native-speakers responses, but also as they relate to responses given by subjects to prompt words in their native language, in order to determine what, if any, patterns emerge. This paper ultimately raises many more questions than it answers, but it is hoped that such an approach to the data can indicate some potentially fruitful areas of inquiry for future research.

Method

Procedure

This study consisted of two single-response word association tests (one L1 and the other L2) administered to 17 native speakers of Japanese. As this study was essentially ethnographic in nature, the tests included prompt words which were varied to include a mix of words from different word classes and both high-frequency and, in the case of the L2 English test, low-frequency words. The English word association test was also given to ten native speakers of English who served as a control group.

The tests were administered orally on an individual basis. Subjects were informed that there were no right or wrong answers, and were asked to provide the first word that came to mind upon hearing each prompt word. Results were then analyzed using criteria designed to determine if any patterns had emerged in the responses. Response patterns were then assessed in comparison with patterns detected on the L1 Japanese word association test and the control group test. Level of proficiency was determined by subjective evaluation and was also compared to response patterns.

Subjects

The subjects (with the exception of the three highest proficiency subjects) were all students of the researcher who had been taking private weekly lessons for a minimum of 8 months and a maximum, in the case of four subjects, of 5 years. The mean duration for years of study with the researcher was 2.96 years with a median score of 3.04 (see Table 1 for specific information). This is of particular significance as each subject's level of proficiency was evaluated subjectively.

While fully acknowledging the problems such subjective analysis creates for external reliability, it should be remembered that general proficiency is a multifaceted concept, and although it cannot claim the validity of established measures of proficiency, informed subjective analysis can in some ways account for more modes of proficiency than formal methods of objective testing. It is hoped that the amount of time the researcher spent with the subjects in personal communication at private lessons will be considered as adequate for making a reasonable assessment of the subjects' levels of proficiency.

The Evaluation Instrument

The evaluation instrument was adopted from Aitchison's (1994) model for classifying responses of native speakers produced on L1 single-response word association tests. The categories include, in respective order from commonest type of response to least common, co-ordination (including natural pairs), collocation, superordination, and synonymy. In consideration of the findings of past L2 word association research, the model was expanded to include a category for phonological responses and one for responses which could not be

accurately classified under the other five categories (a miscellaneous category).

Responses classified into these six categories were then assessed within a broader scheme at the paradigmatic and syntagmatic linguistic levels, with the three categories of co-ordination, superordination, and synonymy comprising the paradigmatic group, and collocation comprising the syntagmatic group. In this sense, the term collocation is being used in a rather general sense to include not only words which are common collocates, but what Carter (1987: 50), following in the tradition of Halliday and Sinclair, calls "lexical collocation" (i.e. words from the same lexical set). Therefore, it may be useful in this study to think of collocation simply as another term for a syntagmatic relation between words. Finally, in addition to the paradigmatic and syntagmatic groups, another group was added to include both the phonetic and miscellaneous categories.

Results

For purposes of comparability, the seven words that comprised the high-frequency word association test (i.e. words that all subjects should have been familiar with) will be treated separately from the low-frequency words in this section. This is due to the fact that responses to low-frequency words were not collected for every word among all 17 subjects, as the proficiency level of the subject dictated what words would be known to the subject.

Results of High-Frequency Word Association Test
The complete results of the high-frequency L2 word association test are listed on Table 1, the results of the L1 Japanese word association test are shown in Table 2, and the control group responses are listed in Table 4.

Phonological links
As suggested by past research, no purely phonological links were made in either of the L1 tests, although one subject did respond with what may be both a phonological and semantic response to the Japanese prompt word for 'river', 'kawa', with 'kawara', (river bed). In line with the findings of past research (Meara 1982 cited in Carter 1987), lower proficiency students tended to produce 'clang' associations on the L2 test, particularly in the case of the prompt word 'tell' which five of the lower proficiency subjects responded to with 'telephone'. This may have been due in part to the fact that businesses in Japan often use the abbreviation 'TEL' to indicate a company's telephone number, however it should be noted that none of the subjects with a proficiency rating of more than 5 produced this response.

Paradigmatic and syntagmatic responses
The experimental group tended to produce fewer paradigmatic (55.5%) and more syntagmatic (37.0%) responses than did the control group (77.1% paradigmatic and 21.4% syntagmatic). The L1 Japanese test, however, showed a much stronger tendency on the part

of the subjects in their native language to produce syntagmatic (62.2%) rather than paradigmatic (36.1%) responses.

In respect to the three categories that were classified as paradigmatic, co-ordinates were the most common followed by synonyms and finally superordinates which appeared only in the experimental group's L2 word association test. The fact that synonyms tended to be much more common than superordinates is not entirely clear, however it appears to be influenced at least somewhat by word class. In listing her categories, Aitchison (1994) gives as examples three nouns and one adjective. This study also included words from the verb group which tended to elicit mostly responses of synonymy and collocation for both the experimental and the control group. This may have been due to the fact that verbs do not seem to have natural pairs to the same extent as words found in the adjective and noun groups and, in addition, seem to lack the sets of co-ordinates found in the noun group.

Proficiency and patterns of responses

As stated above, this study was not attempting to correlate stereotypy of responses with any measure of proficiency. However, in attempting to analyze the data using various approaches, the proficiency scores were correlated with number of paradigmatic responses, syntagmatic responses, and the group consisting of phonological responses and unclassifiable responses using a Pearson product-moment correlation. Not surprisingly, the last group showed a strong inverse correlation (-.79) indicating that phonological and unclassifiable responses were commoner among lower-proficiency subjects than higher-proficiency subjects. Number of paradigmatic responses showed a weak positive correlation with proficiency (.32), but this may have been due, at least in part, to the fact that lower level students produced more phonological responses, thus reducing the total number of what otherwise may have been paradigmatic or syntagmatic responses. The correlation between syntagmatic and proficiency was negligible (-.11).

Results of Low-Frequency Word Association Test

The complete results of the low-frequency word association test are shown in Table 3. It should be stated at the outset that the data in the low-frequency word association test is not nearly as complete as in the high-frequency test, and low-frequency associations were not investigated in the subjects' L1, limiting the comparison of responses on the L2 test to the responses of the control group. The control group's responses are listed in Table 5.

Phonological links

Although phonological links between words are fairly well-documented in the research literature among lower-proficiency learners, in this study three students with a proficiency rating of 7 responded to the prompt word 'evaluate' with what appear to be clang responses of 'valuable', 'value', and 'corroborate'.

Paradigmatic and syntagmatic responses

The low-frequency word test also showed a tendency on the part of the control group to produce paradigmatic responses (78.4%) over syntagmatic responses (18.9%) as opposed to the subjects in the experimental group who, at all levels of proficiency, tended to produce more syntagmatic (63.9%) than paradigmatic responses (19.4%). As compared to the high-frequency test (paradigmatic 55.5%), the subjects produced a much lower percentage of paradigmatic responses. However, all the paradigmatic responses that were produced were synonyms of the prompt word in both the experimental group and control group, perhaps due to the fact that all the low-frequency prompt words were verbs.

Discussion

As this study is psycholinguistic, the results of this study could be addressed from many theoretical perspectives. However, the discussion in this paper will focus only on issues which were felt to be particularly relevant to ESL pedagogy.

Phonological links and word acquisition

Up to now the research has suggested, as stated above, that phonological links are found primarily in lower-proficiency learners, and these findings were confirmed in this study. However, it has not been reported that higher-proficiency learners also make such links between words. The phonological responses produced by three upper-intermediate students seem to suggest the possibility that phonological links are not only made by lower-proficiency students, but may also be made by students at all levels who do not completely know the meaning of a word. Three phonological responses is certainly not adequate to make any firm statements, but it may be possible that phonological links are employed, whether consciously or not, by learners when first encountering words as a sort of mnemonic foothold, so to speak, to assist the learner in retention of the word. Such a theory is highly speculative, but is not in conflict with the findings of previous studies regarding phonological links in lower-proficiency learners.

An interlanguage model of the mental lexicon

The fact that the percentage of paradigmatic responses on the L2 word association test tends to resemble the control group's results more than the results of the subjects' L1 test tends to support the notion that the subjects are working with an interlanguage (or to borrow Kruse, Pankhurst, and Sharwood Smith's 1987 term "interlexicon") model of the target language which is operating somewhere between their L1 system and the system used by native speakers of English. This should be encouraging to teachers, as it indicates that learners are, at least on a subconscious level, moving towards the use of a lexical system which more closely resembles that of a native speaker.[1] Perhaps even more importantly, such a shift is being made without any effort on the part of instructors (to the best of my

knowledge) to teach learners about this aspect of the native English speaker's mental lexicon.

What is not clear is whether or not highly proficient non-native speakers of English ever develop a system which functions in the same manner as most native speakers. The three high proficiency students (two of whom have native-like proficiency and the other near-native) were sought out, in part, to test this notion. When considered separately from the rest of the data, they did produce a percentage of paradigmatic responses on the high-frequency test (71.4%) which came close to that of the control group. However, on the low-frequency words, they showed a much stronger tendency to produce syntagmatic responses with paradigmatic responses comprising only 25.0% (all synonyms) of the total as compared to 78.4% for native speakers. [2] Three subjects is by no means sufficient to draw any conclusions, but it may be worth further investigation into whether or not highly-proficient learners at some point begin to acquire and understand words (in particular, low-frequency words) through gaining an understanding of the syntagmatic properties of the words rather than through the paradigmatic properties as the research indicates native speakers do. If this is indeed the case, it would imply, perhaps in contrast with intuitive thinking, that highly-proficient non-native speakers are developing a system of connections between words which is different from that of native speakers but is, none the less, a completely developed and fully functional system.

Word Class and the Mental Lexicon

As stated above, for purposes of comparison, all the low-frequency words were verbs. This factor, as opposed to word frequency, may have accounted for the high proportion of syntagmatic responses on this part of the test. It is difficult to check this theory against the only verb on the high-frequency word list, 'tell', as this prompt word resulted in several clang association responses. It may be, however, that learners (or at least Japanese learners) of English form different types of connections between words in their mental lexicon which vary in nature according to word class. If the data of this study is any indication, it would appear that connections in the Japanese learner's mental lexicon resemble those of native speakers in the case of nouns and adjectives, but tend to be more syntagmatic where verbs are concerned.

Model of the L2 Mental Lexicon

Bearing in mind that the results of this study alone are by no means sufficient to make strong assertions about that structure of the Japanese learner's L2 (English) mental lexicon, it may be of use in informing future research to propose a few tentative assertions based on the results. It should be stated that these assertions are highly speculative and subject to criticism on many levels (see the section on limitations of this study below) and another researcher applying a different evaluation instrument may reach entirely different

conclusions. However, the results of this study suggest (particularly in regards to Japanese learners) that:

1   Learners are aware on a subconscious level that the semantic connections between words in their L1 and the connections between words in English are fundamentally different, as is evidenced in the percentage of paradigmatic responses produced by learners on the L2 test as compared to both the L1 (Japanese) and L1 (control group English) tests.

2   Although there is weak support to suggest that as proficiency improves the system of connections between words in the mental lexicon comes more and more to resemble those of native speakers, there is also evidence in this study that indicates that even highly proficient non-native speakers have a system that depends more on syntagmatic relationships (in the case of low-frequency and/or words from the verb class) than does a native speaker's system. Thus it would seem possible for a learner to develop a fully-functional system of connections in the mental lexicon without developing a system that mirrors that of native speakers. This point has distinct pedagogical implications.

3   As has been shown in past research, the phonological characteristics of a word play an important role in relating words to one another in the learner's mental lexicon. This is particularly true of lower-proficiency students, but there is some support in this study to suggest that phonological characteristics are important for students at various levels of proficiency for words which are new or are not well known.

Pedagogical Implications

If future research supports the second of the three assertions listed above, then it would have strong implications for teaching. Namely, it indicates that it may be more effective to make use of teaching techniques which increase students' understanding of the collocational properties of words. This is consistent with the widely held belief that teaching new vocabulary in context is more effective than teaching words as discrete items on a vocabulary list (McCarthy 1990). These implications would be especially apposite if future research supports the suggestion above that the arrangement of words in the mental lexicon of highly proficient students depends to a large extent on the syntagmatic properties of words, and may be even more important if it is shown to be particular to the verb class, as syllabuses and language textbooks are commonly structured around the verb group (see for example Nunan 1988, White 1988).

In addition, the third point may suggest a pedagogical approach to vocabulary which encourages students to examine the phonological characteristics of new words in comparison to words they already know. However, research suggests that learners already do this naturally, and any approach which attempted to employ such a technique would have to incorporate a phase which eventually moved students away from a classification of words based on phonological characteristics to a deeper understanding of the semantic properties

of words. Therefore, such an approach may have a limited value in helping students to remember a word, but may not be useful in assisting students to fully understand a word.

Limitations of This Study

As is true with all word association test, this test makes unjustified assumptions about what constitutes 'a word'. In short, word association tests necessarily adopt a simplified definition which assumes a word in the mental lexicon to be the mental equivalent of the word's particular orthographic shape. In-depth discussion of this topic is not within the scope of this paper. However, please see, for example, Aitchison (1994), McCarthy (1990), and Sinclair and Renouf (1988) for further discussion of this issue.

Another limitation which applies to single-response word association tests is that they do very little to inform us of the depth and breadth of connections between words, the word-web, by permitting only a single response to a prompt word (Aitchison 1994, McCarthy 1990)[3]. Thus, in this study a native speaker's response of 'dog' to the prompt word 'tree' was designated as an unclassifiable response. Yet, when one considers the complexity the word-web, this response may be quite reasonable (e.g. 'barking up the wrong tree', etc.).

Another problem involved with word association tests which attempt to classify responses into discrete categories is that the responses are not always clear-cut examples which fit neatly into a single category (Aitchison 1994). This is particularly true when trying to distinguish between co-ordinate responses and collocational responses (e.g. a response of 'pepper' to the prompt word 'salt').

In respect to the limitations this particular study, a rather broad definition of collocation was adopted for purposes of classifying words. As this study was essentially ethnographic, this was done with a sense of purpose in mind. However, when pedagogical implications are suggested, it must be remembered that such vagueness must necessarily carry over into these suggestions.

In addition, although efforts were made to ensure that the two tests administered to the experimental group consisted of comparable words, they were not the same words. This was done in order to eliminate any residual effect of responses from the first (L2) test. However, it could be that some words which were selected for the either of the tests were loaded with more cultural connotations than their respective counterparts, resulting in a higher incidence of syntagmatic responses.

To be certain, several other limitations, such as the subjective analysis of student proficiency and the relatively small size of the control group, can be found. In defense of the study, however, it is important to remember that the aim of the research was not to test any particular hypotheses. Rather, in light of the lack of informed models of the L2 mental lexicon, it was designed only to get a better general picture of a topic of research about which little is known. It is hoped that some clarification of some potentially fruitful areas of future research may have been brought to light in this study. The conclusion of this paper

will focus on a discussion of this issue.

Conclusion: Implications for Future Research

As the primary findings of this study and pedagogical applications were already summarized above, it is not necessary to repeat them here. Instead, as this is an area about which very little is known, the conclusion will focus on five issues which seem particularly pertinent and came to light either in the process of conducting this study or upon assessing the results of this study:

1 There needs to be greater clarification of common types of L1 English responses in regards to word class. Aitchison (1994) states that synonymy is the least common type of classifiable response. However, 81% of the classifiable responses produced by the control group to the verbs on the low-frequency word association test were responses of synonymy.

2 Following this, there needs to be consideration of non-native subjects' responses in respect to word class. This study indicates, in particular, a discrepancy between response patterns of native speakers and non-native speakers in the verb class.

3 There is also a need for more research into low-frequency words in all word classes. This is lacking in both L1 and L2 psycholinguistic research, with patterns being determined only on the basis of native speaker responses to a relatively small number of high-frequency words.

4 Pending the results of the previous three areas of research, the claim by Coulthard (1994 cited in Deignan, Knowles, Sinclair, and Willis 1997) that non-native speakers have a tendency to produce more collocates than native speakers can be tested and, if supported, can be assessed in respect to word frequency and word class.

5 Finally, though this issue was not discussed in depth thus far in this report, there needs to be greater distinction between single-response and multiple-response word association tests. Researchers have tended to view them as theoretically equivalent, although it would appear that the two types of test require quite different types of mental processing, with single-response tests attempting to avoid consideration of the response as much as possible and multiple-response tests asking subjects to explore their individual word-webs. Research may help to clarify the different mental processes involved in the two types of test, making them both more viable analytical tools for psycholinguistic research.

These are just a few of the many research issues regarding the structure of the L2 mental lexicon. It is hoped that researchers will continue to investigate this area of research, which holds much potential promise for pedagogical applications.

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1 It should be stated here that some native speakers in the control group showed a strong tendency to respond with syntagmatic responses. In fact, on the low-frequency test, two of the ten subjects produced all of the syntagmatic responses with one of those subjects providing only syntagmatic responses. Thus, it is important to consider variations in individual tendencies when considering what is 'typical' of native speakers.

2 The high-proficiency subjects were presented with all four verbs on the low-frequency test.

3 Both Aitchison and McCarthy fail to mention the existence of multiple-response word association tests, although these have been used in psycholinguistic research for several years.

Table 1: L2 High-Frequency Word Association Test

Subject	Years	PR+	Tell	She	Pencil	Big	Tree	Red	Beautiful	
a	0.75	1	telephone	he	write	my friend	forest	apple	me	
b	5.00	2	telephone	picture	pen case	tall	lake	black	flower	
c	2.83	3	telephone	her	pen	small	flower	white	bird	
d	0.67	4	telephone	my friend	study	horse	high	stop	actress	
e	5.00	4	lie	red	convenient	buildings	important things	blue	clear	
f	1.25	5	telephone	he	pencil case	little	leaf	blue	landscape	
g	1.50	5	teacher	beautiful	write	company	green	signal***	wife	
h	3.50	6	speak	he	write	outer space	Christmas	signal***	Venus	
i	3.50	6	answer (v)**	girl	eraser	small	wood	green	girl	
j	2.00	7	story	gir	paper	large	Christmas	blood	scenery	
k	2.25	7	say	hepencil case	small	bush	yellow	ugly		
l	3.25	7	say	he	pen	small	leaf	white	pretty	
m	5.00	7	speak	woman	pen	shoe's tdmk*	wood	black	pretty	
n	5.00	8	story	sweetheart	student	man	Christmas	blood	woman	
o	–	9	story	I	pen	small	flower	white	pretty	
p	–	10	lie	he	pen	small	life	green	serenity	
q	–	10	say	he	pen	small	nature	apple	nature	
		Co-ordination	0	8	11	8	9	10	1	39.5%
		Superordination	0	0	0	0	2	0	0	1.7%
		Synonymy	6	5	0	2	0	0	4	14.3%
		Collocation	5	2	6	6	6	7	12	37.0%
		Phonological	5	0	0	0	0	0	0	4.2%
		Miscellaneous	1	2	0	1	0	0	0	3.4%
										100%

Paradigmatic:	55.5%
Syntagmatic:	37.0%
Other:	7.6%

+PR = English proficiency rating with 1 being the lowest amongst the group of subjects and 10 representing native-like proficiency.

*shoe's trademark

**subjects were asked to clarify the word class of their response as this may effect classification.

***traffic signal

Table 2: L1 Japanese Word Association Test

Subject	Years	PR+	aruku (walk)	watashi (I/me)	kuruma (car)	nagai (long)	kawa (river)	kuroi (black)	muzukashii (difficult)	
a	0.75	1	walk (take)*	you	ride	short	water	head	study	
b	5.00	2	run	you	road	holiday	fishing	night	English	
c	2.83	3	feet	you	drive	short	bridge	white	easy/kind	
d	0.67	4	fast	you	run***	holiday	ship	cat	English	
e	5.00	4	tired	air	fast	road	flow	nobleman	easy/kind	
f	1.25	5	feet	you	signal	short	mountain	white	black	
g	1.50	5	park	salary man**	fast	string	cold	tire	test(n.)	
h	3.50	6	walk (take)*	you	bicycle	time	ocean	tunnel	English	
i	3.50	6	sidewalk	you	run***	tunnel	flow	darkness	word	
j	2.00	7	walking stick	glasses	white	bridge	river bed	crow	French	
k	2.25	7	dog	you	road	noodles	boat	cat	test(n.)	
l	3.25	7	run	you	bicycle	short	ocean	red	easy/kind	
m	5.00	7	feet	human	progress(v.)	time	continue	forest	future	
n	5.00	8	town	Ss' name	money	road	flow	Negro	English	
o	–	9	run	you	commuting	short	fish	dark	challenge	
p	–	10	mountain	you	run***	river	water	video	person	
q	–	10	walk (take)*	you	accident	short	snail	white	easy/kind	
		Co-ordination	0	12	2	6	4	4	4	26.9%
		Superordination	0	0	0	0	0	0	0	0.0%
		Synonymy	6	3	0	0	0	2	0	9.2%
		Collocation	11	0	15	11	13	11	13	62.2%
		Phonological	0	0	0	0	0	0	0	0.0%
		Miscellaneous	0	2	0	0	0	0	0	1.7%

Paradigmatic:	36.1%
Syntagmatic	62.2%
Other:	1.7%

+PR = English proficiency rating with 1 being the lowest amongst the group of subjects and 10 representing native-like proficiency.

*the prompt word aruku meaning 'to walk' was responded to with the word *sanpo* which is a noun used in the phrase *sanpo suru* meaning 'to talk a walk'

**'salary man' is a Japanese word borrowed from English which means something like 'run of the mill office worker'

*** the Japanese word *hashiru* can be used both for people and vehicles, meaning roughly 'to move quickly' rather than the sense of the word in the English phrase 'the car is running' meaning the engine is engaged

Table 3: L2 Low-Frequency Word Association Test

Subject	Years	PR+	Choose	Recommend	Survive	Evaluate	
a	0.75	1	meal	–	–	–	
b	5.00	2	correct	–	–	–	
c	2.83	3	chose	*	–	–	
d	0.67	4	cake	my wallet	–	–	
e	5.00	4	by myself	no thank you	–	–	
f	1.25	5	life	*	–	–	
g	1.50	5	–	food	mountain	–	
h	3.50	6	–	–	our company	recognition	
i	3.50	6	–	–	preserve	human being	
j	2.00	7	–	–	earthquake	test (v.) **	
k	2.25	7	–	–	amazon	corroborate	
l	3.25	7	–	–	live	value	
m	5.00	7	–	–	travel (n.) **	valuable	
n	5.00	8	–	–	war	data	
o	–	9	pretty	taste	shock	university	
p	–	10	serenity	between	nature	people	
q	–	10	nature	choice	ability	supervise	
		Co-ordination	0	0	0	0	0.0%
		Superordination	0	0	0	0	0.0%
		Synonymy	1	2	2	2	19.4%
		Collocation	7	2	9	5	63.9%
		Phonological	0	0	0	3	8.3%
		Miscellaneous	1	2	0	0	8.3%

Paradigmatic:	19.4%
Syntagmatic	63.9%
Other:	16.7%

+PR = English proficiency rating with 1 being the lowest amongst the group of subjects and 10 representing native-like proficiency.
*subjects were presented with the prompt word but were unable to produce a response.
**subjects were asked to clarify the word class of their response as this may effect classification.

Table 4: L1 English High-Frequency Word Association Test (Control Group)

Subject	Tell	She	Pencil	Big	Tree	Red	Beautiful	
aa	message	her	pen	small	branch	blue	pretty	
bb	speak	he	eraser	little	forest	blue	ugly	
cc	tale	he	pen	small	branch	blue	mountains	
dd	truth	he	paper	small	grass	black	lovely	
ee	say	her	pen	little	big	blue	pretty	
ff	show	he	ruler	small	bush	blue	big	
gg	told	he	pen	small	bush	black	ugly	
hh	lie	her	write	small	dog	devil	nature	
ii	secret	he	pen	small	bush	orange	ugly	
jj	me	he	eraser	small	big	blue	woman	
Co-ordination	0	7	9	10	7	9	3	64.3%
Superordination	0	0	0	0	0	0	0	0.0%
Synonymy	3	3	0	0	0	0	3	12.9%
Collocation	7	0	1	0	2	1	4	21.4%
Phonological	0	0	0	0	0	0	0	0.0%
Miscellaneous	0	0	0	0	1	0	0	1.4%

Paradigmatic:	77.1%
Syntagmatic	21.4%
Other:	1.4%

Table 5: L1 English Low-Frequency Word Association Test (Control Group)

Subject	Choose	Recommend	Survive	Evaluate	
aa	selection	promote	exist	analyze	
bb	select	*	exist	rate(v.)**	
cc	choice	request(v.)**	thrive	grade(v.)**	
dd	*	suggest	live(v.)	judge(v.)**	
ee	pick	suggest	live(v.)	think	
ff	find	give	live(v.)	*	
gg	option	order(v.)**	live(v.)	test(v.)**	
hh	pick	waiter	Antarctica	training	
ii	select	advise	live(v.)	rate(v.)**	
jj	money	TV commercial	river	numbers	
Co-ordination	0	0	0	0	0.0%
Superordination	0	0	0	0	0.0%
Synonymy	8	6	8	7	78.4%
Collocation	1	2	2	2	18.9%
Phonological	0	0	0	0	0.0%
Miscellaneous	0	0	0	0	2.7%

Paradigmatic:	78.4%
Syntagmatic	18.9%
Other:	2.7%

*subjects were presented with the prompt word but were unable to produce a response.
**subjects were asked to clarify the word class of their response as this may effect classification.